

# Scientific Proceedings



**Finland**  
**30 August – 1 September 2006**



# CONTENTS

Fading of mechanical productivity enchants the need of new business models . . . . .	2
Leadership and productivity – Jack Welch’s productivity triumph . . . . .	7
Strategic human resource management and performance information in boundaries . . . . .	13
Feelings of joy or failure – experiences of self-efficacy in work settings . . . . .	17
A study of the time lagged relationship between intellectual capital investments and productivity . . . . .	22
The employees as a source of external business information . . . . .	29
Framework for improving manufacturing system performance in Finnish mechanical engineering industry . . . . .	37
Lean thinking in product development . . . . .	44
Costs of occupational accidents – effects of occupational safety on company business a research and development project . . . . .	47
Networks between Finnish construction and service companies in the lifecycle of buildings . . . . .	52
Trust, identity, and effectiveness in virtual organizations . . . . .	60
Studying the relationship between indoor air and productivity: theoretical discussion and empirical experiences . . . . .	66
Has cross-border merger affected well-being at work? A follow-up case from banking industry . . . . .	73
Well-being at work . . . . .	81
Do immigrants have more accidents than Finnish workers? . . . . .	85
Measuring effects of ethical operations . . . . .	88
Productivity theory and measurement in business . . . . .	93
How to communicate target information in SMEs? . . . . .	103
Productivity development at construction after branch after the last recession . . . . .	109
Diffusion of new collaborative work environments, and Impacts on society: Towards a system of policy indicators . . . . .	113
The meaning of results oriented pay and its effects on individual performance . . . . .	122
The effects of job and competence evaluation based pay systems on the gender pay gap in the Finnish public sector . . . . .	129
Total rewards from an employee perspective . . . . .	136
Informal communication conversations as a form of organizational communication . . . . .	145
Change management in pay systems implementation . . . . .	151
The meaning of procedural justice in the performance appraisal process . . . . .	157
Labor Market Regulations and European Venture Capital Investment . . . . .	165

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## **European Productivity Conference (EPC 2006)**

Scientific Proceedings, second edition

Layout: Markkinointipörssi Oy, Heikki Hjelt

Editor: Pekka Malmberg

Printing: Paintek Oy

Copyright: Yrittäjärävi Oy 2007

ISBN: 978-952-9737-33-8

The printing of this book has been supported by the European Commission.

# Editorial

Productivity is a key factor affecting the long-term profitability and competitiveness of an organisation. It is vital not only for firms but also for the public sector and whole nations. Despite the seemingly simple nature of the productivity ratio, output per input, improving productivity is not so straightforward in the real world. 'What you measure is what you get' does not always work, as the path from managerial actions to productivity improvement is much more complicated than the simple appearance of the productivity ratio implies.

Productivity can be approached from countless perspectives. Sometimes these approaches have little in common. The papers published in these Scientific Proceedings are an excellent example of the different approaches to productivity. All authors have viewed the situation through their own eyes in their studies. This is an enrichment of productivity research. The topics covered include macro and micro perspectives on productivity measurement. Various phenomena associated with productivity improvement, such as intellectual capital, networks, performance measurement and management, rewarding and well-being at work, are also discussed in the individual papers.

One of the aspects covered in modern productivity research is intangible assets. It is obvious that intangible assets, which play a very important role in today's business environment, are important in any production process. Nevertheless, theoretical constructions modelling the role of intangible assets in production processes are still far from mature. Another interesting question in productivity research is the role of information and knowledge. They are always needed and can have the role of input or asset, or both at the same time. Sometimes they are an integral part of the output, sometimes not. The future will tell what kind of theories become established as de facto theories in this area.

The articles published in this volume of proceedings are based on papers presented at the European Productivity Conference held in Finland in August 2006. According to the conference dictum, sharing productivity know-how is a good way of helping one another to achieve better competitiveness as well as improved working and living conditions. It is our sincere wish that

these papers will benefit productivity research and development in Europe as well as the rest of the world.

The European Productivity Conference 2006 was the first of its kind. Although productivity is a highly topical research issue – as Europe is aspiring to become the most competitive region in the world – it was not certain that researchers would discover the event, let alone contribute to it and participate in person. This challenge is nowadays a significant one since there are dozens of more focused conferences in the field of productivity research. As a wide-scoped and multidisciplinary event has been lacking from the European conference range, however, the Conference was able to attract a fairly good attendance of speakers and other academic delegates.

As editors of these Scientific Proceedings, we would like to acknowledge three main groups who made the Conference possible. First, the Conference was brought about by the joint efforts of Finnish government ministries, labour market organisations, universities and funding organisations. In addition, significant support and financial contribution was received from the European Union. Second, the scientific programme of this large event was put together by a Scientific Committee consisting of Tuomo Alasoini, Pekka Malmberg, Tiina-Mari Monni, Hannu Rantanen, Peter Rehnström, Jorma Saari, Heikki Sirelius, Erkki Uusi-Rauva, Matti Vartiainen and the editors. Third, as in any research conference, the most important input came from scientists who presented their studies and the chairpersons who facilitated the 'production process' by moderating individual conference sessions.

In the short term, the output of the above-mentioned parties consists of the research sessions of the Conference itself and this volume of proceedings. In the long term, we hope, the Conference will play a role in pushing European productivity research one step forward, as well as having practical impacts on European companies and governments. In addition, it generated intangible outputs in the form of learning, new professional contacts, new ideas, etc. All these, and more, must be considered when measuring the productivity of the scientific programme of the European Productivity Conference.

Tampere, 10 November 2006

Editors: Mika Hannula,  
Doctor of Technology  
Professor

Antti Lönnqvist  
Doctor of Technology

Pekka Malmberg  
Producer

# Fading of mechanical productivity enchants the need of new business models

Markku Penttinen<sup>1</sup>; Arto Rummukainen<sup>2</sup>; Simo Tikakoski<sup>3</sup>

<sup>1</sup> Docent, Finnish Forest Research Institute, Markku.Penttinen@metla.fi

<sup>2</sup> Senior Researcher, Finnish Forest Research Institute, Arto.Rummukainen@metla.fi

<sup>3</sup> Researcher, Finnish Forest Research Institute, Simo.Tikakoski@metla.fi

**Keywords-mechanical productivity, business models, wood harvesting, profitability**

## 1 INTRODUCTION

The change from horse to tractors in wood transportation began in the 1960s. Today's structure based on a forwarder was first established 30 years ago. Since then, productivity increments based on technological refinements have at most been at the level of few per cents per year. The felling and preparation of wood assortments has witnessed the replacement of hand-saws by one-man chain saws during the 1960s resulting in the doubling of the productivity per man-hour. By the end of the 1990s fully mechanised harvesters ten doubled the man-hour productivity of harvesting. At this stage the productivity limits of mechanisation were mainly reached.

The increased demands of capital caused changes in the business model and many forest workers became independent entrepreneurs. Because of short production series of costly special machines modern harvesting is a capital-intensive industry. Since 1990, information technology has also shifted the former wood procurement companies' tasks to the harvesting entrepreneurs. This has increased the productivity of the whole wood procurement chain.

In spite of the excellent productivity developments, the wood procurement entrepreneurs face increasing profitability problems. The net result of enterprises has decreased from nine percent to five in just three years. The situation requires improvements in the organisational structures and business models

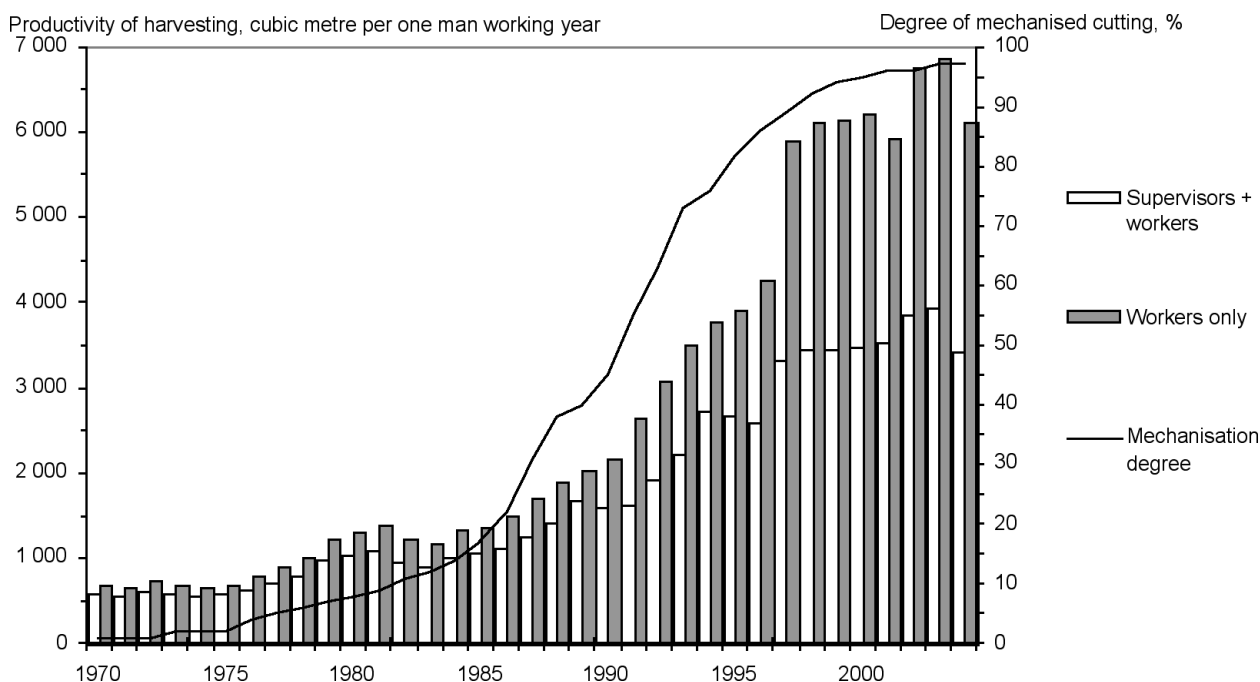
of these firms, as well as the networking of businesses. A lack of qualified drivers also places demands on efficient recruitment and education. Entrepreneurs need to improve their management skills. While the role of the forest industry is crucial as a customer, it is also vital in supporting, planning and control of the workload of the wood procurement entrepreneurs. The development of competitiveness is the key notion of the research.

## 2 MECHANISATION OF HARVESTING WORK

Felling tree, delimbing and crosscutting stems and transporting logs and pulp wood bolts to the roadside has always been heavy work. Consequently harvesting has always been an object for development.

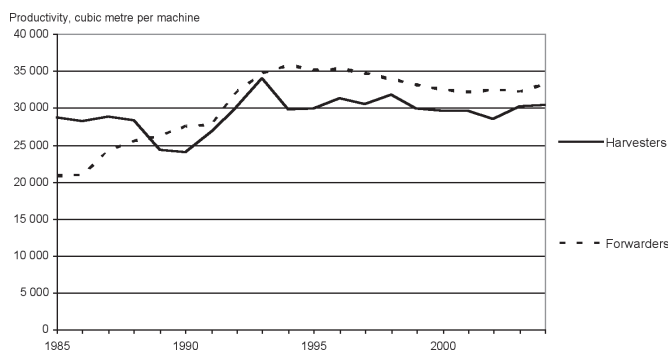
Fig. 1. The developments of work productivity per man-year and degree of mechanisation in cutting in Finland (data: [1]). Worker numbers include work force employed in manual and mechanical cutting and terrain transport. The number of supervisors includes supervisors in harvesting and long distance transport, the procurement of wood from forest owners and some supervision works of silviculture. The workers numbers are slight overestimates, because forest owners, whose number is not counted in the workforce, do part of the work. The degree of mechanisation of cutting describes a situation where forest industry companies or State Forest arrange the harvesting.

One hundred years ago, better hand tools and their maintenance



nance increased worker productivity, as did the introduction of constant scale sledge roads for horse-drawn transport. The harvesting methods began to develop quickly when wheel transport technology, and later hydraulic power transmission and the latest electronic data processing offered new ways to operate in the forest. In the last five to ten years almost all harvesting in Finland has been conducted with up to date technology. Despite these developments, Finnish harvesting and the forest based industries are facing problems because of increasing raw wood imports and more profitable mill investments in abroad. So, how can increase profitability in harvesting be achieved without eroding the local salary levels?

Fig. 2. The development of machine work productivity (data: [1]). The numbers present the cutting and terrain transport organised by the forest industry companies or State Forest.



At the beginning of sixties, horse or farm tractor with trailer and winch started to give way to chassis steered hydraulic driven forwarders that were equipped with hydraulic knuckle boom loaders. The labour requirements were reduced and the purpose build forwarder coped better with the difficult terrain conditions than a farm tractor. Road side debarking in springtime was abandoned when mills build debarking drums.

Cutting was initially mechanised in the 1970s with de-limbing and cross cutting processors, while the boom with felling and processing devices at its head were introduced in the late eighties. These grapple harvesters were a technical and economical success in Finnish private non-industrial forestry, where cutting areas are small. Work productivity per man-year increased with the increasing share of mechanised work (Fig. 1).

In recent years productivity has been at a very high level because forest owners have been preparing for a change in the forest taxation system by selling regeneration stands with large stems. The number of supervising personnel started to decrease when harvesters started to scale the bolts and the operators started to choose the trees to be removed in thinning. During the last ten years, the harvesting productivity calculated per workers and supervisors, has not increased at the same pace as workers productivity because supervisors have duties that do not depend on the efficiency of harvesting (Fig. 1). Until a few years ago, the forest industry companies controlled nearly all aspects of the harvesting enterprises. Forest industry supervisors optimised and guided the use of harvesting resources. Today, industry promotes the enlargement of harvesting enterprises, which can now even organise their work independently [2].

The average productivity per year for a harvester has been at the level of 30 000 cubic metres per year throughout last twenty years (Fig. 2). However, harvesters reached first high productivities by working only in best stands. Increasing mechanical efficiency has levelled off with the need to work in more challenging conditions. Today's best machines in the best conditions can produce 100 000 m<sup>3</sup>/a, but machines in first thinning achieve about

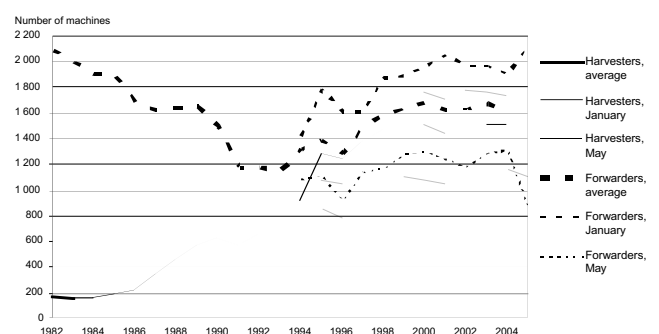
15 000 m<sup>3</sup>/a. The productivity drop in 1990-91 is explained by a very strong economic depression when the total cut decreased by one fourth. Work was divided in order to keep as many entrepreneurs as possible in business, which caused the productivity drop. After that the entrepreneurs were cautious about purchasing new machines, which caused rise in the productivity (Fig. 3). Since then the average trend in harvester productivity has been in gentle declining. With present technical improvement, the productivity may increase only slowly [2].

The productivity of forwarders increased until the beginning of the 1990s as a result of better technology and also because manual cutting declined (Fig. 2 and 3) and was replaced with harvesters that collect the bolts in thinning in more favourable units for forwarder than do manual loggers. In last 10 years the number of harvesters and forwarders have increased along with the volumes of cutting (Fig. 3). Studies of machine numbers reveal the technological improvement and the development of co-operation between machines, but also problems in organising the work. The variation in the number of machines working in Winter and in Spring has generally increased. The extreme numbers in 2005 are the results of a 2-month strike at the paper mills. Natural conditions somewhat restrict the harvesting in Spring, but there is still a need for 20 % extra capacity in January compared to the yearly average. There is an extra capital cost burden for concentrating the harvesting activities in winter.

### 3 COST AND PROFITABILITY

The comparatively good organisation and development of machinery has kept harvesting costs down (Fig. 4). Since the steady improvement up to 1994, the costs from stump to roadside have remained at about 8 €/m<sup>3</sup>. In recent years oil prices have increased, which can be seen in the cost of forest owners' own harvesting. Working with standard size machines may have narrowed advantages that the entrepreneurs with a larger organisation seem to have had. Without any surprise developments, increasing oil and personnel costs will increase the average harvesting cost in the future.

Fig. 3. The development of the number of harvesters and forwarders (data: [1])



Forest machine contracting was based on brave technically skilled men who could keep the machine running in varying forest conditions. The mechanical challenges have increased with need to understand electronics and data processing. Many entrepreneurs were sons of farms, who had financed the workplace for themselves often by selling own forest. Forest industry companies, who bought the machine entrepreneurs services, used to determine the price and limit the size of the business. With the decline of industry's guidance, the abundance of entrepreneurs has resulted in a low average profitability in the



harvesting business (Fig. 5). The "original" entrepreneurs are now retiring [2] so there are now problems in continuing those businesses while at the same time there are new possibilities for restructuring the harvesting sector.

In present decade one fourth of harvesting enterprises have had negative economic results [9] (Fig. 5). The medium result has been less than 10 % with a decreasing trend. This is not new, as in the 1980s even the median contractors made losses [3]. The level of debts has also been high thereby preventing investments. The low profitability depresses wages, which restricts the ability to employ highly skilled personnel [10]. The upper quartile of enterprises has been successful, but there have been no clearly identifiable factors for success [9]. According to Mäkinen [4], the success was loosely connected to factors concerning how the entrepreneur organised his business. The productivity in harvesting business 1960-2000 was constantly growing because of fast technical development. However, the economic results were poor. Today, even the technical development is slow.

#### 4 NEW CHALLENGES

Critical success factor studies by Mäkinen [3], [4] found that specialisation and high quality customer relationships were critical success drivers. Unfortunately, the increase of the total turnover of the sector by 7% in 2004 was not reflected in the economic performance. On the contrary, profitability results, such as the net result percentage of the median forest machine contractor enterprise, decreased below 4% and the operating margin percentage dropped to below 30% for the first time in 2004, which may cause for concern. However, the turnover figures and profitability for 2005 will still decrease. Felling volumes have decreased slightly to 53 million in 2005. Felling volumes will increase in 2006 by 4% according to the Finnish Forest Research Institute [1]. In all, the profitability problems persist in spite of dramatic productivity improvements after 1990s (Fig. 1).

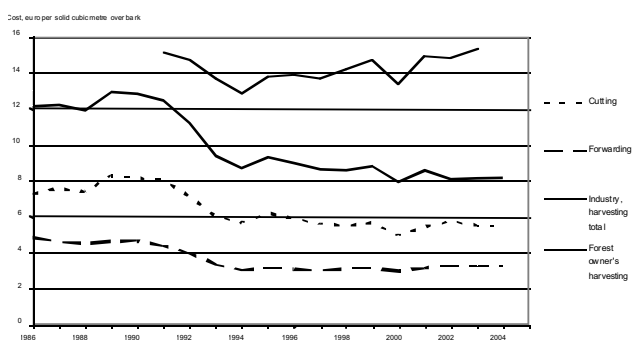


Fig. 4. The development of the deflated harvesting cost by type of business and by performer (data: [1]). The deflation is based on wholesale price index.

Similarly contracting and subcontracting have resulted in organisational changes in forest harvesting also in Scotland during the 1990s [11]. Productivity results covering alternative harvesting systems in mechanised thinning, and which form a good basis for development have been systematically reported by Kärhä [12]. Even the whole business concept of forest entrepreneurship has been discussed [13], [14]. Entrepreneurs are interested in taking responsibility for the planning and control of activities for which they will be compensated financially [15]. A solution to giving entrepreneurs more responsibility has been the establishment of an area entrepreneurship network [16]. This assumes a dual networking pro-

cess: the extended networks associated with organisations, and the informal, personal networks associated with individuals [17].

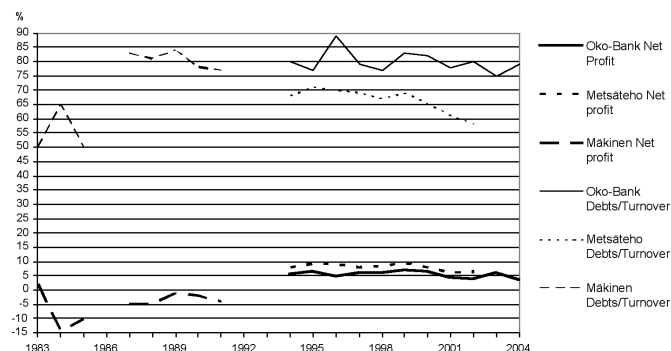


Fig. 5. Development of the median net profit and the ratio of debts to turnover of forest machine enterprises. Mäkinen's material was 27 [3] and 74 entrepreneurs [4]. Oko-Bank data include about 40 % of enterprises of all sizes [5], [6]. Metsäteho data include about 80 % of enterprises, but smallest company sizes are excluded [7], [8], [9].

To tackle profitability and productivity challenges partnership models have been developed already by Norin and Lidén [13] and by Metsähallitus (State Forest and Park Service) and the contractors [18] [19]. Although accounting improvements such as extended applying discounted cash flows in addition to annual calculations have been developed [20], accounting cannot be seen as the solution to the profitability dilemma.

Recently, improvements and innovations are tested in applying the information and communication technology (ICT) as well as in organising the service and developing business models. A traditional dilemma is the unused log-ging production capacity (see e.g. [21], [22]), which can be mitigated by ICT. The innovations concepts can have various dimensions such as: (i) product, (ii) process, (iii) subjective, (iv) co-operation, and (v) normative ones (see [23], [24]). Development and innovations also face a number of preconditions, such as a change in the nature and length of harvesting contracts, an increase in contractor and employee knowledge and skill levels, and the better management of human capital and technology [25]. The level of contractors' skill is in need improvement and the poor availability of employees suggests the need for intensified recruitment and training [10]. In recent years, the forest industries have developed new business models [26], and the outsourcing of wood procurement is increasingly common. Even the aspects of management and administration may in future be outsourced.

Business concepts have also been the subject of discussion in past few years [27], [28]. Business potential can be seen from several perspectives: as value drivers [29], as profit boosters [27] or as competitive advantage [30]. In all, service innovations tend to focus on business models and business processes, the analysis of which is a good beginning for profitability improvement. Moreover, the platform approach commonly used in product development (see e.g. [31]) might also be applicable to the development of wood procurement services (see [28]).

#### 5 OPEN OPERATIONAL QUESTIONS

The Finnish forest industries purchase raw wood throughout the year, but harvesting is restricted by e.g. poor bearing capacity of soils and damaged roads in the Spring. Top harvest-

ting machine capacities should be cut in order to avoid unnecessary capital cost. Larger reserves of purchased logging sites are needed to find the optimal use for different types of machines. However, the forest industries have no incentives to let the inventories increase. By modifying their payment policies from preliminary deposit to final measurement they could reduce their investments in standing timber inventories and thus increase reserves of logging sites. That is needed for minimising the transfers of machines.

Modern forest machines should be used for operations that are best suitable for their technologies, capacities and capital cost. The harvesting processes can be optimised only if machines in the supply chain are coordinated efficiently using the state of the art ICT. Various forms of data and data processing should be standardized so that the real-time integration between operating units and management will be possible. An encouraging sign is that networks in forest harvesting are increasing.

An increasing number of stands in Finland require thinning. Moreover, thinning is subject to new norms that demand greater professional competence from machine operators. However, profitability is a problem in thinning [32], [33]. Because few operators have a professional forest education, there is a continued need for further education in harvesting work and computer technology.

Contractors should develop better methods for relating the cost calculations of machine work to the qualities of the logging sites. For example, it is useful to know the proportion thinning activities during a given calculation period.

## 6 CONCLUSIONS

The customers are outsourcing the harvesting and limiting the number of subcontractors. This opens an opportunity to restructure the whole harvesting business. Today's many small entrepreneurs have a challenge to increase business volumes by purchasing other firms or by networking.

At the same time business models and business process analyses are under continuous development. The lack of business skills of the entrepreneurs and the lack of skilled drivers jeopardise the efforts to improve profitability. There is still considerable potential to improve and extend the application of information and communication technology (ICT), especially concerning the requirements of the customer. Business models, business processes and service platforms should be able to streamline the challenges of wood procurement services.

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# Leadership and productivity - Jack Welch's productivity triumph

**Mustafa Said Karaman**

*Mr, National Productivity Centre of Türkiye (MPM), mkaraman@mpm.org.tr*

**Keywords – productivity, leadership, Jack Welch, performance**

## 1 INTRODUCTION

Productivity is a term that its importance is increasing everyday. Especially the developed countries attach a special importance to productivity owing to being a development factor. Nowadays, being one of the requirements of becoming globally competitive in the track of becoming productive is not out of fashion on the business-world agenda.

In the 20th century, the greatest and unique success of the management science was; the labour productivity has been increased by fifty times in production. Likewise, the management science has to contribute to improving the knowledge worker's productivity in the 21st century. Thus, productivity issues that aim to be better today than yesterday will continue to keep its up-to-dateness.

In this study, the aim is to demonstrate whether leadership effects productivity or not; by examining productivity, leadership, and the relationship between leadership and productivity. Aiming to display the effects of leadership on productivity concretely, the most emulated business leader Jack Welch's leadership practices were examined and assessed. For collection of required data; written articles and books about Welch, published interviews with him, the web sites about him are all reviewed. These secondary sources about Welch are meticulously examined, analysed and assessed.

Leaders play an important role in improving productivity. While the management of the modern business functions are getting much more complicated, the role of the leader comes into prominence. General Electric's CEO Jack Welch is a well-known leader who has improved both organizational and labor productivity by creating a transformation in his company and he could be taken a bright case as playing an important role in this matter.

Leaders could boost productivity by reorganizing the company, by creating organizational culture, by being pioneer of continuous changes, by guiding, by motivating, by managing their performance, by empowering them, by supporting the personal development, and by building up teams.

In solving the European Union's productivity problem, transformational leadership approach may be one of the starting points for not only businesses but also administrative state organizations and NGOs.

## 2 THE MEANING OF LEADERSHIP

Leadership is a process by which one person influences the thoughts, attitudes, and behaviours of others. Leaders set a direction for the subordinates; help them see what lies ahead; help them visualize what they might achieve; encourage them and inspire them. Without leadership, a group of human beings quickly degenerates into argument and conflict, because the employees see things in different ways and lean toward different solutions. Leadership helps to point them in the same direction

and harness their efforts jointly. Leadership is the ability to get other people to do something significant that they might not otherwise do. It is energizing people toward a goal [1].

## 3 THE IMPORTANCE OF LEADERSHIP

One of the important issues, which the business managers have to pay attention, is leadership. Owing to the accountability of managers and the characteristics of their role, it is expected that the managers should lead and have leadership competencies [2]. While the organizations' requirements change, the concept of "leadership" develops and becomes more significant. In one of the study done in this field that it is determined by 12 thousand trainers from 70 countries all over the world at the meetings in 1999 in Atlanta and in 2000 in Dallas that one of the five tendencies in the first 15 years of 21st century is "the requirement for leadership attitude at every level" [3].

Leadership that is basic concept of contemporary management approaches' comes into prominence gradually because of the recent changes in the business world. These changes are [4]-[5]:

- Weakening of formal organization structures,
- Predominance of knowledge worker,
- Changes in the new labor force expectation,
- Spreading of project, network group approaches in organizations,
- Increased competition and more demanding customers, and
- Frequent crisis.

## 4 THE EFFECTS OF LEADERSHIP ON PRODUCTIVITY

Nowadays, businesses discard the traditional organization structures and reorganize according to new management approaches. Intensive competition environment and continuously improving technology brings forth adopting flexible, dynamic and participative management understanding for them. New dynamics of the business world require organizational structures with fast decision making and transmitting to every level, paying attention to productivity, making the employers more voluntarily participative and empowering them, instead of organizations having cumbersome, bureaucratic and documented structures [6].

Popular French management scientist Fayol aimed to find organizational effectiveness and advocated the truth that businesses could only be efficient when they adapt the shifts in internal and external environmental conditions [7]. He paid attention to the leadership's role in organizational effectiveness while putting forward creating team soul is the most important one in management principles [8].

Pioneer of the total quality management Deming said relating this matter "the objective of leadership is improving the performance of labor and machinery, enhancing quality, increasing the production, and getting the people to feel proud

of their work at the same time” [9]. Also popular management philosopher Drucker mentioned the relationship between leadership and productivity in this way: “one of the leader’s roles is utilising inadequate sources continuously to the fields which bring the best advantages” [10].

Management scientist Kraines says “leaders are accountable for the effectiveness of their subordinates and for continually improving their capabilities” [11], while the other management scientist Blanchard mentions “leader has to create the desired organization that is straightforward to productivity [12].

Improving the productivity in businesses is primarily in the accountability of managers. The success of productivity improvement activities depends on managers’ attitudes and behaviours, strategies that are developed and mostly on the implementations [13].

Because of productivity is related with management practices and styles and also leadership is considered to be superior to management in managerial science, the role of leader in improving productivity has to be examined instantly. Powerful leadership contributes to productivity improvement efforts [14] substantially. In this study, it is asserted that leadership could be more successful than management according to its transcendentness.

## 5 EVALUATING POPULAR BUSINESS LEADER JACK WELCH’S LEADERSHIP PRACTICES IN THE VIEWPOINT OF PRODUCTIVITY

### 5.1 Objectives and Importance of the Study

In this study, aiming to demonstrate concretely whether leadership effects productivity or not in businesses; the most emulated leader of the business history “Jack Welch”’s leadership practices were analysed and assessed.

Business leaders actually play an important role in business life. This role is leadership but this is not defined as always a product of powerful and charismatic personality or inborn characteristic. Some people are naturally apt to activate their subordinates but the leaders in business life have to develop a clear direction and a strategy for their organizations. Furthermore, they make all of the systems of their companies obey this direction and the organization has to be tied to the common objectives for a long time. Behavioural, transformational and practice oriented leadership influences the subordinates positively and improves productivity entirely.

One of the many different methods aiming to improve productivity is the leadership that is repeatedly mentioned in contemporary human resources systems. Due to this, leadership has to be examined in context of productivity to help the businesses in finding new practical ways of boosting productivity.

### 5.2 Extent of the Study

This study covers examination of the popular business leader Jack Welch’s leadership practices in context of productivity who was CEO of GE for 21 years between the years 1981-2001.

### 5.3 Methodology and Examination of Data

In this study, in order to meet the above-mentioned objectives, secondary data sources were studied for collecting the required data. Written articles and books about Welch, published interviews with him, the web sites about him are all reviewed. These data sources about Welch are meticulously examined, analysed and assessed.

### 5.4 Findings and Evaluations

Leaders play a significant part in meeting the objectives and improving the productivity of their businesses. This should be more fundamental due to the business world has been getting more

complicated. The findings and evaluations about the leadership practices of Welch who improved the productivity of his company and subordinates by creating a change storm in his company are below explained.

#### 5.4.1 The Profile of Popular Business Leader Welch

Jack Welch whose original name is John Frances Welch Jr., was a legendary Chief Executive Officer (CEO) of one of the world’s greatest companies namely General Electric (GE) (Appendix: The Brief Information about General Electric Company) between the years 1981-2001. Mr. Welch, a native of Salem, Massachusetts, received his B.S. degree in chemical engineering from the University of Massachusetts in 1957 and his M.S. and Ph.D. degrees in chemical engineering from the University of Illinois.

He joined GE in 1960 and was elected Vice President in 1972 and Vice Chairman in 1979. In 1981, he became the eighth Chairman and CEO. He retired in the fall of 2001 [15].

For grabbing the the first row of annual “the greatest”, “the most favorite”, “the best”, and “the most profitable” lists for the giant world companies [16], GE was grateful to Welch. Besides GE is in the first row in “the most admired company” list once again, for the sixth time in the last decade [17], the company is once again the Fortune’s most respected company, as it has been in every one of the five years that the Financial Times/PwC World’s Most Respected Companies Survey has been published [18].

Welch who worked for GE for 20 years as a CEO and for totally 41 years [19] has been chosen “the most admired business leader” in the same years by Financial Times [20]. Fortune even announced Welch as a “manager of the century” in 1999 [19].

More than a dozen of books have been written about Welch and they have been mostly bestseller owing to the success stories of Welch in business world [20]. Besides Welch has been a transformational leader, he is also charismatic. His success depends not just on his personality but his quality of thinking. Welch had developed a leadership style that took advantage of the development of bright, disciplined and creative way of thinking [21].

General Electric saw great growth and expansion under Jack Welch’s leadership. Through streamlining operations, acquiring new businesses, and ensuring that each business under the GE umbrella was one of the best in its field the company was able expand dramatically from 1981 to 2001. [22].

Popular management guru Peter Drucker, who was former consultant of GE, was quite impressed from Welch [21]. Welch should be a candidate for being a fundamental case on leadership matters for future generation. Over the past 20 years, Welch, more than any other business leader, has changed the way people view the role of the CEO. There was no General Electric separate from Welch and no Welch separate from General Electric. Through his bold and sweeping reinvention of the company--thanks in no small part to the force of his personality--Welch created the CEO not just as public figure but as icon [20].

#### 5.4.2 The Productivity Secrets of Welch

Welch’s main goal at GE Company was, “Working productively like the most productive competitors” [21]. The productivity secrets are listed below that Welch made use of to create a boundaryless organization [23]:

- Flatten the organization and get rid of bureaucracy,
- Instigate raising productivity by the three ideals of: speed; simplicity and self-confidence,
- Adopt total quality methods to save costs, raise productivity, and delight customers,

- Behave like a small company,
- Eliminate boundaries,
- Understand the subordinates and energise them, and
- Get good ideas from everywhere.

#### *5.4.3 Welch's Doings as a Leader in Productivity Improvement*

Jack Welch had been a change pioneer at GE and starting from the first day of CEO mission; he reorganized all of the systems for being more productive, disseminated modern business approaches and exerted great effort for raising productivity.

Welch spurred the company to design a set of tools and processes that delivered 6% annual productivity gains in 1986 [24] while this rate was below 2% in 1981. This number was equal to its Japanese direct competitors and a bit low than Japan's productivity rate in general. Even in their standstill term, GE has succeeded to reach a rate between 4-5%. GE's profit before tax per one unit in productivity gains has been 300 million dollars since a couple of years. One third of the revenues came from the productivity improvement with Welch's calculation in 1991 [21].

The leadership practices behind this conspicuous productivity triumph by Jack Welch are unveiled below by ten different headings:

##### *i. Reorganized GE*

While Welch was appointed to CEO duty, it was seen that enormous number of businesses in GE had been lethargic and had focused on bureaucracy deeply. This was perhaps true for those years, but time is going on very fast. To be attuned to rapid shifts, the reorganization work, which was started in the beginning of 1980, had embraced all the aspects of GE. 350 business segments of GE all covered and all conducted to Welch's "Reorganization Programme" according to productivity principles.

From the beginning of reorganization work in 1980 to starting total quality practices in mid-1990, Welch had continuously transformed GE [25]. According to Welch, "If a business becomes productive then it will control its destiny" and he says about reorganization [21]:

"If you deal with injury, you will come down to bottom layer and after that you will see the results. If you hold of productivity again, business will return, you will be successful in the market and your profit share will increase. You have been hurt for a while of time but you feel good afterwards".

##### *ii. Reduced the Hierarchical Layers*

When Welch was appointed as a CEO, GE's organizational structure was too much complicated that there were nine layers between the top management and the lower layer. Being too many layers in the middle management level assured everybody feeling comfortable and thinking about rising to be so simple. Owing to being popular about training managers guaranteed that outsiders are not recruited for the unemployed positions [26]. However, there was an entrenched mentality about promotion; Welch had a thought of realizing the approaches of being small and lean. He achieved this by breaking hierarchies and the chain of command and communicating freely up and down.

In due course, this great idea segued into Welch's early 1990s principle of "boundarylessness" as "the value that underlies GE's increasingly supple organizational style" [21]. This principle emphasized informality and candour in a delayed organisation without "organisational silos". Though linguistically clumsy, boundarylessness was, according to Welch the only way that GE would be able to achieve its productivity goals [27].

He says; "Layers slow decision-making; blur responsibility

and create undoable jobs. Cut layers and double the span of control". In theory Strategic Business Units make the unwieldy manageable yet the vices are often fatal: businesses do not cooperate; focus becomes short term and bureaucracy and control often reign".

Welch pointed out the hierarchies' harm to the businesses by saying "Every layer is a bad layer. The world is moving such a pace that control has become a limitation. It slows you" [28]. Besides, Welch believed that distended hierarchical layers had brought in GE a very huge cost. Whereas he emphasized that he had required a trim and aggressive GE, so this means more smaller GE.

In the beginning of 1980's none of the American managers were ready to do Welch's doings. He was the pioneer of this matter: "downsizing by reducing personnel [28]". As a matter of fact, this is one of the ways of getting more from the less input. Welch implemented this successfully despite the perturbation and affliction of his subordinates. Because he had known that the most important thing was company's keeping on subsistence. If there is no company, than all of the personnel will be jobless eventually.

##### *iii. Dismantled of the Bureaucracy*

The first step in realizing his vision was a dismantling of the bureaucracy at GE. At the start of Welch's tenure, GE administration was built around three hundred separate businesses, a recipe for inefficiency. Welch tore into the ossified corporate structure with a vengeance and by the mid-1980s had overseen nearly 120,000 layoffs and earned the nickname "Neutron Jack." The name was derived from the neutron bomb, a weapon designed to minimize heat and blast effect but maximize dispersal of lethal neutron radiation-in effect, eliminating people but leaving buildings and equipment intact. Welch was never fond of the moniker [29].

Jack Welch ha always hated and fought bureaucracy because it lowers productivity. "To him, bureaucracy is the enemy. Bureaucracy means waste, slow decision making, unnecessary approvals, and all the other things that kill a company's competitive spirit. He spent many years battling bureaucracy, trying to rid GE of anything that would make it less competitive" [29]. He didn't simply strip away a little bureaucracy. He reshaped the face of the company to rid it of anything that was getting in the way of being informal, of being fast, of being boundaryless.

Welch felt that ridding the company of wasteful bureaucracy was everyone's job. He urged all his employees to fight it. "Disdaining bureaucracy" became an important part of GE's shared values, the list of behaviors that were expected from all GE employees [29].

##### *iv. Had Been the Pioneer of Continuous Changes*

Welch is perhaps the most popular business leader whose name had become identical with change. Moreover, he was inside the radical transformations from the beginning of his career not progressive years. In 1980's, when Welch was just appointed to CEO mission, he revealed the strong characteristic of this leadership style.

While there have been many revolutionary leaders in politics and business with clear vision and unbreakable motivation to implement their vision, not many have succeeded in maintaining the momentum for 20 years. Welch is unique in his successful implementation of revolutionary change in a company that was already among the most admired when he became CEO. How did Welch achieve this [30]?

Welch's 20-year revolution could be conceptualized as three waves with the following starting dates and major objectives [30]:



#### - 1981, first wave:

Create a new vision and strategy to drive reorganization, mass dismissals, divestments and acquisitions.

#### - 1985, second wave:

Revolutionize GE to gain the strengths of a big company with the leanness and agility of a small company.

#### - 1996, third wave:

Develop an integrated, boundaryless, stretched, total quality company with A-players.

To summarize, during the first wave, Welch changed the physical infrastructure of GE and what people did. During the second wave, he changed the organization and how people operated. During the third wave, he changed the culture and both what and how people should think [30].

#### *v. Created an Organizational Culture based on Freedom*

The organizational culture that was created by Welch is based on freedom and liberty. He explained this in this way:

"In order to be faster, more productive and more competitive; you have to free the energy, intellect and naturalness of the American worker who is still the most productive and talented one all over the world. The way of activating these people's energy is protecting them not oppressing. Free managers to manage - and to rise, defeat bureaucracy and rigidity, generate and use new ideas and empower workers to flourish and grow" [28].

In 1996's, Welch had to create new GE values, a new GE culture, and an emotional climate that would transcend his personality as well as his strategic and organizational reforms. These soft improvement included watchwords like "speed, simplicity and self-confidence," "candor, openness, ownership," "integrated diversity," and even "evangelizing".

One of the paces that carried GE to the productivity victory was the created democratic climate. Welch has always claimed, "It is a necessity that creating atmosphere not only white-collar workers but also blue-collars talk freely". He believed sincerely that the actual employees had always bright ideas about how the work would be done better. The climate that all the employees present their ideas was created in his term.

#### *vi. Captured Intellect from Every Person*

"The only way to get more productivity is capturing intellect from every person and obtaining people to be enthusiastic from their work" [28] said Welch and could not endure no one entering in GE offices or plants who performed below 120%. At this point, Welch stated that he did not mention about "running hither and yon and dripping with sweat" but the importance of working faster and agile. He continuously expressed that he had wanted to discuss about "satisfied employees means productive human resources" [31].

Welch has warned managers about improving labour productivity [32]:

"Do not be overwhelmed by charm of the great ideas by neglecting small ideas. Now we are getting regularly 6-7% productivity improvement by means of small ideas on a large scale. An idea should not absolutely be a wonder of biotechnology. This understanding concludes in looking the ideas incorrectly. Faultless invoicing system is an idea. Dealing with getting a work to be done in one day that was done in six days before is also an idea. Everybody could contribute to this. Ordinary people could too."

#### *vii. Worked with the Best People and Motivated Them*

According to Welch, the way of being a leader passes through to excite subordinates. Nevertheless, he expressed this: "You should have a good team to excite and energize. Work with the best subordinates" [16].

Welch by saying these words "If you could not append the

best people into you team, then you are in failure. Finding the right people for the right job is more important than developing a new strategy" [16] underlined a significant productivity reality. The present CEO of GE Jeffrey Immelt has also attached importance to working with the best people and developing them to be leaders for global companies [33]. Spiritedness defines Welch well. He is a reactor that creates energy. He perhaps uses his interior struggle as fuel. [21]. Welch motivated his subordinates by his energy and got them more productive.

Jack Welch of GE said: "Ten years from now, we want magazines to write about GE as a place where people have the freedom to be creative, a place that brings out the best in everybody, an open, fair place where people have a sense that what they do matters, and where that sense of accomplishment is rewarded in both the pocketbook and the soul. That will be our report card" [34]. So he spented his 60% of time fully to select and recruit people and energize them. For the upper 500 managerial position, he interviewed one by one with the potential candidates whose career seems to be improved in the future [19].

#### *viii. He was a Leader not a Manager*

Jack Welch is all about leadership, not management. Actually, he wanted to discard the term "manager" altogether because it had come to mean someone who "controls rather than facilitates, complicates rather than simplifies, acts more like a governor than an accelerator". Welch has give a great of thought to how to manage employees effectively so that they are as productive as possible. And he has come to a seemingly paradoxical view. The less managing you do the better off your company. Manage less to manage more. Welch continued [28]:

"We are constantly amazed by how much people will do when they are not told what to do by management". In the new knowledge-driven economy, people should make their own decision. Managing less is managing better. Close supervision, control and bureaucracy kill the competitive spirit of the company. "Weak managers are the killers of business; they are the job killers. You could not manage self-confidence into people."

Welch decided that GE's leaders, who did too much controlling and monitoring, had to change their management styles. "Managers slow things down. Leaders spark the business to run smoothly, quickly. Managers talk to one another, write memos to one another. Leaders talk with their employees, filling them with vision, getting them to perform at levels the employees themselves didn't think possible. Then they simply get out of the way" [28].

Indeed Slater quotes Welch as saying he detests the very notion of management. According to Slater, Welch insists that most managers overmanage, with the result that they all too often help to create the bureaucratic sloth and sluggishness that large companies should avoid [28].

That said, by differentiating management from leadership [28]: "I do not mean to imply that one or the other be ignored or is redundant. Rather I believe that by recognizing the important differences between them, an individual is better able to exercise them appropriately in a given situation, and meld them seamlessly in their organizational behaviour".

Managers muddle - leaders inspire. Leaders are people who inspire with clear vision of how things could be done better. "What we are looking for are leaders at every level who could energize, excite and inspire rather than enervate, depress, and control" [28].

#### *ix. Paid Attention to Performance Management*

All the employees assessed their subordinates and managers

crisscross by 360-degree performance management method systematically within the GE Company and the collected data are assessed to improve the overall performance. This work also includes the customer side [28].

Welch's suggestions for the managers who wants to improve productivity of their subordinates are listed below [20]:

- Apply performance appraisal to every layer because they want to know their performance is assessed and took into consideration.
- Knowing the meaningfulness of the contributions of the employees is critical.
- Rewarding of their doings is also critical for the employees.

In assessing the employees' performance, Welch's 20-70-10 approach has been used at GE [35]. The 20% group performing the best leads the change at every layer. The worst 10% group encounters difficulty in realizing the objectives. The others form the 70% medium group. The upper 20% group gets 3-4 times more increase in payment. The lower 10% group even gets no increase and they have to leave the company if they are in the lower performers for one after the other year successively.

20-70-10 approach had got performance discipline and increased accountability sensation at GE. In order to apply this system successfully, the older organizational culture has to be removed and aimed to bring forth a performance oriented culture [36].

Jack Welch's goal was to make GE "the world's most competitive enterprise." "We now know where productivity - real and limitless productivity- comes from. It comes from challenged, empowered, excited, rewarded teams of people," he said. Welch knew that the current business environment requires an energized, energizing leader: "You've got to be live action all day. And you've got to be able to energize others. You could not be this thoughtful, in-the-corner-office guru. You could not be a moderate, balanced, thoughtful, careful articulator of policy. You have got to be on the lunatic fringe" [16].

#### *x. Attached Importance to Coaching*

As far as Jack Welch, the legendary former CEO of GE, is concerned, middle managers have to be team members and coaches. "They have to facilitate more than control. They should be able to excite and praise people and know when to celebrate. Managers should be energizers, not enervators" [28]. In the company's 1993 Annual Report, Welch noted [38]: "To be blunt, the two quickest ways to part company with GE are, one, to commit an integrity violation, or, two, to be controlling, turf-defending oppressive manager who can't change and who saps and squeezes people rather than excites and draws out their energy and creativity."

The created coaching system in order to making use of experiences, not repeating the same faults, guiding the the new employees has been using efficiently all over the company [28].

## CONCLUSIONS

In today's business world, while the competition has increasingly been keen, the core reference point is becoming "How to train leaders?" aiming to utilize the resources effectively and meet the customers' and shareholders' expectations efficiently. While the speed of change increases, competition intensifies, and the new employees' expectations changes; the systematic development of leadership competencies of every layer is coming into prominence day by day.

In the literature so many publications have been issued related with the term of "leadership" but there are a few publications relating the theme of "the relationship between

productivity and leadership and the leader's role in productivity improvement". In this study, the effects of leader's role in business and labour productivity are given as an important case study. Leaders could be successful in improving the productivity by the best leadership practices within the company.

The question "Could a business leader absolutely improve the productivity of his or her company?" finds its response in the leadership practices of popular leader Jack Welch of GE. Welch may be the most popular and widely emulated leader in business history. He's used his own uncanny instincts and unique leadership strategies to run GE, the most complex organization in the world, increasing its market value by more than \$400 billion over two decades.

In his two decades as CEO, Jack Welch's principles, strategies, and tenets transformed GE into one of most dynamic and valuable corporations in the business history. As a result, executives in all industries are now eager to hear Welch's every pronouncement and implement his strategies in their own organizations.

To whom wants to improve productivity in business world, Welch's successful leadership practices should be inspiration source. The managers who leads instead of manages, makes his company more flexible and lean, captures intellectual ideas from his or her subordinates, motivates them and apply performance appraisal according to their competencies; so meet their objectives sooner.

## ACKNOWLEDGEMENT

This study appeared originally in an expertise thesis of the author, defended in 2003 at National Productivity Centre of Türkiye (MPM).

## APPENDIX THE BRIEF INFORMATION ABOUT GENERAL ELECTRIC COMPANY

GE; is internationally in the business from jet engines to power generation, financial services to plastics, and medical imaging to news and information. GE worldwide turns imaginative ideas into leading products and services that help solve some of the world's toughest problems. It has 313.000 personnel worldwide and active in more than 100 countries.

GE was founded by Thomas Edison who was inventor of light bulb in 1878 [21]. By 1890, Edison had organized his various businesses into the Edison General Electric Company. The Thomson-Houston Company and the various companies that had merged to form it were led by Charles A. Coffin, a former shoe manufacturer from Lynn, Massachusetts. These mergers with competitors and the patent rights owned by each company put them into a dominant position in the electrical industry. As businesses expanded, it had become increasingly difficult for either company to produce complete electrical installations relying solely on their own technology. In 1892, these two major companies combined to form the General Electric Company.

Several of Edison's early business offerings are in fact still part of GE today, including lighting, transportation, industrial products, power transmission and medical equipment. The first GE Appliances electric fans were produced at the Ft. Wayne electric works as early as the 1890s, while a full line of heating and cooking devices were developed in 1907. GE Aircraft Engines, the division's name only since 1987, actually began its story in 1917 when the U.S. government began its search for a company to develop the first airplane engine "booster" for the fledgling U.S. aviation industry. Thomas Edison's experiments with plastic filaments for light bulbs in 1893 led to the first GE Plastics department, created in 1930.



GE's leaders through the years have built a diverse portfolio of leading businesses; a stream of powerful Company-wide initiatives that drives growth and reduces cost; financial strength and Controllershship that allow it to capitalize on opportunities through numerous cycles; and a set of common values that allows it to face any environment with confidence [37].

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# Strategic human resource management and performance information in boundaries

**Terttu Pakarinen**

*Senior adviser; HRM, The Commission for Local Authority Employers, Finland  
terttu.pakarinen@kuntaliitto.fi*

**Keywords:** Strategic Human Resource Management (SHRM), performance information, boundaries, realism

## 1 INTRODUCTION

### *1.1 The background of the study*

This study is on the one hand founded on the increased productivity demands of the public sector, and on the other hand, on the development of the knowledge society, in which the success of organisations largely rests on their capacity to process information. This study deals with performance information as a function of strategic human resources management (SHRM). The two case studies on which this study is based both deal with vocational education. The evaluation of education performance has become increasingly more important both locally, nationally and internationally (cf. the Lisbon Strategy).

The data of this study has been gathered during the national research programme for the evaluation of the performance of municipal services (KARTUKE) and is one of the studies under the project “Increased performance in municipal organisation through competence” (OSAATKO) between 2002 and 2004. The study examines vocational education in a situation where educational services are provided to students and enterprises by experts in different fields.

National vocational education curricula have been revised so that the length of education has been extended to three years and emphasis is placed, through on-the-job learning, on an increasingly closer co-operation between education, business and working life. Furthermore, vocational qualifications provide eligibility for higher academic education. The system of credit-based funding has been designed based on performance evaluation in line with quality award criteria and the Balanced Scorecard model. Another measure to improve the quality of vocational education is the ongoing reform that will include competence-based examinations for young people, in curricula. During the same time period, a major organisational reform was implemented in the Northern Savo Vocational College, which is the object of my research, where decision-making and responsibility was pushed further down the organisation and the college was transformed into a team and process organisation.

### *1.2 The purpose of the study*

The purpose of this study was to ground a theory of performance evaluation as an information system of Strategic Human Resource Management (SHRM) in complex organisations [1], [2]. The aim of this study is to track the mechanisms causing the effects of performance evaluation [3]. The research question were: How does the Balanced Scorecard (BSC) -based performance evaluation work as a SHRM function and thus build strategic competence in a knowledge organisation? Performance information is examined both as a management system and a feedback system [4], [5]. In this study I explore the potential of performance information to produce effects on the organisation's performance and learning capacity, for which the concept of strategic

competence is used [6]. Social change is defined not only as strategic competence but also as the way in which strategies work in practice. The practical objective of this study is to find out what requirements learning based on performance information sets on human resources management and implementation of management systems.

## 2 THEORETICAL BACKGROUND

### *2.1 Performance evaluation as information system*

Performance evaluation as an information system has the consequence that also the organisations must be viewed as information systems [7]. Therefore, the relationship of strategic human resource management (SHRM) to performance evaluation, to knowledge management and to the concepts of competence and capability must be defined at different levels of organisation. Performance evaluation is usually viewed as a basic function of strategic human resource management in the sense that both strategic choices and goals and measures of human resource management (HRM), such as rewarding and development of personnel, are based on evaluation information [8].

In this study, joint authorities for education are viewed as knowledge organisations operating in their own context, and work is viewed as knowledge-intensive work involving expert positions where the prerequisite for success is the functioning of an information system that supports strategic human resource management. In complex, adaptive organisations, information related to performance is non-linear, flowing in the network of individuals, groups and organisations [9].

The studies on strategic human resource management have not really looked at SHRM from the viewpoint of complex systems. Colbert [1] calls for a view according to which the approach used in adaptive systems links together the tradition of resource based studies on human resource management and knowledge management practices that emphasise how people's own resources and hidden capabilities can best be brought out. Here, besides HRM contents, attention should be paid to processes used by individuals to create individual meanings related to HRM.

### *2.2 Organisational learning and strategic competence*

In order to illustrate the advantages of conceptualising organisations in terms of competencies it is useful to consider the ability to learn. This is one of the most discussed qualities of productive systems focused upon in the recent literature. Moreover, most accounts stress the importance of the collective nature of learning. Lawson [3] suggests the distinctions between capacities, capabilities, competences and dispositions using critical realism as a framework:

The term capacity is used for more passive power of a structure to attract, contain or receive. There is no learning involved in this. The term capability is used to refer to an ability which is possible but has not yet realised. At the system level, the main focus will be upon the networks of interconnections that enable skill or knowledge acquisition to

take place. The term competence refers to an ability (requiring skills and knowledge) that has been acquired. At the system level the focus is likely to be upon the abilities of systems to perform certain kinds of jobs etc. Finally, the disposition or propensity is a way of acting or being that the thing is likely or inclined to pursue or do. At the system level a disposition is any characteristic that is likely to be manifest in a certain outcome.

Organisational learning takes place through shared processing of evaluation information and through activities based on it. Lähteenmäki et al. [10] criticise the shallow theoretical foundation of organisational learning. They suggest that more research should be conducted on how individual learning is transformed into organisational learning. They emphasise the role of the individual and empowerment. There, attention should be paid to the organisational culture, leadership, structures and HRM. Various organisational factors either prevent or promote organisational learning. The organisation's knowledge creation process and the system of knowledge management allow the organisation to tap into its unused resources.

According to Viitala [11], competence management emphasises leadership for which immediate superiors have the main responsibility. Järvinen et al [12] see the development of teacher competence as two intertwined processes, professional work and organisational work. Work carried out at a joint authority for education is professional work where, following changes in the operating environment, a change from individual work to organisational work has taken place. Information from clients, both from students, business and working life, is strategically important.

Strategic competence can be developed and managed if emphasis is placed on how the personnel at workplace acquire, store, recall and interpret information and how they act based on this information [13]. In this case, strategic management is cognitive in nature, which means that emphasis is placed on strategy processes and on the development of organisational cognition. In a competent organisation the competency is situated in and between collectives [6].

The concept of competence can also be defined from several viewpoints. Markowitsch et al. [14] distinguish between individual competence related to work performance, competence related to goal setting and tasks, and the organisation's core competence where competence is embedded in organisational structures and processes. Both individual and organisational competence can be influenced with HRM.

To bring out competence, not only must individual competence be documented but conditions conducive to learning must also be developed. These include demands from customers, the management, colleagues and owners; changes in technology, organisation and working methods; management responsibility; the number of external customer contacts; feedback on work; management's encouraging attitude towards learning; rewarding competence with challenging tasks, career development and compensation [15].

### *2.3 Strategic human resource management and performance*

To achieve success, the organisation must generate knowledge through collective learning. When human resource strategies are based on competence, the competency point of view is relevant to all functions. The key functions of HRM include personnel recruitment, development, career planning and performance evaluation.

In this study, the definition of the SHRM concept is based on Gratton and Truss [2]. Strategic human resources

management is seen as a three-dimensional model: it is based on vertical alignment between people strategy and operational strategy; on horizontal alignment between individual HRM functions; and on an action and implementation dimension. The alignment of strategies and action is expected to be reached through competence and capability thinking that includes learning. Therefore, in this study, SHRM is linked to knowledge management. It is feasible since in the Northern Savo Vocational College, strategies are based on capability thinking and emphasis has been placed on individual competence management.

Kamoche [16] outlines the links between strategic human resources management (SHRM), competence and learning and develops a resource-capability paradigm for SHRM research. In the SHRM research school that emphasises resources, the organisation is seen as a combination of material and immaterial resources. They are expected to provide competitive edge to the organisation. In these studies, resources and capabilities have been defined as skills, collective learning (core capabilities embedded in the organisation's structures and processes) or as core competence. Some representatives of this school define resources as capabilities, organisational processes, organisation's characteristics, information and knowledge.

The earliest representatives of this school distinguish between resources and competence. Resources are input in the production process whereas organisational competency refers to what the organisation can accomplish with its resources.

The inclusion of the resource-competency viewpoint in SHRM emphasises the importance of human knowledge. This is related to organisational learning and, in particular, to the processing of evaluation information in organisations. Views that emphasise capability underline those processes and functions that aim for a competitive edge.

Strategic capability includes both human, structural and relationship capital. Individual competence is a good example of human capital. Structural capital consists of intellectual property and infrastructure; systems of performance evaluation and management provide an example of the latter. Finally, relationship capital refers to those distinct features that mark the organisation's relationship with customers, personnel and interest groups. From this viewpoint, HRM is seen as a promoter of strategic capability, as a driver or as the organisation's core competence [17]. The latter consider that HRM functions typical to the organisation can create unique competence that makes the organisation stand out from the rest. This in turn increases its competitive advantage or, in a public organisation, its public value.

When we talk about competence at the level of an organisation, some of the research emphasises the definition of the organisation's core competencies which incorporate collective learning [16]. The definition of individual competence is usually based on the relationship between individual skills and work demands [18]. Theories that emphasise individual competence often link competence to good work performance. Kamoche [16] aims to combine the concepts of individual and organisation-level competence through HRM. Thus, HRM must start from individual competence which includes both skills and behaviour that leads to good work performance.

From a performance point of view, individual competency can be defined as an effective response to work demands [18]. Task-specific competency is a combination of behaviours and aptitudes which are used to reach a desired result. Occupational competency is goal-oriented behaviour aimed to respond to work demands and service needs. Goal competency includes initiative and successful goal-directed



behaviour used to respond to the organisation's demands. Role competency refers to social setting-specific transactions that are instrumental in reaching desired goals. Competency potential encompasses the individual attributes that are necessary for the production of desired outcomes. The prerequisites for competency depend on circumstances and are related to the facilitators of and barriers to reaching organisational goals, created by the organisation and by social relations. Individual competency potential and the characteristics of the organisation influence work competency i.e. effective response to work demands. Here, it is a question of reconciling desired behaviours and outcomes with actual behaviours and outcomes. This can also be considered as the prerequisite for learning in HRM.

In this study, performance evaluation at the level of an organisation and performance evaluation at the level of an individual constitute the basic functions of SHRM and can be used to co-ordinate strategies and personnel strategies and HRM functions. This mechanism is expected to establish a link between HRM and performance by increasing the motivation and building performance capability of personnel [19].

### 3 METHODS AND DATA

The methodology of the study is based on critical realism. The performance information is thus seen as a social phenomenon, and it is presumed that its application will lead to a change in municipal services. The study was carried out combining intensive and extensive research [20]. The intervention 2002-2004 was the implementation of Balanced Scorecard as performance evaluation system. The joint authority has been organised into 11 study sectors and operates in six locations in the region. The total number of personnel was 497 in 2002, of which 249 were women and 239 men. The average age of personnel was 45.5 years.

The material was collected from a joint authority for vocational education using individual and group interviews (focus group) and a questionnaire. The collection of material took place in four separate stages from causal groups, management, staff, political decision makers, consultants and owner municipalities of the joint authority. In the first phase of the study, data were collected from documents and through interviews of individuals; in the second phase, a survey questionnaire on learning opportunities offered by work and workplace and on human resource management was used; in the third phase, focus group interviews were conducted; and in the fourth phase, the survey questionnaire of the research programme was used. Theoretical, methodological and data triangulation as a research approach was used. Each phase of data collection is based on the analysis of the material and feedback from the previous phase. The data were collected and analysed using grounded theory approach applied to the ontology and epistemology of realism.

In 2002, an initial survey was made and the following were interviewed: 2 representatives of strategic management, 6 superiors, 8 staff representatives and 2 representatives of interest groups. The initial survey showed that HRM and competence have the greatest influence on the success of a joint authority for education. The personnel survey conducted in spring 2003 was based on the themes surfaced in the initial survey. The section on HRM of the survey was based on the WERS survey [19] and on the questions included in Ehrnrooth's [21] dissertation on HRM. The section on learning conditions provided by workplace was adapted from the survey by Skule and Reichborn [15]. The strategic competence, core capability of the organisation was measured by the open question in this survey.

Altogether 96 persons (25%) responded to the 2003 survey. The survey was internal and was carried out in spring 2003 among the entire personnel of the joint authority by using an electronic questionnaire. The distribution of respondents closely corresponds to the distribution of personnel except for the management whose share slightly exceeds that of teachers and support personnel. Teaching personnel accounted for 57 percent of the respondents, support personnel 19 percent and management 24 percent of the respondents.

The agency in this article is defined as management and personnel. The variables related to learning conditions offered by work and to HRM were grouped into sum variables on a theoretical basis since the survey questionnaires used had been tested in earlier studies and thus, the theoretical framework was solid. Among the variables, statistical testing (T-test) has been used for leadership position and gender.

Focus groups were conducted 2003-2004 to 15 groups (11 study sections, management team, support personnel, political decision makers and customers). The aim of the survey in the end of the study 2004 was to measure the implementation of the Balanced Scorecard –based performance evaluation system. The results of this case study (top down implementation) were compared with an case study on the bottom up implementation of management systems conducted 10 years earlier in order to analyse the historical context of vocational training and management systems.

### 4 RESULTS

The results of the study can be divided into three reality areas [22]; management systems affecting performance (empirical), phenomena connected with the performance information flow and its effects on organisational learning (actual), and action and interaction (real) in boundaries [23]. A boundary phenomenon explains learning from performance information and knowledge flow. This phenomenon can in turn be explained by the social identity theory [24], which is the link between organisation/management research and social psychology. Social change is connected to learning at micro-, meso- and macro level in complex system and can be enhanced by action and interaction between levels.

In practice, the results suggest, that performance evaluation works as an information system and produces strategic competence in organisations, when the three dimensions, vertical, horizontal and action dimensions of SHRM are in use [2] and when the learning-intensive jobs are designed [15]. The most important dimension of SHRM seems to be the action dimension, where the arenas for performance and knowledge management practices are used.

Management of change emerges as a challenge to leadership and management at two levels. In the work of the immediate superior, the importance of identity work in interaction with staff is emphasised, whereas top management should focus more on the process of strategy work and on support for middle management, who play the role of boundary spanner. The actual performance of management systems requires that the socio-cognitive processes has been developed within the organisation so that the performance information can flow at the boundaries both horizontally and vertically.

### 5 DISCUSSION AND CONCLUSION

The results of the empirical study were compared with the theoretical findings in previous research literature. In order to develop the strategic competence in organisations, emphasis should be put on the learning-conducive work designs, which enable the competencies to develop. The development of

strategic competence would require the processes of gathering, storing, recalling and interpreting performance information [13].

The limitations of this study were that it was the first empirical study based on critical realism and the research process developed by Danermark [20]. It was conducted to describe the structures and processes of one organisation, where the performance evaluation system was implemented. Since both case studies dealt with vocational education, the results cannot be reliably generalised to other organisations. Nevertheless, similar results were also obtained in studies on other municipal services under the KARTUKE Research Programme.

Finally, strategic human resource management is supported by the view put forward by Colbert [1] that in complex context, especially strategic human resource processes, "strength" of the HRM system and performance culture should be developed and the climate improved in order to promote the success of organisations. This paradigm of SHRM needs much more research than was possible in this study.

If the aim of the performance management is to promote the development of human resources and people's commitment to the organisation's objectives, attention must be paid to learning conditions, opportunities for middle-management (the role of boundary spanners) to carry out activities (goal-setting and appraisal), and to knowledge management, where so-called tacit knowledge is made use of and structures and processes (arenas for strategic dialogue) are developed.

Educational organisations provide a good example of knowledge organisations where expertise needs to be constantly improved and where learning is of critical importance from the viewpoint of both customers and personnel. In complex context, the management of knowledge and competence has become a success factor of increasing importance for the organisation. What this means in practice is a sensitivity to recognise needs for change and an ability to analyse organisational information. In this analysis is helpful, if you consider this information from the viewpoint of personnel, work and organisational development. Once strategic competence has developed, organisations are able to act proactively and not merely react to changes once they have already taken place. Then the organisation will be able to constantly develop its competence and make new strategic conquests.

#### ACKNOWLEDGEMENT

This study has been carried out with financial support from the Finnish Work Environment Fund.

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# Feelings of joy or failure – experiences of self-efficacy in work settings

Liisa Myyry<sup>1</sup>; Tuija Hytönen<sup>2</sup>

<sup>1</sup> Researcher, University of Helsinki, [liisa.myyry@helsinki.fi](mailto:liisa.myyry@helsinki.fi)

<sup>2</sup> PhD, Helsinki Police Department, [tuija.hytönen@helsinki.poliisi.fi](mailto:tuija.hytönen@helsinki.poliisi.fi)

*Keywords – self-efficacy, emotions, learning*

## 1 INTRODUCTION

### 1.1 Background

The purpose of this study is to examine how people conceptualize their positive and challenging experiences of self-efficacy in organizations. The present study is a part of the Learning Network for Knowledge Management Project, which is a participant in the Finnish Workplace Development Programme administered by the Ministry of Labour. The aim of the project is to support the development of knowledge management in work organizations as well as to study how organizational culture enhances or on the other hand inhibits learning in organizations. The network has six work organizations both from the public and private sector representing different branches as network partners. In addition, there are three research organizations (Department of Education in University of Helsinki, Institute for Educational Research in University of Jyväskylä and The Finnish Employers' Management Development Institute) and the coordinating organization, Palmenia Centre for Continuing Education in the University of Helsinki.

The Learning Network of Knowledge Management operates on three levels. Firstly, there are development processes in each of the work organizations dealing with the individual issues of knowledge management of the organization. Secondly, research concerning knowledge management is carried out in every work organization hand in hand with the development processes. Thirdly, network forums for all the participants are held four times a year in order to increase the learning on the network level.

The Meritum-model of intangible assets [1] serves as a framework of the network. The model is a result of a MERITUM project (Measuring intangibles to understand and improve innovation management) administered by the European Commission, and it has three main dimensions: 1) human assets, i.e. components which include knowledge skills and other attributes related to individuals, e.g. attitudes and emotions; 2) structural assets, i.e. components consisting of internal structures and processes, e.g. organizational culture, values and norms; and 3) relational assets, i.e. components related to external, e.g. customer and partnership relations of an organization. Thus, the Meritum-model can be used to define the facets of knowledge management in an organization and it has been used successfully to identify the objectives of development in the organizations of the Learning Network of Knowledge Management.

### 1.2 Beliefs of self-efficacy

In the current study the episodes of success and challenges in work settings were assessed as the positive and negative experiences of self-efficacy. To be successful at work, people must not only hold the required skills but they should also believe they have capability to exercise control over events to achieve desired goals. The belief that one can perform successfully is called self-

efficacy. Thus, even if people have the same skills they may perform differently depending on whether their self-efficacy beliefs increase or decrease their motivation and problem-solving efforts. [2] The beliefs and experiences of self-efficacy obviously belong to the dimension of human assets in the Meritum-model.

Beliefs of self-efficacy develop through the interaction of personality and environment, and they have four main sources. Firstly, people can develop a strong sense of efficacy through mastery of experiences. Success strengthens self-beliefs of capability and failures create self-doubts. However, experiences of overcoming obstacles are important in order to gain a resilient sense of efficacy and to learn that success usually requires effort. Secondly, modeling is an effective way to enhance one's beliefs to perform. Especially seeing similar others succeed by persistent effort raises observers' beliefs in their own capabilities, whereas observing similar others fail despite high effort lowers one's judgments of her/his own capabilities and undermines her/his efforts. Thirdly, social persuasion by getting realistic encouragements can raise one's self-efficacy. However, if one's beliefs are raised to unrealistic levels, the risk of failures increases. Fourthly, a person's physiological state can affect the way she/he assess her/his capabilities in a given situation. Emotional arousal and tension may be signs of vulnerability to poor performance. [2] In terms of organizational behaviour, beliefs of self-efficacy are found to be positively related to perceived control at the workplace and to problem-focused reactance, which refers to reactive behaviours intended to directly restore freedom at work, for instance, attempting to increase autonomy and participation, if this freedom is threatened some way [3].

One's judgments of personal self-efficacy affect also one's choice of activities and environments. People tend to avoid activities and situations they believe will exceed their coping capabilities but are inclined to choose activities and environments they judge themselves capable of managing [2]. Thus, people can choose their occupation depending on what kind of capabilities they believe they have [4]. In a same way people can choose different situations and activities at the workplace. Persons with high beliefs of efficacy may be prone to select situations where they can meet challenges whereas those with low beliefs of efficacy might try to avoid too challenging situations.

### 1.3 Emotions at work

It is plausible that experiences of self-efficacy and success produce feelings of joy and happiness, whereas experiences of failure may cause feelings of self-doubts and frustration. Moreover, different occupations have different requirements for desirable emotions. Although research has generally neglected the impact of everyday emotions on organizational life, the existing findings suggest that there are a number of factors that are related to emotional variation in organizations. Group norms, group roles and social hierarchies can affect the types of emotions people express at work and the ways they do it [5]. Ashforth and Humphrey [6] claim that there are four institu-

tionalized mechanisms for regulating the experiences and expression of emotion in the workplace. Emotions can be neutralized by preventing the emergence of emotions for instance by formal organizational structures and processes and by emphasizing the rigid role obligations. If emotions are unavoidable by-products of role performance (i.e. for a doctor) they can be buffered by compartmentalizing emotionality and rationality. Goffman's [7] conceptions of front stage, where emotions are involved, and backstage, where the routine tasks can be performed without the charge of emotionality, illustrate this. On the other hand, if emotional expression is desired component of role performance, the manners in which emotions are expressed are usually prescribed. Different occupations (e.g. salesperson, flight attendants) may have different "feeling rules", which specify the range and intensity of emotions and which can be institutionalized by organizationally-sanctioned scripts. In Hochschild's [8] terms, prescribing emotions is emotion work. Finally, emotions can be normalized by diffusing (e.g. apologizing, making jokes) unacceptable emotions or by reframing the meaning of emotions, e.g. trying to make it look like rationality. Contrary to the traditional view of motivation in work as cognitively based, there is growing literature which shows that emotions are begun to be seen as important motivational factors in organizational behaviour, as for instance the conception of "flow" by Csikszentmihalyi [9] demonstrates. On the other hand, self-beliefs of efficacy are related to the commitment of goals as well as to the level of motivation by influencing the amount of effort people will put forth and how long they will keep trying.

Consequently, while beliefs of self-efficacy and emotions belong to the dimension of human assets, the organizational culture - the norms and values that guide the organizational behaviour - are part of structural assets of the organization. How these two dimensions interact with each other, in other words, how organizational culture enhances or restricts beliefs of self-efficacy and how it regulates emotion expression is one issues of this paper.

#### *1.4 Organizational culture*

The factors involved in organizational culture or structural assets in terms of Meritum-model are of course numerous but here the Job Demands – Resources (JD-R) Model [10] is used. According to the JD-R model two broad work characteristics can be distinguished regardless of the occupation, namely job demands and job resources. Job demands refer to the physical, psychological, social or organizational aspects of the job that require persistent cognitive or emotional effort. Albeit job demands might reflect the challenges in work they may become stressors in situations which require high effort to sustain an expected performance level. Examples of factors of job demands used in research are e.g. work overload and poor physical work environment [11].

Job resources refer to the physical, psychological, social or organizational aspects of the job that may (1) reduce job demands and the associated physiological and psychological costs (2) are functional in achieving work goals, and (3) stimulate personal growth, learning, and development. Job resources have been measured by factors like job control, access to information, supervisory support, innovative climate and social climate. [11].

#### *1.5 Learning in organizations*

Another question concerning the experiences of self-efficacy in work settings is how these experiences are related to learning. The project of Learning Network of Knowledge Management has utilized the notion of knowledge creation by Nonaka and Konno [12] to analyze learning in organizations. In terms of Nonaka and Konno's model, organizations can be seen

as spaces for learning. They describe this kind of space with a Japanese concept *Ba* which means a shared space for emerging relationships. These spaces can be physical (e.g. office), virtual (e.g. e-mail, internetconference), mental (e.g. shared experiences, ideas, ideals) or any combination of them. When participating in *Ba* individuals or teams or organizations can transcend their own perspectives or boundaries. The idea is close to Vygotsky's [13] zone of proximal development, which means that people can learn together with others things they could not learn alone.

According to Nonaka & Konno [12] knowledge creation in organizations is a spiraling process of interaction of explicit and tacit knowledge. Explicit knowledge is something that can be expressed in words and numbers and shared in the form of data, scientific formulae, manuals etc. It can also be transmitted between individuals formally and systematically. Tacit knowledge, on the other hand, is highly personal and difficult to communicate or share with others. It is usually rooted in an individual's ideals, values or emotions.

Consequently, knowledge creation can take place in four different processes: 1) socialization, which involves the sharing of tacit knowledge between individuals; 2) externalization, which refers to expression and explication of tacit knowledge into explicit knowledge so that it can be understood by others; 3) combination, i.e. conversing explicit knowledge into more complex sets of explicit knowledge, e.g. documents; and 4) internalization, which involves converting explicit knowledge into the organization's tacit knowledge, e.g. through learning-by-doing.

Furthermore, there are four types of *ba* which correspond the four knowledge creation phases. Representing the socialization phase there is the originating *ba* where the knowledge creation begins. It is characterized by physical, face-to-face experiences where individuals share feelings, emotions and experiences and empathizes with others. The interacting *ba*, which corresponds the externalization process, is more consciously constructed than the originating *ba* and it is illustrated e.g. in teams. To make the tacit knowledge explicit, dialogue is used to share mental models and skills and to convert them into common concepts. For combination phase there is the cyber *ba*, which most efficiently takes place in collaborative information technology environments like on-line networks, documentations and databases. Finally, there is exercising *ba* which represents the internalization process where explicit knowledge is transformed to tacit knowledge in action. This is done e.g. through training programs which help individuals to understand the organization and themselves in the whole.

Thus, besides the individuals' motivation to learning, organizations should provide a suitable place or space for learning. Organizational culture plays an essential role in this (e.g. [14]). Considerable evidence suggests that a culture that fosters inquiry, openness and trust enables effective organizational learning whereas a rigid and perpetuating culture may inhibit learning. Therefore, albeit beliefs of self-efficacy influence strongly learning and performance at the individual level the impact of organizational culture is essential, too.

The focus of the present paper is on the positive and negative experiences of self-efficacy in work. We also tried to identify emotions the respondents felt in these situations and how those experiences are related to learning. Because the interviews did not directly deal with emotions or learning in terms of the episodes of success or challenge, we focused on emerging emotions and learning experiences that were spontaneously reported.

## 2 METHODS AND PROCEDURE

We collected 28 narratives about experiences of self-efficacy in three of the work-organizations of the Learning network of

knowledge management. The number of the narratives per organization varied from five to 18, and the organizations represented branches of day care, information management and food industry. The interviews were done individually during the working days, and they took about an hour to complete.

The interviews consisted of the following issues:

1. Tell me about your work.
2. Tell me about the episodes of success in your work. What happened? What did you do? What kind of knowledge was related to them? With whom?
3. Tell me about the problematic episodes in your work. What happened? What did you do? What was the problem? Why?
4. In what way have you solved the problems? What was the result?

The data was analyzed using the Atlas-ti –programme. From the episodes of positive and negative experiences of self-efficacy, spontaneously reported emotions as well as the experiences of learning were assessed. How organizational culture was related to the experiences was also examined.

### 3 RESULTS

#### 3.1 Episodes of success

The respondents reported altogether 86 episodes of success, approximately three episodes per respondent. Three types of successful episodes were identified from the data (Table 1). Firstly, doing one's work well was a powerful source of feelings of self-efficacy for the respondents (note that each of the respondent could have been described several episodes of the same kind). It means that people felt they have succeeded when they performed well in their day-to-day work. The emotions associated to these kinds of episodes were satisfaction and relief. The level of the feelings of satisfaction varied from relatively neutral pleasure to deep feelings of content which could last several days or even weeks. Long-lasting emotions were typically reported after time-consuming jobs or if the job was done under extreme time pressure.

TABLE 1 Positive experience of self-efficacy, emotions and spaces for learning

Positive experiences of self-efficacy	Reported emotions	Space for learning
Doing one's work well (N=32) – perform well in everyday work	Satisfaction Relief	Exercising ba Cyber ba
Emotional work (N=29) – helping – calming down	Satisfaction Relief	Originating ba
Innovation (N=25) – new way to do something – new tool or procedure	Satisfaction Exercising ba	Enthusiasm

The second main category was episodes of emotional work. According to Hochschild [8] emotion work is the act to change the degree or quality of an emotion or feeling. Here emotional work refers also to the acts where respondents try to affect the feelings of the other people, e.g. customers. The situations might require appeasement, trying to calm down other's anger or excitement, empowerment, trying to heighten other's beliefs of self-efficacy, or simply helping or supporting the other one in need in some way. Especially among the respondents from

the day care centre emotional work was common. The successful episodes of emotional work aroused same kind of emotions as the first category, namely satisfaction and relief. Satisfaction was strongly associated especially to the episodes of helping and supporting others. Even if the actual performances could be sudden the emotional experience might be intense and empowering. Positive feedback received from others increased the emotional arousal.

The third type of positive experiences of self-efficacy were situations where the respondents have done some innovation, for instance figured out some way to do the job better or invented a new tool or procedure to facilitate working. This was particularly typical for information management personnel. Besides satisfaction, which was linked to all three types of positive experiences of self-efficacy, experiences of innovation raised feelings of enthusiasm. Enthusiasm was described as a deep feeling of joy.

As Table 1 further presents, positive experiences of self-efficacy provide spaces for learning in different forms. Doing one's work well took place in exercising ba through e.g. learning-by-doing or in the cyber ba where the respondents take part in combining the explicit knowledge to more complex forms. Emotional work was performed in originating ba, space of face-to-face interaction. There interviewees met the needs of others and made efforts to respond to them. The successful episodes of innovations took mainly place in exercising ba. Using their skills in different work tasks and facing their new problems respondents might – sometimes after several trials and errors – create a new way to perform. In some occasions an innovation occurred when a newcomer viewed things differently and invented a new way to perform.

#### 3.2 Experiences challenging beliefs of self-efficacy

From the episodes where beliefs of self-efficacy were challenged four categories were formed, reported in Table 2. Number of reported episodes was 93, and the mean for each respondent was 3.3. The most common experiences were cognitive challenges that test the cognitive capabilities of the respondents. Solving complicated problems or doing tasks which require extreme accuracy were the prototypical episodes in this category. These experiences were particularly typical for the respondents from the information management and the food industry organizations. In some situations cognitively challenging experiences produced feelings of frustration when the problem seemed so difficult that it formed a risk to one's beliefs of self-efficacy, but on other occasions cognitive challenges could generate feelings of devotedness (uppoutuminen) when the respondents got deeply involved in the problem and concentrated hard on solving it. If – and when – they succeeded; their self-efficacy beliefs were raised.

TABLE 2 Negative experiences of self-efficacy, emotions and spaces for learning

Experiences challenging self-efficacy	Reported emotions	Space for learning
Cognitive challenges (N=39) – problem-solving – accuracy	Frustration Devotedness	Cyber ba Exercising ba
Emotional challenges (N=32) – problems in human relationships, e.g. with customers or in work group	Insecurity Anger Mental strain	Originating ba Interacting ba
Insufficiency of resources (N=13) Perseverance (N=9)	Frustration Frustration	Exercising ba Exercising ba

The next representative type was emotional challenges. These were the situations where relationships with customers or colleagues entailed emotional problems which were difficult to



solve or sometimes it took a long time to reach the solution. This kind of experiences promoted emotions like insecurity and anger. Furthermore, personnel could get deeply engaged and mentally strained during these experiences. However, it seems that although the situations could be a threat to self-efficacy, respondents having strong beliefs of self-efficacy were more prone to seek emotionally challenging experiences.

Thirdly, the respondents found out challenging the situations where insufficiency of resources induced problems for job performance. Lack of personnel and economical cuts causing impoverishment of facilities were the most typical challenges faced by respondents in this category and concerned especially organizations of the public sector. Poor work conditions aroused frustration when the expected and desired performance level could not be achieved. Having to show unusual perseverance in order to get the work done was the last category for the challenging experiences of self-efficacy. Some respondents described long and laborious processes which they felt made working more difficult and hindered successful performance. The situation might be a consequence of close control or resistance of other parts of the process, e.g. customers, to proceed. Like experiences of insufficient resources, frustration was the feeling associated to experiences of perseverance.

In terms of spaces for learning cognitive challenges took place in cyber ba or in exercising ba. As successfully performed cognitive challenges turn into experiences of success, the respondents may struggle with cognitive demands of knowledge combination while working with databases etc. Most often, however, cognitive challenges were encountered in everyday action where problems of work have to be solved. Emotional challenges were mostly faced in originating ba, in face-to-face and informal interaction with others where socialization of tacit knowledge takes place, or in interacting ba, more formal spaces were ideas and emotions were shared between individuals to make them explicit. Perseverance and insufficiency of resources were often experienced through action; hence exercising ba was the space for them.

### 3.3 Organizational culture

Characteristics of organizational culture, or structural assets in terms of Meritum-model, that increase and support the beliefs of self-efficacy relieved by this data could be classified according to the Job Demands-Resources Model [10]. As job demands were identified time pressure, control, unpredictability of procedures, insufficient job resources, negative social climate and lack of supervisory support (Table 3). Time pressure was found to be especially stressful if it was extreme and continuous. Sometimes it was related to control. However, time pressure and control did not per se affect harmfully the beliefs of self-efficacy or learning opportunities. If the challenges were overcome the experiences could turn into the episodes of success in one's work history. Unpredictability of procedures at the workplace reflects situations where no permanent and commonly shared rules exist. This caused frustration and decreased motivation to develop.

Negative social climate and lack of supervisory support refer to the social relationships in organizations. Strong tensions between colleagues may decrease the self-efficacy beliefs if the feedback got from others is mainly negative. The effects of missing supervisory support were not usually so severe but might influence the general performance level. Insufficient job resources, e.g. reduced economic resources, on one hand caused time pressure by the lack of personnel, and on the other hand decreased learning opportunities when the employees could not take part in courses etc.

TABLE 3 Job demands and job resources identified from the data

Job demands	Job resources
Time pressure	Respect
Control	Trust
Unpredictability of procedures	Supervisory support
Negative social climate	Positive social climate
Lack of supervisory support	Flexibility
Insufficient job resources	

Respect, trust, flexibility, supervisory support and positive social climate were recognized as job resources. Respect and trust provided from the organization are found out to be effective predictors of work satisfaction and commitment [11]. These aspects are also related to supervisory support and positive social climate – the positive relationships between employees. Flexibility was described as resiliency of control and norms of organization in order to induce adaptability of procedures.

## 4 CONCLUSIONS

In the current study we assessed the positive and negative experiences of self-efficacy in work. The spontaneously reported emotions and learning experiences involved in these experiences were also examined.

In line with earlier research the data revealed that success strengthens self-beliefs of capability. The respondents also seek challenges, both cognitive and emotional, but readiness to face emotional challenges seems to be more related to the high self-efficacy beliefs. Often individuals who have acquired a strong sense of professional identity were more prone to seek emotionally challenging situations.

The positive experiences of self-efficacy produced positive feelings like satisfaction, relief and enthusiasm whereas emotions aroused in challenging situations were mostly negative. However, cognitive challenges gave sometimes rise to devotedness. The mental strain related to the emotional challenges perhaps induce that the positive feelings stay in the background in these experiences. In all, consistent with the suggestion that emotions are important motivational factors of organizational behaviour [6], our data implies that positive emotions motivate individuals in their work and help to reduce the psychological costs posed by negative feelings.

In regard with the spaces for learning, it is worth to notice that most often the experiences of self-efficacy took place in the exercising ba, in everyday action. Knowledge creation took also place in the cyber ba, the virtual space where the explicit knowledge is combined to more complicated forms, or in the originating ba, where the socialization of tacit knowledge occurred. The low frequency of the interacting ba as a space for self-efficacy experiences might indicate that situations where individuals can share ideas and convert tacit knowledge in explicit knowledge are relatively rare in these organizations.

As noted earlier, to be successful at work, people must not only hold the required skills but they should also believe they have capability to exercise control over events and achieve goals. Realistic beliefs of self-efficacy increase productivity both at the personal and at the organizational level. As organizational culture plays an essential role in organizational behaviour [11], this data also demonstrates that job demands (e.g. time pressure, negative social climate, unpredictability of procedures) require cognitive or emotional effort and might affect harmfully to the beliefs of self-efficacy or inhibit learning. Positive job resources (for instance trust, supervisory support and positive social climate) create a supportive atmosphere for

personal growth. However, the relationships between human and structural assets of the Meritum-model should be scrutinized more closely in order to understand better how they interact. This is the issue of further research.

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# A study of the time lagged relationship between intellectual capital investments and productivity

Jaani Väisänen<sup>1</sup>; Paula Kujansivu<sup>2</sup>; Antti Lönnqvist<sup>3</sup>

<sup>1</sup> Researcher, Tampere University of Technology, jaani.vaisanen@tut.fi

<sup>2</sup> Researcher, Tampere University of Technology, paula.kujansivu@tut.fi

<sup>3</sup> Senior Researcher, Tampere University of Technology, antti.lonnqvist@tut.fi

**Keywords** — intellectual capital, investment, productivity, profitability, relationship

## 1 INTRODUCTION

Intellectual capital (IC), or intangible assets, is an important part of any given company's resources. It is a fact that is heavily emphasised in a modern knowledge-oriented economy and it is reflected in the growth and importance of the so-called knowledge workers [1], [2]. However, IC does not reside just in workers' heads. IC is said to consist of an organisation's immaterial sources of value that are related to its employees' capabilities, resources and ways to operate as well as the relationships with the company's stakeholders [3]. The amount of IC usually varies across industries. A Finnish study [4] has stated that industries that are richest in IC include electronics and business services, both industries that do not necessarily depend on large and expensive tangible resources such as heavy machinery. On average the amount of intangible resources was reported to be larger than that of tangible resources in these industries. On the other hand, the same study proposed that industries such as forestry, metal refinery, and gas and water suppliers had intangible/tangible resources ratio of about 25 per cent. Nevertheless, the importance of IC should not be underrated regardless of the industry.

Since companies do have IC at their disposal, it seems reasonable to assume that it will also affect their performance in the markets. For example a well-known and esteemed brand is something that is hard to classify as a tangible resource, but it is clear that a well-respected brand is worth a lot to its owners [5]. Similarly, improving employees' talents and capabilities by superior training or better working environment should lead to increased productivity [6]. Managing IC is not a straightforward process however. It can include different types of activities. For example, it can mean developing employees' competencies or the long-spanning development of corporate culture. Either way, it is likely that when managing IC in a company, there are bound to be some expenses to it, and as with any other investment, IC investment plans need to be justified before they are executed.

The main objective of this study is to determine how investments in IC affect company's productivity and profitability. A theoretical framework for IC and related components is presented along with previous research that this study is based on. Variables for IC investments, productivity and profitability will be defined, which will be used in the empirical part of the study. The empirical part consists of examining the relationships between IC investments and productivity and profitability by statistical methods using a large data set of Finnish companies.

The data set used is gathered by the Central Statistical Office of Finland (Tilastokeskus), and it consists of financial statements of approximately 20,000 companies. The financial statements were recorded in 2001, 2002 and 2003 making the total number of cases altogether 60,304. The data is divided into eleven largest industries in Finland as well as into small and medium-sized enterprises (SMEs) and large companies. More information on research methods can be found in the Methodology section.

## 2 CHOOSING RESEARCH QUESTIONS

A body of evidence has been gathered from the previous literature suggesting that an investment in IC can yield twice as much benefit as a similar investment in a physical asset [7]. But different industries and different companies have different needs and amounts of IC at their disposal, and those needs need to be taken into account when making any managerial decisions [8]. It is currently still unclear as to how investments in IC actually affect company's profitability, and what the influential components behind this relationship are. One reason for this is that IC investments can be made in a very broad range and it is probable that they will not yield profits until years from the investment [9], so the effects of the initial investments are hard to value properly.

In the past literature R&D costs have been one of the most used measures in measuring IC and there is evidence of association with R&D and enterprise productivity or profitability [10], [11]. Although R&D costs are relatively easy to obtain from financial statements, some problems will arise. For one, R&D costs in financial statements

encompass different things depending on the industries, geographical location and technology affiliation [7], [12]. The other problem arising from using R&D expenditures as a measure of IC is naturally the fact that not all IC investments fall under the category of R&D. Examples of this are advertising costs and human resources management expenditures. The authors are aware of the issue, and advise the reader to think critically when interpreting the results from any R&D-measured study.

For most part this study is based on the findings from a study by Theodore Sougiannis [9], which presented results from a number of US-based companies. The study showed that one-dollar increase in a company's R&D expenditures would produce a two-dollar increase in profits over a seven-year period of time. Furthermore, according to the study the benefits were not realised immediately, but rather so that they gradually increased for three years, and then started to decrease. Another important finding from Sougiannis' research is that when the investment value of R&D was estimated, it was found out that the direct effect of R&D investments was considerably smaller than the indirect effect. That is to say it is possible that the R&D investments themselves can actually have a negative effect on market price, but the earnings from the investments were so high that the overall impact on market value was positive. The main shortcoming of Sougiannis' study is the fact that it was carried out by using a multi-industry sample and not considering industry-specific differences, as well as disregarding the companies' sizes, as these factors might be used to explain some of the results. These issues will be taken into account in this study.

Other studies imply similar results not only from R&D investments and profits. Proper human resources management is said to improve productivity [13], [14], along with information technology acquisition and competence that increases both efficiency and financial performance [15]. Advertising and product-related immaterial property rights are also linked to IC, and are bound to increase profits [16], [17]. Based on these findings the authors have formulated the following assumptions that form the basis of this study:

- 1) Although R&D expenditures have already been used a great deal in prior research to measure IC investments in companies, it is an important component of IC, and therefore should be included in this study as well.
- 2) Besides R&D, other components should also be investigated in order to obtain a broader image of IC.
- 3) Separation between different industries and different-sized companies should be taken into account.
- 4) Investments in IC are reported to accumulate profits with a delay from the original investment, so a time-lagged model must be introduced to accurately depict the effects from these investments.

As the previous findings suggest, various relationships exist between the initial IC investment, and its outcome. In

this study the following concepts are used:

- a) *IC investments* are defined as various monetary efforts that are aimed to improve company's intangible resources, and here they are divided in pure R&D investments and overall IC investments, which include R&D, advertising, IT and programming, and immaterial property expenses.
- b) *Productivity* is defined as output per the input that has been used to create the output.
- c) *Profitability* is defined as the financial results of business operations.

From assumptions 1)–4) and definitions a)–c) the following research questions have been formulated:

- I How and at what rate do R&D investments affect company's productivity?
- II How and at what rate do overall IC investments affect company's productivity?
- III How and at what rate do R&D investments affect company's profitability?
- IV How and at what rate do overall IC investments affect company's profitability?

The research questions I–IV are studied in settings where companies are divided by their industry and size. The authors acknowledge that the relationships are complex. For example, good profitability may result from investing in IC and, respectively, strong profitability provides good possibilities for investments in IC. However, in this study, we examine these relationships only from one direction.

### 3 METHODOLOGY

#### 3.1 Data

The data used in this study is gathered by the Central Statistical Office of Finland, and it comprises information from the financial statements of Finnish companies between 2001 and 2003. Companies that employed less than five employees or operated less than six months a year were excluded from the data set. The sample sizes per year were as follows: 20,677 for 2001, 19,013 for 2002 and 20,614 for 2003.

The data was divided into eleven largest industries in Finland, namely food, forest, chemical, metal refinery, electronics, vehicle manufacturing, construction, business services, electricity, gas and water supply, wholesale and retail, and transportation, storage and telecommunications industries. The data was also divided between large companies and SMEs. According to the new EU definition guideline [18], to qualify as an SME, a company must have no more than 249 employees. There are other factors included in the EU definition as well, including annual turnover and annual balance sheet, but in this study only the staff headcount is taken into account. This classification is important as 99.7 per cent of all Finnish companies in 2003 were SMEs. Equally important observation is that 92.9 per cent of all Finnish companies were reported to have nine or less employees [19]. This means that with a sample of 60,304 companies the results may not apply to

all of the Finnish micro-enterprises.

### 3.2 Measures

As previously mentioned, investments in IC can be measured with pure R&D expenditures and overall IC expenditures. However, there are various-sized companies in the data set across industries, which is a fact that provides a problem for comparative analysis of the results. To counteract this issue, the statistical analyses in this study are performed with relative R&D expenditures and relative overall IC expenditures. The term “relative” means here that both the R&D and overall IC expenditures are divided by company’s net revenues. From here on, when any kind of IC expenditures are discussed, we refer to the relative expenditures.

In this study, productivity is measured by value added per number of employees in the company [20]. This is not a fully valid measure of productivity but its results can be compared within different-sized industries. Profitability is measured by return on investments, which is a common and widely used tool to measure a company’s profitability [20].

### 3.3 Statistical methods

First, the data is examined by correlation analysis. The whole sample is observed along with different industries and different-sized companies. Both Pearson and Spearman correlation coefficients are computed between IC investments (R&D expenditures and overall IC expenditures) and their results (productivity and profitability). The Spearman correlation was included in case the data was not normally distributed or if outliers would provide bias. Correlation analysis gives us the first insight into which variables might be worth investigating. The correlations are calculated by using time-lagged observations. That is to say, correlation of IC investments at the time  $t$  will be computed with the IC investment results at time  $t$ ,  $t+1$  and  $t+2$ .

To find out better how different IC investments influence the productivity and profitability of the company, the authors have also applied regression analysis to the data. The aim of the regression analysis was to provide as simple model as possible to depict how and when IC investments benefit the company. Hence, a simple regression model was constructed as follows:

$$y_{j,t} = \beta_0 + \beta_1 x_{k,t-i} + \varepsilon, \quad j = 1,2, k = 1,2, i = 0,1,2 \quad (1)$$

where  $y_{1t}$ =company’s productivity at time  $t$ ,  $y_{2t}$ =company’s profitability at time  $t$ ,  $x_{1t}$ =R&D investments at time  $t$  and  $x_{2t}$ = overall IC investments at time  $t$ . The  $\beta_1$  coefficient will measure the direct benefits that may come from the IC investments.

As well as with the correlation analysis, the regression analysis is carried out from three perspectives: the whole sample, by industry, and by company size. To counter any possible bias from any outliers or other influential observations, the *dffits* statistic was used, which measures

the influence of  $i^{\text{th}}$  case on the fitted value from the model [21]. An absolute value for the cut-off point for influential observations was 2. If the absolute value of the *dffits* statistic turned out to be any larger, a weight of 0.1 was used to counter the bias from these influential observations.

## 4 RESULTS

### 4.1 Correlation analysis

The results of the correlation analysis for lagged observations for the whole sample are presented in Table 1. When the 5 % risk level is assumed, it was seen that the Spearman correlation coefficient provides the most satisfactory results, so only they are presented here. This is most likely due to non-normal distribution of the data. When we observe Table 1, we see that the only significant positive correlations are between R&D investments and productivity. Nevertheless, the numerical values of the correlations seem to increase as the time lag increases with the exception of profitability and R&D costs. This implies that with time, it becomes more and more unlikely that IC investments yield negative results in companies even though the correlation observed here is quite weak. This provides evidence that it will take some time before the results of the investments actually show. The two-year lag used in this study, however, is not enough to verify this.

TABLE 1  
LAGGED SPEARMAN CORRELATIONS (0.05 RISK LEVEL)

	R&D investments 2001	Overall IC investments 2001
Productivity 2001	0.175	-0.182
Productivity 2002	0.181	-0.130
Productivity 2003	0.194	-0.111
Profitability 2001	-0.084	-0.163
Profitability 2002	-0.101	-0.117
Profitability 2003	-0.094	-0.086

As we break the data per industry, the correlations remain relatively small in value. The industries where productivity correlates the most with R&D costs are business services, construction, retail and wholesale, transportation, storage and telecommunications, and electricity, gas and water supply industries. Like the results from the overall data, the numerical values for correlations tend to increase with more time lags. Out of all the significant correlations, only the metal refinery industry provided negative correlations with R&D expenditures and productivity. Like in the whole sample, this negative correlation was getting weaker by the year.

When correlations between the R&D costs and productivity were compared with the correlations between overall IC costs and productivity, the data suggests that the former type of relationship is much clearer, as well as providing more consistent results. The only positive significant correlations between the overall IC investments and productivity were with the electronics industry. This suggests that investments in advertising, immaterial

property expenses and most likely investments in information technology and programming are more related to productivity than R&D investments in that particular industry. Other industries that exhibited clear positive growth in the correlations were forestry and metal refinery. In all the other industries the correlations with overall investments and productivity were much harder to interpret. This is most likely due to the fact that the overall investments consist of many smaller variables, which all affect the relationship in their own way. This can be seen, with the exception of the electronics industry, in the way how the overall investments in general did not correlate as strongly with productivity as just R&D investments alone.

The relationships between R&D investments and profitability tend to be negative regardless of the industry. The negative correlation decreases the most with chemical, metal refinery and electronics industries. This indicates that given enough time, the relationship between the initial investment and profitability could turn positive. Other industries did not exhibit any significant patterns in their correlations. Therefore based on these results, it is impossible to say, whether there are any patterns to be found between R&D investments and profitability in the remaining industries.

The only positive correlations between the overall IC investments and profitability were observed within the electricity, gas and water supply industry. Decreasingly negative correlations were found in metal refinery, electronics, business services, and retail industries. Overall the correlation analysis did not provide as consistent results when the data was broken down into different industries as it did with the whole sample. Industries with the most convincing evidence supporting the proposition about slowly increasing productivity and profitability as a result of IC investments were found in metal refinery, business services, and retail and wholesale industries. In all three industries all the possible combinations for correlations were statistically significant, and showed a pattern where longer time lags increased the numerical values of the correlations. In a comparison between SMEs and large corporations only SMEs provided similar results than those found in the whole sample.

#### 4.2 Regression analysis

The aforementioned correlation analyses reveal the existence of a possible dependency between investments in IC and company's productivity and profitability. Even though the linear dependency is stronger in some cases than in others, it does not imply that these industries necessarily are the ones that benefit the most from IC investments. To study this, the authors have constructed a simple regression model with correction weights (1). In the following paragraphs the direct effects of the initial IC investments in a company's productivity and profitability are examined.

Table 2 presents the estimates of the regression coefficients for the R&D investments and the overall investments when they are used to explain companies'

productivity and profitability. The investments have always been measured in 2001 and their outcomes in 2001, 2002 and 2003 according to the table.

TABLE 2  
REGRESSION COEFFICIENTS ON PRODUCTIVITY AND PROFITABILITY (0.05 RISK LEVEL)

<i>Productivity</i>			
	<u>2001-2001</u>	<u>2001-2002</u>	<u>2001-2003</u>
R&D investments	-0.24	-0.21	-0.11
Overall IC investments	-0.06	-0.04	-0.02
<i>Profitability</i>			
	<u>2001-2001</u>	<u>2001-2002</u>	<u>2001-2003</u>
R&D investments	1)	1)	1)
Overall IC investments	1)	1)	1)

<sup>1)</sup> Not statistically significant

From Table 2 it can be seen that neither of the IC investments had any direct effect to company's profitability. On the other hand, both types of investments had a negative impact on productivity. This is consistent with Sougannis' results where investments in R&D actually had a negative direct effect on company's market price, which in turn is affected by productivity [22] among other things. What is to be noted here is the fact that the negative effect diminishes over time implying that the initial cost of investments can possibly be projected as future benefits in productivity.

The direct negative impact is much smaller when overall IC investments are studied indicating that the R&D investments are expected to increase productivity much later than other types of investments. Indeed, as R&D investments are included in the overall investments, the remaining components (i.e. advertising and marketing expenditures, IT and programming investments, and immaterial property rights expenditures) seem to have direct positive effect to productivity with much smaller time span.

When studying the data between the different industries, similar patterns with the regression coefficients can be found (see Table 3). The upper portion of Table 3 represents the effects of R&D investments on productivity in different industries. The R&D investments steadily increase productivity the most in the wholesale and retail, and transportation, storage and telecommunications industries. Also consistent, but smaller increases can be seen in chemistry, metal refinery, electronics, and business service industries. As consistent increase in productivity coefficients occurred in six out of eleven observed industries, and none of the industries showed any decrease in two years' time, there is a reason to believe that the effects of R&D investments do increase productivity gradually, but the rate depends on the industry.



TABLE 3  
REGRESSION COEFFICIENTS ON PRODUCTIVITY PER INDUSTRY (0.05 RISK LEVEL)

<u>R&amp;D investments</u>	<u>Δ</u>		
	<u>2001–2001</u>	<u>2001–2002</u>	<u>2001–2003</u>
Food	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Forest	<sup>1)</sup>	13.27	<sup>1)</sup>
Chemical	-2.73	-2.53	<sup>1)</sup>
Metal refinery	-6.35	-5.21	<sup>1)</sup>
Electronics	-0.73	-0.41	-0.19
Vehicle manufacturing	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Construction	<sup>1)</sup>	16.58	12.31
Business services	-0.48	-0.33	-0.27
Electricity, gas and water supply	<sup>1)</sup>	41.17	<sup>1)</sup>
Wholesale and retail	17.27	23.49	34.87
Transportation, storage and communications	<sup>1)</sup>	6.37	8.7
<u>Overall IC investments</u>	<u>Δ</u>		
	<u>2001–2001</u>	<u>2001–2002</u>	<u>2001–2003</u>
Food	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Forest	-2.66	<sup>1)</sup>	<sup>1)</sup>
Chemical	-0.58	<sup>1)</sup>	<sup>1)</sup>
Metal refinery	-2.09	-1.29	-1.92
Electronics	-0.56	-0.28	<sup>1)</sup>
Vehicle manufacturing	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Construction	-0.78	<sup>1)</sup>	<sup>1)</sup>
Business services	-0.06	-0.04	-0.02
Electricity, gas and water supply	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
Wholesale and retail	-0.63	<sup>1)</sup>	<sup>1)</sup>
Transportation, storage and communications	-0.58	<sup>1)</sup>	-0.36

<sup>1)</sup> Not statistically significant

The lower portion of Table 3 shows the effects of overall IC investments in productivity per industry. Similar to the results from the whole sample, in industries where significant results were obtained, the overall IC investments other than R&D increased the regression coefficients, and thus increased the investments' impact on productivity. However, for more cohesive results, significant statistics should have been obtained from industries that had high regression coefficients from R&D investments alone.

For now we have concluded that IC investments, and especially R&D investments, do increase productivity in some industries. Especially noteworthy is the fact that even in industries where the direct impact is negative, this effect diminishes over time, possibly projecting as better productivity in future beyond the two-year scope of this study. It is generally argued that there is a positive relationship between a company's productivity and profitability [23]. For example in manufacturing industries it has been recorded that the broader the range of measures to improve productivity is the more efficient and profitable will the operations in a company be [24]. Here we examine whether the investments in IC affect directly to profitability. Some evidence has already been gathered to support this assumption [25].

However, in this study, the same regression model that

provided evidence of linkage between IC investments and productivity failed to show any relationship with IC investments and profitability. In a within-industry setting practically none of the regression coefficients were statistically different from zero, so we must conclude that our regression model was not sufficient to depict the relationship between IC investments and profitability.

When observing the data in a setting where companies are divided by their size, the regression model gives very similar results for SMEs and the whole sample as far as productivity goes (Table 4). From the time-lagged models we can see that although the direct effect from IC investments is negative, it once again diminishes over time. On the trails of the previous results, no statistically significant direct effect was found between either of the IC investments and profitability in SME vs. large enterprises setting. In Table 4 we also see that the regression coefficients are exactly the same for SMEs than what they were for the whole sample (see Table 2). This is most likely due to the fact that SMEs constitute such a large portion of the data, and the effect of large enterprises is unnoticeable.

TABLE 4  
REGRESSION COEFFICIENTS ON PRODUCTIVITY BY COMPANY'S SIZE (0.05 RISK LEVEL)

	<u>R&amp;D investments</u>		
	<u>2001–2001</u>	<u>2001–2002</u>	<u>2001–2003</u>
SMEs	-0.24	-0.21	-0.11
Large enterprises	<sup>1)</sup>	<sup>1)</sup>	<sup>1)</sup>
	<u>Overall IC investments</u>		
	<u>2001–2001</u>	<u>2001–2002</u>	<u>2001–2003</u>
SMEs	-0.06	-0.04	-0.02
Large enterprises	<sup>1)</sup>	<sup>1)</sup>	-0.49

<sup>1)</sup> Not statistically significant

This study focused on the relationships between IC investments and productivity as well IC investments and profitability. Accordingly, the relationship between productivity and profitability was not examined.

## 5 CONCLUSIONS

The results of this study provide evidence that investments in IC do yield benefits, but these benefits may come with a delay. These benefits, however, are dependent on the types of investments and the type of profits that are expected. Our first research question addressed the issue of R&D expenditures and their effects on company's productivity. Regression analysis showed that the direct impact of R&D expenditures on productivity was negative. However, the negative effect diminishes over time, and reduces in half in the time of two years. This implies that in general some time is needed in order to fully see the changes in productivity that the R&D investments make



possible.

The wholesale and retail, electricity, gas and water supply, construction and forest industries provided the biggest regression coefficients in an industry-specific setting in general. It would be tempting to conclude that these industries are the ones that benefit the most from R&D investments because the investments tend to be large, and thus the benefits are also expected to be large. This is true, but since we have used relative measures for both R&D investments and productivity, the size of the company does not play such a role here. Rather it is possible that the nature of investments in these industries is aimed to improve productivity more than in the other industries. In most of the industries, the impact of R&D investments grew stronger in two years, providing more evidence that it takes time to fully utilise them. Additionally, the results from SMEs alone correlate better with the industry-specific results than results from just large enterprises.

The second research question addressed the overall IC investments, and their impact on productivity. Here, the regression coefficients from the whole sample were also negative, and that negative impact was seen to diminish as well. The regression model stayed the same from R&D investments, with the only difference being that the advertising, IT and programming, and immaterial property expenses were added to the equation. This addition clearly lessened the negative impact caused by the pure R&D investments.

The same effect could be seen in an industry-specific setting. The overall IC investment model did not provide as many significant coefficients as the R&D investment model, but for those industries where the coefficients were significant for both models, the addition of other types of IC investments seemed to improve the effect on productivity. Since the number of statistically significant results throughout the time span of this study was so few (only the metal refining and business services industries provided consistent results), we were unable to determine, whether the overall investments need the same amount of time than R&D investments to be fully utilised. The correlation between the overall IC investments and productivity was again clearly shown in SMEs, unlike in large companies.

The third and fourth research questions examined IC investments and profitability. A linear relationship was found between both types of IC investments and profitability. However, in a setting where IC investments were used to predict company's profitability (i.e. regression analysis), no statistically significant results were found regardless of the industry or the company's size. The same occurrence took place with both R&D investments and the overall IC investments. The authors found no obvious explanation why profitability does not seem to be affected by IC investments.

A number of issues can be pointed out about the validity of this study. First, the data can be considered reliable, as

all of the information stored in the data is publicly available. Secondly, the models that were constructed should give results that closely resemble reality due to high number of usable observations. However, the methods used to measure IC investments in this study apply only to a small portion of all the possible IC investments, and by no means capture the whole essence of IC. Also, despite of the uniform accounting standards, companies may use them in different fashion depending on the situation. On the other hand, these measures are widely in use, and for the moment, no perfect solutions exist.

This study expands especially the understanding of the relationships between IC investments and productivity. The most understanding comes from the industry-specific research setting, where a number of target industries that reported to have the highest productivity increase for a single unit of IC investment were found. From a managerial perspective, the results of this study may help decision-makers to identify and justify important IC investments in their own industry as well as giving them understanding of the possible returns these investments might yield.

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# The employees as a source of external business information

Vilma Vuori

Researcher, Tampere University of Technology, vilma.vuori@tut.fi

**Keywords**—information, business intelligence, external business environment, employees, human capital.

## 1 INTRODUCTION

### 1.1 Abstract

Relevant information and knowledge on company's competitors, customers, industry and other operators in the external business environment can give the company a competitive advantage. Usually this external information is gathered by a business intelligence unit from external sources, but an important and underutilized information source lies within the company walls: the employees may have valuable information on the external business environment important and useful to the company. This information should be converted into company's shared information to be used in decision-making and other key activities. So far companies do not consider being successful in obtaining information possessed by the employees and the methods used are scattered. The literature presents some methods for obtaining the information from the employees, but there is no consensus of opinion on which of these methods is best suited for the purpose.

Another matter that makes the issue more complex is the form of the information. The information possessed by the employees is usually rather knowledge than raw data or information, and it may be difficult to articulate or write down which may complicate the obtaining, storing and disseminating. In addition, the employees' reluctant attitude towards writing down or sharing information with others effects obtaining information from them. The reluctance to share information may originate from an attitude of not wanting to do anything extra that is not mentioned in the job description or because of a fear of losing something when having to share information. This paper discusses these viewpoints to information possessed by the employees and aims to clarify the concept of employees as a source of external business information.

### 1.2 Background, objectives and method of the study

Information and knowledge have always been important assets to companies. A prerequisite to establish a company is that it has some special know-how or knowledge which to provide to its customers. The role of information and knowledge has grown in recent decades; Hintikka [1] states

that information can nowadays be considered as the fourth production factor together with capital, raw materials and labour.

Essential information and knowledge can create a competitive advantage to a company. The information gotten from the company's own information systems and processes is important to the company. Knowing your company's resources and capabilities helps to recognize the strengths and weaknesses of the operations and the opportunities and threats in the business environment. However, the information concerning the external business environment can be seen as even more crucial to the company's competitiveness. A research conducted in the top 50 Finnish companies in 2005 concludes that the companies' most important business information needs concern their competitors, industry and customers [2]. Usually companies collect this information with the help of an information service etc. gathering information scanning the news, conducting market researches or from some other external source. But a remarkable source of information and knowledge lies within the companies' walls: in many cases company's employees possess a great deal of useful information and knowledge on the external environment. Companies are beginning to be more and more aware of the fact that their employees hold a significant amount of information that could be valuable to the company. The challenge is getting the information and knowledge from the employees so that it can be turned into company's information and utilized in the whole organisation.

The aim of this paper is to discuss employees as a source of external business information and ways to get this information to the use of the whole company. In addition, the objective of the paper is to define what is meant by information and business intelligence (BI) and what are the sources of business information. The paper also discusses how a company's employees can be a source of external information and what methods presented in the literature can be used to convert this information into company's information and utilization. The research is conducted with an overview of the literature.

## 2 INFORMATION HIERARCHY

In spoken language the word information can have many different meanings. It may as well refer to data, knowledge or intelligence whereas academic approach distinguishes these concepts distinctly according to their contents.

However, it has to be considered that also in academic world the terms and their contents are not coherent and depend on the author. To make sure that the author and the reader are on the same page, the concept of information has to be discussed. The following information hierarchy and the conversion factors illustrated in figure 1 is a common view on the levels of information and their contents.

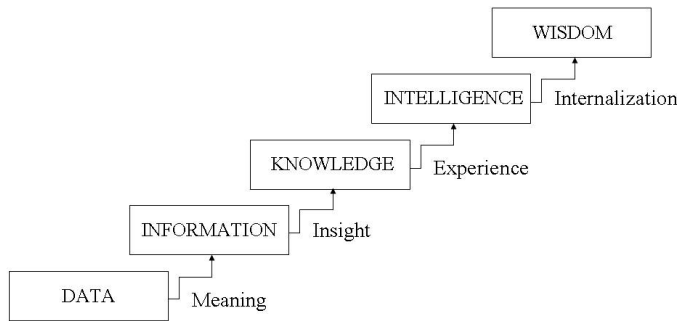


Figure 1. Information hierarchy and the factors which bring about the conversion to the next level.

*Data* is static text, numbers, code or other marks or signals that do not necessarily include any other meaning and do not necessarily lead to anything [3], [4], [5]. Committee for the future [6] concludes that data is a sort of building material for information: when data is given a meaning it becomes information. *Information* has a meaning, purpose and value for its receiver and it is usually new to him [3], [5]. New information affects the receiver's view of a matter and therefore it has a remoulding effect. Awad and Ghaziri [5] state that information's main purpose is to help decision-making. On the basis of information can be formed *knowledge*.

Committee for the future [6] states that information turns into knowledge by human brainwork. Nonaka and Takeuchi [7] add that knowledge is closely related to human actions, because information becomes knowledge only when insights, beliefs and values are added to it. Because knowledge is the end product of human processing, it has different meanings to different persons, and therefore knowledge is personal, individual information.

When personal experience is added to knowledge it becomes *intelligence* (see e.g. Thierauf [8]). Intelligence includes the ability to acquire and apply knowledge and with the help of explanations added to knowledge causes and effects can be understood and the connections between things can be seen [5], [6]. The next level in information hierarchy is *wisdom*, which can be approached from a philosophical viewpoint: wisdom begins when a person understands that the present truth does not necessarily remain forever [8]. Thierauf [8] states that wisdom includes the ability to look beyond the present situation and detect the factors which may affect the result. Many authors consider wisdom to include personal experience, moral, values and the creation of new information.

In this paper, to avoid confusion the term information is used as an umbrella concept including all the aforementioned subterms data, information, knowledge, intelligence and wisdom.

### 3.1 Defining the concept

A concept of business intelligence (BI) is quite new and its definitions vary. Also the term itself varies; in addition to BI the function is called competitive intelligence, market intelligence, competitor intelligence etc. depending on the author and region. In example, competitive intelligence is the prevailing term in Northern America whereas in Germany market intelligence is a common term for the function and in the Netherlands and Finland the same activity is called BI. In this study the term BI is seen as an umbrella concept and the aforementioned terms as its subterms.

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In the literature, there is no coherent definition for BI and authors tend to promote their own opinions on its contents and meaning (see e.g. [9], [10]). Collins [11] recognizes BI as a process in which information about competitors, customers, and markets is gathered by legal means and analyzed to support decision-making. According to Prior [12] BI is a combination of any data, information, and knowledge concerning an organization's operational environment and which leads to decisions that create competitive advantage for an organization. Sawka [13] emphasizes that BI is particularly gathering of external information and predicting of changes in the markets. On the other hand, BI can be seen as a larger concept. Besides screening the external environment, BI is managing the information inside an organization. Barndt [14] stresses the role of internal information in BI, because in his opinion decision-making is based on an organization's strategy, resources, and operative opportunities.

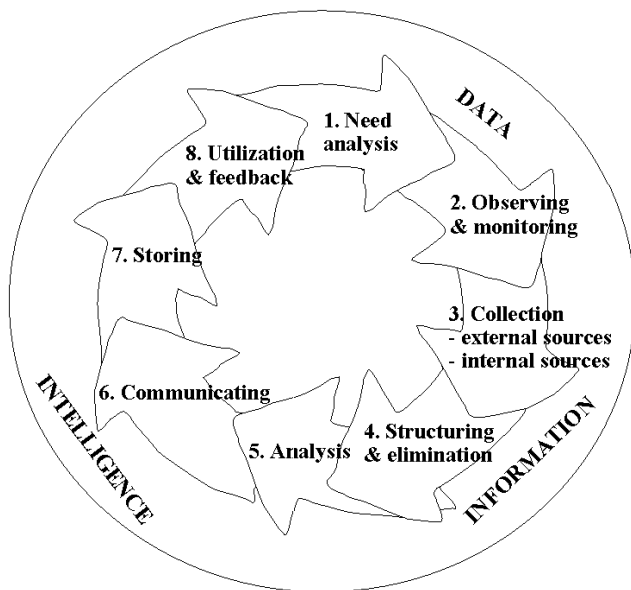
BI can also be used to describe different kinds of technological applications; some even see the technological approach to be just about all there is to BI (see e.g. [15],[16]). The function of these technological BI solutions is usually to process and warehouse the gathered data and information and to provide it for the decision-makers.

In this study, BI is understood as a process by which an organization systematically gathers, manages, and analyzes information essential for its functions. It aims to provide accurate and timely information for operative and strategic decision-making. BI is considered in this study as a comprehensive concept including both the internal and external information sources and the whole operating environment of a company.



### 3.2 BI process and information sources

The literature introduces several different BI process models (see e.g. [17], [18], [19]) and the models seem to be quite similar. According to Pirttimäki and Hannula [10] the most significant distinctions between BI process models occur among others in the number of phases, structure of cycles and sources of information. Most of the BI process models discuss at least phases that include information needs analysis, information acquisition, information storage, information distribution and information use. It is also typical to the process models to function as a continuous cycle, so that the last phase of the process leads to the very first phase, and thus the cycle continues rotating. Figure 2 represents a cyclic BI process model by



Novintel [20].

Figure 2. A cyclic BI process model. [20]

Phase three in figure 2 is collection of information from internal and external sources. Choo [21] states that information sources should be picked carefully and their observation and evaluation should be continuous. This is important due to the reliability of information. It has been said, that decision-maker is not interested where and how the information is gotten from [22], but for the sake of the reliability the decision-maker should to some extent be interested in what the source is. Censoriousness is critical especially when the information is gotten from an external source, because depending on the source's own interests the information's truthfulness can be questioned: competitors can on purpose spread fallacious information i.e. disinformation. According to Choo [21] information should be acquired from many different sources so that the company has the possibility to choose the information that is most expedient and best suited for the company's purposes. The use of multiple sources helps also in corroborating information and therefore gives more certainty in using the information.

Butcher [23] states that internal and external information sources can be personal i.e. human or impersonal, such as databases. Pirttilä [24] states that although information obtained from impersonal sources, such as reports and information systems is easier to access and there is a great amount of it available, it is less appreciated than information gotten from personal sources. Often these sources can be overlapping: information obtained from a personal source can be originally from an impersonal source, for example, a subordinate has read a report and tells about its content and meaning to his peers and superiors in a meeting. Actually, this kind of information is extremely valuable because the subordinate has interpreted the report from his own point of view and has added his insight and expertise to the information he shares with his colleagues. Fleisher [25] promotes the importance of human sources and states that they are the best sources to acquire the most critical pieces of information. The following table 1 illustrates the external and internal sources' division into personal and impersonal (the list is not exhaustive).

TABLE 1.  
SOURCES OF INFORMATION ON THE EXTERNAL ENVIRONMENT. [23]

INFORMATION SOURCE	INTERNAL	EXTERNAL
PERSONAL	<ul style="list-style-type: none"> <li>- Subordinates</li> <li>- Peers</li> <li>- Superiors</li> <li>- Other internal (e.g. the sales force)</li> </ul>	<ul style="list-style-type: none"> <li>- Customers</li> <li>- Suppliers</li> <li>- Business associates</li> <li>- Peers</li> <li>- Professional advisors (e.g. bankers, management consultants)</li> </ul>
IMPERSONAL	<ul style="list-style-type: none"> <li>- Reports</li> <li>- Memos</li> <li>- Scheduled company meetings</li> <li>- Databases</li> <li>- Intranet</li> </ul>	<ul style="list-style-type: none"> <li>- Newspapers</li> <li>- Periodicals</li> <li>- Government publications</li> <li>- Trade and professional publications</li> <li>- Web sites</li> <li>- Commercial databases</li> <li>- Annual reports</li> <li>- Clipping service</li> <li>- Television and radio</li> <li>- Advice agencies</li> </ul>

According to the study conducted in the top 50 Finnish companies in 2002 49 percent of the companies collect information from both external and internal sources and 46 percent from only external sources. Only five percent of the companies considered the information generated from their own operations most important. The same study reveals that companies see their employees as the most important source of information. [26]

### 3.3 The employees as a source of business information

A company's human capital consists among other things of its employees' skills, experience and knowledge. Human

capital is an intangible asset and it has been stated that nowadays more and more of companies' success depends on managing intangible assets [27]. Managers utilize their experience and knowledge in everyday decision-making and thus help to create competitive advantage to the company.

Actually, all of the company's employees participate in some level in producing data, information and knowledge that are used in decision-making. Most of this information concerns the company's own processes, for example sales figures and productive capacity, and is therefore internal. Internal information is typically in the form of data or information and it is automatically gathered and processed by the company's information systems and therefore the employees are not directly the sources of information. If a company has an organized way of gathering and storing this information, which nowadays usually is the case, acquiring and accessing information is fast and effortless. More complex issue is the acquiring of external information, and in this case the employees may be valuable sources of information.

The employees often have valuable information not only on the company's own operations but also on competitors, customers and external market situation, and they should not be overlooked as a source of external information. Especially the sales force has often a direct contact to customer, competitor and market information that is extremely valuable and needed in the organizations decision making. Nevertheless the sales force is identified to be a great possessor of important information many organizations do not have the means or abilities to utilize them in the information gathering process [28]. Employees besides the sales force can also be significant information sources: they may have obtained the information from newspapers, television, internet, customers, conferences or some other external source of information. Although the company would gather information from the same sources the information obtained by the employees may be more of value: when the information is processed in human brain it gains insights, values, opinions and perspective making it richer.

The concept of information hierarchy discussed earlier has to be brought up again when discussing employees' information. Namely, Drott [29] states that as long as the information is possessed by the employee it is actually knowledge and when it is in some way converted into the use of the whole company, it degenerates to information. This is a logical conclusion taken to account the definition of information and knowledge discussed earlier: the information possessed by the employee includes his personal interpretations and insight of the issue but when it is converted to company's information it is often compressed to a written abstract etc. stored in a database and therefore it loses some of its dimensions. There are also other differences besides the level of information concerning whether the information is possessed by the employee or the company. These differences are represented in table 2.

TABLE 2.  
THE SEVEN ELEMENTS OF KNOWING: EMPLOYEE'S KNOWLEDGE COMPARED TO  
COMPANY'S INFORMATION (ADAPTED FROM [29]).

EMPLOYEES KNOWLEDGE	COMPANY'S INFORMATION
Individually integrated	Corporately integrated
Dispersed	Distributable
Low-cost	Expensive
Accidental	Structured
Open	Closed
Temporary	Permanent
Knowledge	Information

Prescott [30] states that just about all employees can be used as a source of information and provide valuable information to the BI unit. Koskinen et al. [2] state that in some cases employees do not know that the information they have could be useful to the company and in other cases there are no given method or channel to distribute the information. According to an international BI study conducted in large companies on nine different market areas the average utilization of information possessed by the employees was estimated to be "fair" or "satisfactory" [31]. None of the Finnish top 50 companies gave themselves the grade highest "excellent" and the median grade was "satisfactory" [2]. Interestingly, utilization of information possessed by the employees was seen as the second most important target for development which indicates that companies realize the potential of this information and the current lack of its utilization [2]. Koskinen et al. [2] conclude that the collecting and utilization of information possessed by the employees is one of the most difficult tasks in BI. However, Drott [29] states that BI can be greatly improved by creating appropriate methods to convert relevant information possessed by the employees into company's information.

#### 4 WAYS OF COLLECTING AND SHARING BUSINESS INFORMATION POSSESSED BY THE EMPLOYEES

##### 4.1 *Some examples on how companies obtain information from their employees*

Drott [29] presents three cases of turning employees' information to company's information. In the first case the company found out by a chance that one of its employees had specific and needed information on a crucial issue and used this person and her knowledge to solve a problem. The other case Drott [29] describes is a sales manager who put some additional simple questions concerning the customers in a fairly standard sales report which the salespersons filled in after meeting with customers. From the answers the sales manager could conclude whether the customer's business was growing or shrinking etc. Important in this case is, that the salespersons knew why and to what purpose these questions were asked for and

therefore they were able to shape their answers in a way that they did not result to an abundant amount of insignificant data. These cases do not indicate that the companies had a systematic way or a policy of gathering knowledge from its employees in order to enhance their BI. In the first case it was merely a coincidence that the company happened to come across the employee with the needed information and in the second case it was only a single individual's effort to get information to his own use. [29]

The third case presented by Drott [29] describes a more systematic company policy for acquiring external business information, which encouraged the employees to obtain and share information. After discussing with someone e.g. on a business trip, the employee sent a report describing who she had met with and what she had learned via email to the vice president for planning department, who in this case was in charge of the company's BI activities. After sending the report she got a thank-you email or a follow-up phone call asking details about the information. The spur to meet with people, get information from them and report it in this case was the idea of getting to be involved in the company's BI activities and gaining points in the eyes of the management. Another incentive factor was that up to a limit the costs of e.g. taking the information source to dinner to get information from him were compensated from a fund established specially for this purpose. [29]

The methods actually used by companies to gain information from their employees are scattered and there are no coherent systematic means [2]. Koskinen et al. [2] mention that common methods used by the companies are e.g. enabling the feeding of information in a portal tool or intranet and using forms developed for this purpose. This indicates that the initiative to store the information is in the hands of the employee and if the employee is not interested or motivated enough in doing so the information will not be successfully obtained and distributed by these means. This raises a question of who should be the active party responsible of obtaining and disseminating the information possessed by the employees: should it be used a push technique, in which the employee would be the one to make the initiative and "push" his information into the system, or a pull technique, in which some other instance would "pull" the information out of the employee and be in charge of its processing? Several authors stress that unless knowledge sharing is not somebody's specific job, the information will not be written down [32].

Usually business information is stored in to a data warehouse, database or intranet, from where it can be easily disseminated or retrieved when needed. In many companies a BI unit collects, analyses, stores and disseminates data and information essential to the company's operations and acts as the coordinator of the business information systems and tools, such as data warehouses, databases and BI portals. Because the BI unit has the expertise and usually the means and technology to process information it would also be a straight choice to be the one to collect and coordinate external information possessed by the

employees. The BI unit could also combine this information to other information that it has in store and thus further refine it. However, Drott [29] points out that in addition to the fact that setting down information properly is challenging it is also time-consuming and can be expensive. Rajaniemi [32] adds that is not usual to employ people to write down and document information of other people, especially because companies consider it to be too expensive.

Therefore, it should be carefully considered which methods to use, how to store information and who will do the actual processing and storing. Another point of view is that not all information can be set down and stored in a database. Knowledge lying inside employees' head will not always fit the database paradigm or it can not be organized in a way the information system requires. This information has to be obtained and shared with different methods.

#### *4.2 How to obtain unstructured and oral information*

According to Sydänmaanlakka [33] managers get two thirds of information by direct personal contacts and interaction situations, such as meetings and telephone conversations. Pirttilä [24] adds that information gotten informally from peers and subordinates is valued the most. Consequently, important information is unsystematically disseminated in discussions, meetings and other interaction situations. The problem is that others than the participants of these situations do not get the information, or they get it by coincidence or too late. This information could be needed for many decisions and actions in the company, but it will not undoubtedly and without unnecessary delay reach the person in need if it is not systematically shared, collected and disseminated.

Pirttilä [34] notes that especially in the case of competitor information the sources are usually informal and oral and therefore the information gotten from them is often unorganized and unstructured, which makes it difficult to store in a technological BI tool such as a database. As Pirttilä [34] and Sydänmaanlakka [33] state most of the information that managers value the most comes through informal channels and is distributed orally. Studies conducted by Fuld, Bernhardt and Herring indicate that a great deal of the needed competitor information and other business information already exists hidden inside the company e.g. within the employees, and that this potential has been underutilized [34]. The studies point out that the lack of communication and coordination is the reason for underutilization of this information [34]. To conclude, it would seem to be appropriate to improve the oral communication channels in order to spread the business information possessed by the employees.

A feasible method to share information in a non-technological way is to create an organized way of collecting and sharing information surfacing in discussions. The BI unit as the coordinator could set up regular meetings where people having information on certain issues could share their information and insight on the

topic. These discussions could be organized by inviting employees who are probable to know something about the issue. Another way is to notify employees with an open invitation that reveals the topic of the discussion and hope that the employees with information on the topic will come to the meeting to share their information. The first option is more problematic, because the BI unit would have to make assumptions about who knows what and the employees that the BI unit overlooks or is not aware of who actually have valuable information are not included in the discussion.

The second option can be further developed as Drott [29] suggests by announcing the employees of the information that the BI unit or actually its customers are in need of and thereby making it a two-way process. However Drott [29] points out that a down side in this method is that if the specific interests of BI are widely circulated it can be seen as too revealing and risky. Another matter that makes it chancy is that the employees would have to be active in reading the invitations and willing to come and discuss their information. In some cases employees only do “what they are paid for” and nothing more and do not bother to take part in meetings they consider to be only extra work. Sydänmaanlakka [35] states that employees should change their attitude to sharing information and understand that active sharing of information and knowledge is part of their job description. The employees should also trust that by sharing the information and knowledge they have they promote their own and the company’s success [38]. Organizational culture has an important role in shaping the attitude towards information sharing.

Drott [29] states that the information does not actually have to be obtained from the employee, but the information can remain with the individual. Drott [29] proposes creating a simple index with a list of the employees’ names and contact information on who has knowledge on specific topics. The person in need of information can search for a topic in the index and then contact the employee listed in the index having the knowledge on it. This way the information does not have to be formalized and fed into a database, but the information is shared by interaction after getting the contact information from the index.

## 5 EXAMINING THE OBTAINING AND SHARING OF EXTERNAL INFORMATION POSSESSED BY THE EMPLOYEES THROUGH SECI MODEL

### 5.1 Introduction to the SECI model

The ways to obtain external information and knowledge from the employees and its sharing and disseminating in a company described in this paper can also be examined through the SECI model by Nonaka and Takeuchi [7], completed by Marchand [36], see figure 3.

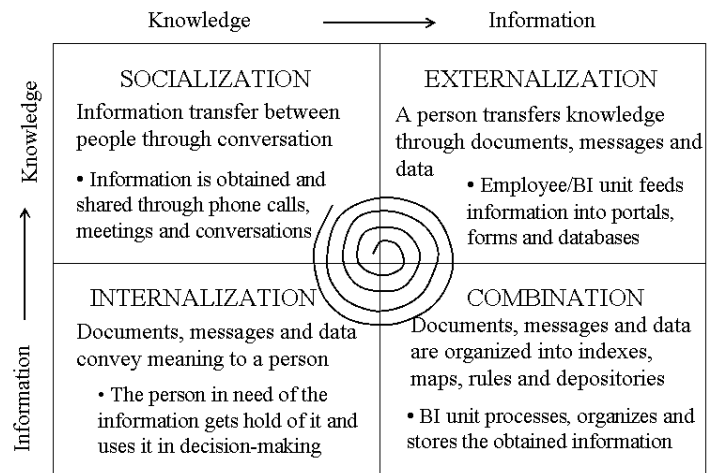


Figure 3. Obtaining, converting and sharing employees’ external knowledge into company’s information and use. Adapted from [7], [39].

The four phases of knowledge conversion in the SECI model are socialization, externalization, combination and internalization. Nonaka and Takeuchi [7] describe the process to proceed spirally through every quadrant; the preceding phases of the process enable the following phases, thus creating a spiral progression.

#### 5.1.1 Externalization – knowledge to information

Nonaka and Takeuchi [7] call the process of articulating tacit knowledge into explicit concepts externalization. Marchand [36] states that in the externalization process knowledge is degenerated into information. Given the information hierarchy described earlier, the classification is just: explicit knowledge defined by Nonaka and Takeuchi [7] is in the form of e.g. documents and numbers, therefore it can be defined to be more of data or information, not so much of knowledge. When employees or the BI unit write down information and feed it into a portal or a database they carry out the externalization process.

#### 5.1.2 Combination – information about information

In combination process new and already existing explicit knowledge and information are united [7]. Marchand [36] sees the information in this process to be meta-information i.e. information about information: according to Marchand [36] many companies have indexes, catalogues, maps and etc. to locate information or people having information within the company. Drott’s [29] suggestion that not all information has to be obtained from the employees but rather to form an index goes under this category. Also, when the BI unit processes the obtained information and stores it into databases etc., they follow the idea of combination process.

#### 5.1.3 Internalization – information to knowledge

In internalization process the combined explicit information is taken into use and thus converted into a person’s tacit knowledge [7]. According to Marchand [36]



in this process individuals access and interpret information and seek meaning from it. When the information obtained from the employees is stored and disseminated inside the company, the person in need of the information can get hold of it and make decisions based on it. The aim of BI is to support decision-making by providing relevant and timely information; in internalization this aim is accomplished.

## 6 CONCLUSIONS

The role of essential information and knowledge in succeeding in business has grown. At the same time, the appreciation of intangible assets, such as the employees' knowledge and information they possess, has increased. As discussed in this paper, companies consider information on the external business environment to be of great importance and a source of a competitive advantage. Companies also are aware of the fact that their employees may be valuable sources of this information, but they often do not have the means to obtain information from the employees. Methods for obtaining information from employees and converting it to company's information have to be carefully selected depending on the situation. When discussing information possessed by employees it has to be taken into consideration that the information processed in the human brain can be complex in many ways: Sometimes it may be difficult or even impossible to write down or store information in explicit form, and therefore alternative methods have to be applied.

Organizational culture has a great impact on how information and knowledge are shared in a company. Shaping the employees' attitudes towards more open sharing of information and making them realize that gathering and sharing information is part of their job description enhances the company's information management and improves its BI activities. The underutilization of the information possessed by the employees is a known problem in many companies, but the methods for obtaining and sharing this information are scattered and problematic. Another interesting question only shortly discussed in this paper is who should be the one responsible for collecting and sharing information possessed by the employees, what are the advantages, downsides and costs of the different alternatives. This is an interesting question for further discussion and study, especially a case study approach in a case company could lead to interesting results.

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# Framework for improving manufacturing system performance in Finnish mechanical engineering industry

Mikko Koho<sup>1</sup>; Seppo Torvinen<sup>2</sup>

<sup>1</sup> Tampere University of Technology, Institute of Production Engineering, mikko.koho@tut.fi

<sup>2</sup> Professor, Tampere University of Technology, Institute of Production Engineering, seppo.torvinen@tut.fi

**Keywords** – manufacturing, manufacturing system, performance

## 1 INTRODUCTION

Finnish manufacturing industry is facing a fierce challenge and pressure from low-cost countries, and jobs and companies are being transferred to these countries. In order to survive the pressure and to compete in global markets, Finnish companies need to improve their competitiveness and performance. Finnish manufacturing industry accounts for about one fourth of gross domestic product and its share of total employment is about one fifth, which makes efforts at improvement and their result significant also from the viewpoint of national economy [1], [2]. In this context, this research is intended to support Finnish companies in their effort to improve performance and competitiveness by providing a new and useful tool for improving the performance of manufacturing systems.

In improving the productivity and competitiveness of manufacturing systems, the key problem faced by companies is identifying appropriate and applicable improvement principles. As used here, the term improvement principle refers to identifying the area in a manufacturing system that needs to be improved together with the objective of improvement, i.e. the characteristics or capabilities that should be developed. The suitability of an improvement objective, and hence also the suitability of an improvement principle, for a certain company depends on the type and current state of the company and its manufacturing system. It is argued here that the available literature on manufacturing and manufacturing improvement does not provide adequate support for identifying appropriate improvement principles. Thus, it is claimed that there is a need for a framework that supports and simplifies the decision process faced by companies. Therefore, this research strives to develop a framework that assists companies in improving the competitiveness and performance of their manufacturing systems by supporting the identification of appropriate improvement principles. The framework consists of best practice principles of manufacturing and manufacturing systems that are classified based on two dimensions: decision areas in manufacturing system improvement and manufacturing objectives. The dimensions of the framework are intended to enable identification of improvement areas, while the best practice principles assist in determining improvement objectives.

In order to ensure the relevance and applicability of the framework and of the best practice principles included in it, the focus of the research is limited to a certain industry sector and further to a certain type of manufacture. The research concentrates on Finnish mechanical engineering industry, which is an important industry sector for Finland, as can be seen from Table 1.

TABLE 1  
FINNISH TECHNOLOGY INDUSTRIES [3]

	Electronics, electrotechni c	Mechanical engineering	Metals industry	Technolog y industries total
Turnover (mill. €)	18900	18500	6800	44200
Value- added (mill. €)	7600	6600	1500	15700
Material investments (mill. €)	524	608	301	1441
Goods exports (mill. €)	12046	9360	5299	26705
Employees	62300	128500	15800	207200

Furthermore, the research focuses on companies that manufacture customer-specific products, which are designed before the customer orders are received but are configured or customised based on the customer order. Thus, there is a large degree of similarity between products. In terms of general manufacturing approaches, the research considers companies that operate on the basis of assemble-to-order or make-to-order approach. Consequently, companies that produce products to stock and those operating on the basis of engineer-to-order approach, in which products are designed and produced according to customer specifications, are not included in this research. From the viewpoint of the functions and processes of a company, this research focuses on manufacturing and on the order-delivery process and excludes other areas such as marketing and product design. Finally, in terms of product life cycle, the focus is on the later part of the growth stage and on the mature stage, where production volumes are relatively stable.

This paper presents a tentative framework for improving competitiveness and performance in Finnish mechanical engineering companies that has been developed during the first phase of an on-going research project. The framework has been developed on the basis of a literature survey covering manufacturing strategy and current manufacturing paradigms (lean manufacturing, agile manufacturing and mass customisation) and by using a deductive approach. Previous Ideal Factory research at the Institute of Production Engineering at Tampere University of Technology has provided the foundation for this research and the principles of an Ideal Factory presented in Lapinleimu's work [4] have been used as a starting point in developing the framework. The principles presented by Lapinleimu have been evaluated and modified, and new principles have been identified on the basis of a literature survey related to manufacturing paradigms. The literature on manufacturing strategy has been used to generate the structure of the framework, i.e. to identify the decision areas in manufacturing system improvement and the manufacturing objectives.

The organisation of the paper is as follows. The next section presents findings of a brief review of manufacturing improvement literature and justifies the need for a new framework.

Section 3 describes the structure of the developed framework. The best practice principles included in the framework are introduced in Section 4. Section 5 summarises the structure and principles in the form of a tentative framework and outlines its purpose and use. Finally, the results of the first phase and future directions of the on-going research project are discussed.

## 2 NEED FOR A NEW FRAMEWORK

The need for a new framework for improving manufacturing system performance is based on identified shortcomings of available literature, models and frameworks. Similarly to Tan and Platts [5] and Muda and Hendry [6], the problem of identifying and selecting appropriate improvement programs and principles for a certain company from the wide variety presented in the literature is seen to be central in improving the performance of manufacturing systems. It is argued here that the available literature does not provide adequate support for selecting improvement principles that are applicable at operational level to the target companies in this research.

The lack of support provided by available literature, models and frameworks is seen to result from issues related to level of detail, scope and focus. Some authors approach manufacturing and its improvement at a very general level and aim at defining or describing a certain manufacturing paradigm, such as agile manufacturing (e.g. [7], [8]) or world class manufacturing [9]. Other authors adopt a very broad view of improving manufacturing performance by taking areas such as actions of customers, competitors and even government into consideration (e.g. [10], [11]). These approaches typically result in a presentation of descriptions and characteristics of well-performing manufacturing systems and companies. Consequently these tend to be too general to provide advice on operational-level performance improvement. In contrast, some authors and improvement programs have a very narrow focus and concentrate on a specific method or technique, such as Kanban control or Single Minute Exchange of Dies [5]. The potential problem related to this approach is that improvement efforts focus on too limited an area and fail to consider the manufacturing system as a whole. Furthermore, manufacturing improvement literature often treats all industry sectors and company types as being the same and does not consider to which industry sectors or company types the presented principles are applicable [9]. As a result, the advice provided may be too universalistic to be applicable to a specific industry sector or company type.

For the reasons presented above, it is argued that there is a need for a framework that helps companies in identifying appropriate, operational-level improvement principles. Other authors (e.g. [6], [9], [12], [13]) have also had similar objectives and have presented frameworks or models for improving manufacturing performance. The framework developed here is distinct from such frameworks and models because of the different focus and scope of this research. Here the focus is on the order-delivery process, while other authors have adopted a broader focus by considering areas such as marketing, management system, performance measurement, etc. It is assumed that by focusing on a narrower area, more detailed improvement principles can be identified. In addition to that, the framework developed here differs from other models and frameworks by limiting the target companies to a certain industry sector and company type.

## 3 STRUCTURE OF THE FRAMEWORK

The developed framework consists of best practice principles of manufacturing and manufacturing systems. It involves decision areas in manufacturing system improvement and

manufacturing objectives, which are used to classify the principles and to indicate their effects. The structure aims at supporting the process of determining applicable improvement principles and at providing an overall view and approach for improving the performance of manufacturing systems. The decision areas in manufacturing system improvement are used to group the best practice principles and they aim to ensure that all the relevant areas of a manufacturing system are considered in improving its performance. Furthermore, the relationships between the best practice principles and the four manufacturing objectives are indicated in the framework. The aim in identifying these relationships is to provide assistance in determining appropriate best practices and improvement principles based on the priorities of a company.

### 3.1 Decision areas in manufacturing system improvement

Similarly to Miltenburg's [14] approach, the manufacturing system is here divided into decision areas, or subsystems, to which changes can be made in order to improve the performance of the manufacturing system. In this research the following decision areas have been identified and included in the model:

- Product architecture and product structure
- Manufacturing system structure
- Manufacturing equipment
- Production operations and production control
- Information and communication
- Human resources

Product architecture includes allocating functional elements of a product to physical components of the product and specification of interfaces among interacting physical components [15]. Product architecture provides guidelines to and has implications for a product development process during which the structure of a product is designed. Hence, product structure, which presents how the product is built up from parts, components, sub-assemblies and assemblies, is considered to be a subset of the product architecture. Product architecture and product structure are included in the framework because they have a significant effect on the structure and the performance of a manufacturing system [4], [15].

Manufacturing system structure refers here to the physical arrangement of production resources and it also includes the relationships between the units of a manufacturing system. As used here, a manufacturing system can be a single factory or a network of factories. The area of manufacturing equipment concerns general characteristics of machines used in manufacturing. Manufacturing system structure and manufacturing equipment are seen to be key enablers or prerequisites of production operations as they provide the means for production and also determine the flow of material and other characteristics of production. Therefore, these areas need to be considered in improving manufacturing system performance.

Production operations and production control cover the operations of the order-delivery process and controlling the execution of these operations. Production operations and their outputs determine the actual performance of the manufacturing system and are therefore included in the framework.

Information and communication are considered from the viewpoint of production operations and production control. The area is included in the framework because information and communication are important production factors that have a significant effect on the structure and performance of a manufacturing system [16].

Human resources are an important part of a manufacturing system. Here, the focus is on the organisation and on the skills of human resources. However, the area is not discussed in great detail in this paper.



### 3.2 Manufacturing objectives

Manufacturing objectives are the dimensions of performance with which the company and its manufacturing system satisfy customers and compete against other companies [14], [17]. Here, the manufacturing objectives are grouped into four categories: cost, quality, time and flexibility. Cost refers to expenditures on resources, such as labour and material, used to produce a product. Quality is defined as the ability of materials, products and operations to conform to specifications and to meet the expectations of customers. Time consists of two sub-objectives: firstly the time required to produce and to deliver a product, and secondly the reliability of delivery time. Flexibility refers here primarily to product variety, i.e. the range of products the company and the manufacturing system are able to produce.

## 4 IMPROVEMENT PRINCIPLES INCLUDED IN THE FRAMEWORK

### 4.1 Product architecture and product structure

Product architecture and product structure should enable rapid configuration of a customer-specific product and production of the required product variety in an efficient and controllable process. In order to fulfil these requirements, the following practices and principles have been identified and included in the framework:

- Product architecture and product structure are modular
- Product platforms are used
- The number of levels in the bill of material is minimised

Ulrich [15] divides product architectures into modular and integral architectures. Characteristics of a modular product architecture include a one-to-one mapping from functional elements to physical components of a product and de-coupled interfaces between interacting physical components. In contrast, an integral product architecture includes a complex allocation of functional elements to physical component and/or coupled interfaces between physical components [15]. Further, a modular product structure contains one or more product modules. A product module is defined to be a building block of a product that provides a certain function and characteristics for a product and has well-defined and standard interfaces. Modularity of both product architecture and product structure provides several advantages in manufacturing. It enables configuring a product according to customer specifications, i.e. creating the required product characteristics and functions, by selecting the appropriate modules and module variants [4]. Further, a wide variety of products can be configured using relatively few modules [17], [18]. Modularity also supports standardisation at module or component level. Standardisation of components or modules enables standardisation of processes and production in larger volumes, which improves the efficiency of the manufacturing system. Modular products are also ideally suited for formulating the manufacturing system structure [4].

A product platform is a set of parameters, features, parts, components or modules that are common to different products. Product platforms are closely related to modular product structure as product variants are often created by adding different modules to a product platform [19]. Similarly to modular product structure, the use of product platforms reduces the number of parts, components and modules needed to produce the different product variants.

The main benefit and objective of both modularity and product platforms is postponement of product differentiation. In the postponement concept, the aim is to differentiate products at the latest possible stage of the production process. In other words, the aim is to incorporate customer-specific characteris-

tics and functions in the product only after customer orders are received. Postponing product differentiation supports both flexibility and efficiency of operations. Commonality is increased and the number of parts and components needed is reduced because parts and components produced upstream of the point of differentiation can be standardised [20]. Delivery time can also be reduced as the customer-specific part of the production process is shortened. Furthermore, cost efficiency can be improved by producing the standardised parts and components in an efficient mass production environment [21]. Figure 1 summarises the principle and advantages of postponement.

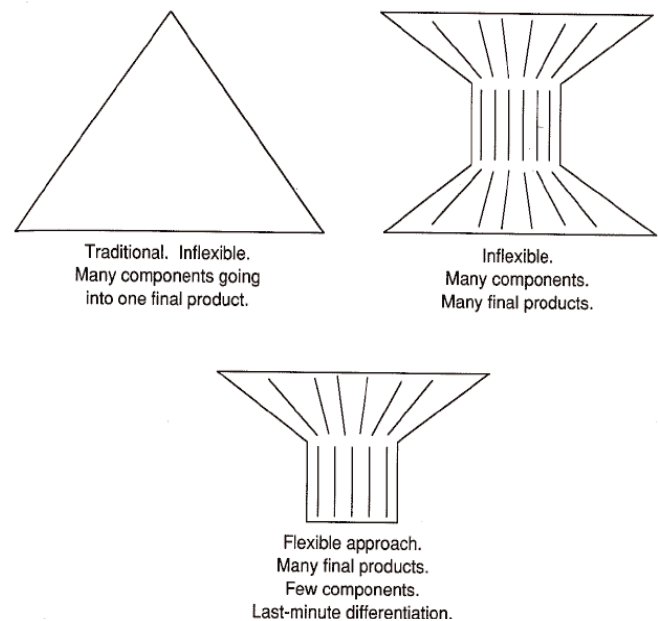


FIGURE 1 POSTPONEMENT OF PRODUCT DIFFERENTIATION [20]

The third principle, the lowest possible number of levels in a bill of material, aims at simplifying the product and the required manufacturing system and at improving efficiency of production. Reducing the number of levels in the bill of materials reduces the complexity of a product and the manufacturing system [4]. Further benefits include reduced inventories and shorter lead time [20].

### 4.2 Manufacturing system structure

The structure of a manufacturing system should enable the rapid, controllable and predictable flow of products. The manufacturing system must also be able to produce the required product variety efficiently. The following principles aim at achieving these objectives:

- Manufacturing system structure and product structure correspond to each other
- Manufacturing system consists of manufacturing units that are responsible for certain parts of the product
- Distances between manufacturing units and distances between machines are short
- Relationships between units of the manufacturing system are based on long-term partnerships

The first principle, presented by Lapinleimu [4], results in a product-based layout that supports rapid production flow. The product-based arrangement of production equipment is seen to be most suitable for producing mature products of relatively low variety and is supported by a number of authors (e.g. [22], [23]).

According to Lapinleimu [4], the manufacturing system

should consist of manufacturing units that are independent in terms of resources. Each manufacturing unit should be responsible for one or more parts of the product [4]. The principle improves and simplifies production control by allocating responsibility and authority to the operational level. In addition, flexibility in terms of producing different product variants is improved [4]. Lapinleimu [4] argues that the applicability and functionality of the principle has been proven in cellular manufacturing.

Short distances between machines and between manufacturing units aim at reducing lead time and transportation time by reducing the need for and the distance of transportation. The principle is also presented in lean manufacturing literature (e.g. [24]) and by various other authors (e.g. [12], [22]).

The long-term partnerships within the manufacturing system aim at shared effort to continuously improve operations and products in terms of cost, quality and time. These issues have been emphasised in lean manufacturing (e.g. [24]) and they are seen to be suitable for the type of companies and products on which this research focuses.

#### 4.3 Manufacturing equipment

The principles related to manufacturing equipment aim at combining flexibility with rapid and predictable production. The principles are derived mainly from lean manufacturing literature.

- Right-sized and general-purpose equipment is used
- Set-up of equipment is rapid
- Manufacturing equipment is reliable and available

The first principle calls for using equipment that supports rapid production of different product variants. Highly specialised and high-volume equipment is argued to cause a need for batch production, which results in problems such as queuing and longer lead times [24]. Hence, right-sized and less specialised equipment that enables production of the required variety and quantity of products should be used [23], [24]. The principle is also related to costs because general-purpose equipment is usually cheaper than specialised equipment.

Short set-up times are required to achieve short lead times and rapid production flow. Quick set-up is also a prerequisite for producing different product variants in small batches based on customer needs [4], [23].

Finally, equipment needs to be reliable and available for use when needed in order to achieve predictable production.

#### 4.4 Production operations and production control

The principles included in the framework focus mainly on cost-effective, reliable and rapid production, but the aim is also to allow for required flexibility in terms of product variety available to customers.

- Production prerequisites are created and in place before an order is received
- Responsibility for production control is allocated to manufacturing units
- Lean manufacturing and agile manufacturing principles are combined in the manufacturing system
- Production operations are standardised
- Reserve capacity, i.e. 70-80% utilisation, is secured by production planning and control

Production prerequisites include all the capabilities, plans and resources needed to produce a required product [4]. To enable immediate execution of a production order, the prerequisites should be planned and generated in advance. This indicates that planning should be separated from production. The principle reduces or eliminates order-specific planning and hence supports rapid, standardised and predictable execution of production orders [4].

Allocating responsibility for production control to manufacturing units, or more generally to lower levels of the manufacturing system, aims at simplifying production control and improving flexibility of operations [4], [22], [23]. The principle also improves the manufacturing system's ability to react to changes and problems [23].

The aim of combining lean manufacturing and agile manufacturing approaches in one manufacturing system is to achieve optimal combination of cost effectiveness and flexibility. The principle is based on the leagile paradigm presented by Naylor, Naim and Berry [25]. The idea is to use cost-effective and standardised lean processes upstream from the decoupling point while simultaneously applying flexible, customer-oriented agile processes downstream from the decoupling point, which is the point to which the customer order penetrates (Figure 2).

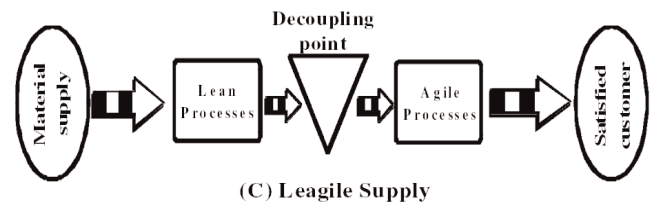


FIGURE 2 LEAGILE SUPPLY CHAIN [25]

Downstream from the decoupling point, production is based on customer orders and operates according to push principles. Simultaneously, upstream from the decoupling point production operates in pull mode e.g. by using kanban control. The principle and positioning of the decoupling point are closely related to postponement and modularity of product architecture discussed above.

Standardising production operations requires that input, content, output, duration and sequence of operations should be defined in advance. The importance of standardisation of production operations is emphasised in lean manufacturing (e.g. [23], [26]) and the principle of production prerequisites presented by Lapinleimu [4] is also closely related to standardised operations. The principle aims to increase the predictability and reliability of operations and their lead time, and also to improve quality by improving the conformance of products and operations to specifications. Due to the characteristics of agile manufacturing, standardisation of operations may be less applicable to processes downstream from the decoupling point where production is customer-driven. However, the similarity between products, assumed in this research, supports standardisation of operations also in the customer-driven part of the order delivery process.

Reserve capacity is seen to be important for improving the flexibility of the manufacturing system [4], [20], [22]. Reserve capacity may also improve the manufacturing system's ability to meet promised delivery times as it provides resources for reacting to changes and problems. Thus, the aim should not be 100% utilisation, but rather 70-80% utilisation.

#### 4.5 Information and communication

The principles included in the framework present key characteristics of information and communication needed to support rapid execution of customer orders.

- Useful and relevant information is available to all units and members of the manufacturing system
- Information flow within the manufacturing system is rapid and reliable
- Visual information and control systems are used to communicate the status of production

The first principle focuses on the type and amount of information available. Only useful and relevant information should be provided, because information overload, i.e. too much information, reduces the efficiency and effectiveness of communication and use of information [18], [23]. The second principle aims to ensure availability of information. Rapid flow of information also reduces lead time by eliminating delays. Use of visual information and control systems aims at transparency of production, which allows everyone to see and understand every aspect of production and its status at all times [24]. The wide variety of visual controls and systems includes boards, cards and colour-codes, which can be used to control production or to indicate proper location of tools and materials [27].

Together these principles aim at providing relevant information rapidly and in an easy-to-understand manner. From the production point of view, two types of information are highly relevant. Firstly, information on orders and demand provided from customers upstream the manufacturing system, and secondly information on the current status of products and production from manufacturing units. If actual demand information is made available, the need for forecasting and the risks related to forecast-based production are reduced. Information on the current status of production, on the other hand, supports production control and early identification and correction of problems. The principles are expected to support shortening production lead time and to improve quality and flexibility of production.

#### 4.6 Human resources

The area of human resources is not considered in detail, but two principles, related to skills and the organisation of employees, are presented.

- Multifunctional teams and teamwork are used in production
- Employees are cross-trained and multi-skilled

Use of multifunctional teams and teamwork, as well as multi-skilled workers who are able to perform several tasks and operate several machines, are typical characteristics of lean manufacturing [23], [28]. Similar principles are also presented in other approaches to manufacturing (e.g. [20], [22]). Teams and employees who are able to perform several tasks improve the flexibility of a manufacturing system. Furthermore, providing teams and workers with the ability, responsibility and authority to solve problems on the shop floor improves the quality of products and operations. [20], [23].

### 5 TENTATIVE FRAMEWORK FOR IMPROVING MANUFACTURING SYSTEM PERFORMANCE

Table 2 presents the tentative framework for improving the manufacturing system performance of Finnish mechanical engineering companies. The structure of the framework shows four categories of manufacturing objectives and six decision areas in manufacturing system improvement. The decision areas are used to group the best practice principles of manufacturing and manufacturing systems included in the framework. The decision areas also aim to provide and ensure a holistic approach to manufacturing system improvement. The manufacturing objective dimension, on the other hand, enables indicating the linkage between the best practice principles and manufacturing objectives. It should be emphasised that the aim is not to present or to identify quantitative relationships between best practice principles and manufacturing objectives, but rather to indicate the expected effect of the principles on the different manufacturing objectives on the basis of the literature and logical thinking.

The developed framework attempts to support improvement of manufacturing system performance by simplifying identification of appropriate improvement principles. The improve-

Decision areas	Best practices	Manufacturing objectives			
		Quality	Time	Cost	Flexibility
Product architecture and product structure	Product architecture and product structure are modular		X	X	X
	Product platforms are used		X	X	X
	The number of levels in the bill of material is minimised		X	X	
Manufacturing system structure	Manufacturing system structure and product structure correspond to each other		X	X	
	Manufacturing system consists of manufacturing units that are responsible for certain parts of the product	X			X
	Distances between manufacturing units and distances between machines are short		X	X	
	Relationships between the units of the manufacturing system are based on long-term partnerships	X	X	X	
Manufacturing equipment	Right-sized and general-purpose equipment is used			X	X
	Set-up of equipment is rapid		X		X
	Manufacturing equipment reliable and available	X	X		
Production operations, production control	Production prerequisites are created and in place before an order is received	X	X		
	Responsibility for production control is allocated to manufacturing units	X			X
	Lean manufacturing and agile manufacturing principles are combined in the manufacturing system	X	X	X	X
	Production operations are standardised	X	X		
	Reserve capacity, i.e. 70-80% utilisation, is secured by production planning and control		X		X
Information and communication	Useful and relevant information is available to all units and members of the manufacturing system	X	X		X
	Information flow within the manufacturing system is rapid and reliable		X		
	Visual information and control systems are used to communicate the status of production	X	X		
Human resources	Multifunctional teams and teamwork are used in production	X			X
	Employees are cross-trained and multi-skilled	X			X



ment principles are defined to include the areas that need to be improved and the objectives of improvement, i.e. the desired characteristics and capabilities that should be developed. Identifying these is enabled by the structure of the framework and the best practice principles included in the framework. By comparing the current manufacturing system and practices with the best practice principles of the framework, companies can identify differences that indicate possibilities for improvement. In addition, the best practice principles also serve as, or at least support the determination of, improvement objectives. The grouping of the best practice principles can then be used to identify the areas in the manufacturing system that need to be improved.

As a result of the structure, the framework is expected to make possible different approaches to identifying improvement principles of manufacturing system performance. For instance, a company can identify improvement possibilities and principles by comparing its current practices and manufacturing system with all the best practice principles included in the framework. In this way, the framework and the best practice principles provide a benchmark against which a company can evaluate its practices in order to identify improvement needs and to develop improvement principles. On the other hand, improvement principles can also be identified on the basis of manufacturing objectives. By way of illustration, a company may have identified a need to improve quality or some other manufacturing objective. In such a case, the framework makes it possible to identify those best practices that are linked to the manufacturing objective in question. Hence, the framework can also be used to generate improvement principles on the basis of identified improvement needs.

## 6 DISCUSSION

This paper presented a tentative framework for improving the manufacturing system performance of Finnish mechanical engineering companies. It has been developed on the basis of a literature survey during the first phase of an on-going research project. The framework consists of best practice principles of manufacturing and manufacturing systems that have been classified on the basis of decision areas of manufacturing system improvement and manufacturing objectives.

The developed framework attempts to support manufacturing system performance improvement by simplifying the identification of appropriate improvement principles. The framework facilitates identifying improvement needs and principles by benchmarking current practices of a company against the best principles included in the framework. Furthermore, the linkage between best practices and manufacturing objectives supports the identification of improvement principles based on a company's priorities or improvement needs related to manufacturing objectives.

The on-going research and the developed framework aim to introduce a new and more useful tool for manufacturing system performance improvement by avoiding identified shortcomings of currently available literature, frameworks and models. The key to achieving this is seen to be the scope of the research, which has been limited in terms of the process, the type of company and manufacturing system and the type of product considered. The intention is to limit the scope of the research so that the framework can provide useful operational-level advice, instead of general level descriptions. Simultaneously, the aim is to avoid focusing on too narrow and specific an area or method by considering the entire order-delivery process.

As the presented framework is part of an on-going research project, further research is planned in order to evaluate and

improve the framework. Firstly, because the framework presented has been developed on the basis of the literature, more effort is required to evaluate and improve the appropriateness and usefulness of the structure of the framework and the best practice principles included in it. Case studies as well as interviews in companies can be used to collect data and evidence which will be used to evaluate the framework and the need to modify it. Subsequently, measures and methods that support the use of the framework and identification of improvement principles should be generated. More detailed descriptions of the best practices and assessment scales for evaluating the realisation of each best practice would support the identification of improvement principles based on benchmarking. Similarly, identifying performance measures that focus on manufacturing objectives would assist in identifying improvement needs and improvement principles based on current performance of a manufacturing system.

Consequently, the on-going research is expected to provide a useful improvement tool for Finnish mechanical engineering companies. By simplifying and supporting the identification of improvement principles, the framework can assist companies in their efforts to improve competitiveness and performance.

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# Lean thinking in product development

**Ole-Christian Bjarnoe**

*Associate Professor, Department of Manufacturing Engineering and Management, Technical University of Denmark,  
ocb@ipl.dtu.dk*

**Keywords – lean manufacturing, set based design, value stream mapping, product development flow**

## 1 INTRODUCTION

In the winter 1939/40 England had its back to the wall confronted with a German war-machine superior in almost every aspect. A particularly critical field was the lack of long-distance fighters with the capacity to escort the bombers into German territory, and the capacity to engage the German fighter forces into defensive operations to relieve the pressure on the British homeland defence.

In April 1940, as a consequence of this critical lack of fighter capacity, the British Ministry of War handed in an order to the American aircraft manufacturer, North American Aviation, to develop and manufacture an advanced fighter, which was named P-51 Mustang.



Figure 1. P-51 Mustang

The aircraft was built in record time. After only 117 days an airworthy prototype was ready, and afterwards an equally fast test programme and production preparation followed, and shortly thereafter the aircraft was operational.

The fighter pilots were of the opinion that an aeroplane, that looked well also flew well, and P-51 did indeed look elegant, had outstanding flying qualities, and was the answer to any fighter pilot's dreams. It was able to operate in almost every situation: in low as well as high altitudes, against ground as well as air targets, and equipped with drop tanks able to reach the most distant corners of the Third Reich. It was faster than the best fighter the Allied had at that time, the Spitfire, and was one of the fastest and probably the best fighter during WWII.

One would think that well-tested design principles were chosen for such a speedy product development, but this was in no way the situation. The aeroplane included several designs that sat new standards for fighter design, and one must ask oneself how on earth it was possible to design such an advanced fighter aircraft in only 117 days?

One of the approaches applied was modularization. In those days an aircraft was made as an integrated design, but when developing the P-51 a kind of modularization and parallelisa-

tion of the sub-processes was applied. The airframe was for example divided into sections which could be developed independently as the interfaces were defined from the beginning which is the same principle used in contemporary modular product-architectures. This made it possible to execute parallel product development and set-based design, which means that several designs of the same module were developed concurrently and consequently the decision about the final design could be postponed. The result of this made it possible to work with new, advanced designs in a very limited time frame. Maybe the most effective tool, however, was a very highly qualified project management – and besides this access to many resources as it is possible in the design of critical war material.

Some of the tools applied back in time have been further developed, among them modularization and set-based design, which require a lot of planning and architectural work and which are also the elements in frontloading in which as much decisions as possible are placed in the beginning of the product development process. Parallelisation is further developed into concurrent engineering based on multifunctional teams and supported by tools e.g. DFM, design for manufacturing. IT as well has played a significant role and generated tools such as CAD, simulation and prototyping. And of course leadership is still a decisive factor.

In other words, absolutely contemporary principles of efficient product development were applied, but many more have been added since then.

Now the question is, does the lean philosophy, which until now primarily has been applied within the manufacturing area, incorporate ideas usable in product development? To throw light on this we will start looking at some of the lean principles.

## 2 DIMENSIONS IN LEAN THINKING

The lean principles were developed in the sixties by Toyoda and Ohno as an integrated production development and product development process with common philosophy and frame of understanding and based on the management concept of the Toyota factories. The philosophy was later on crystallized into the five lean principles:

- Value
- Value stream
- Flow
- Pull
- Perfection

At the end of the eighties a big international research project within the automotive industry aimed at decoding of the Toyota Production System was executed at MIT. The results of this project were popularized in the book entitled *The Machine that Changed the World* and in the successor entitled *Lean Thinking* from 1996, in which the pieces were united to form a mosaic, the groundwork was laid for a markedly increasing interest in the lean concept in the following years.

From its origin in classical production areas such as the automotive industry Lean Thinking was soon adopted to other production areas and recently also widely applied within the areas of administration, service and health care.

### 3 DIFFERENCES BETWEEN LEAN THINKING IN PRODUCT DEVELOPMENT AND IN PRODUCTION

Although the original TPS included product development, and though MIT proceeded with a new big Lean Thinking research programme within the aerospace industry at the end of the nineties that put great emphasis on product development, the lean philosophy was only recently broadly adopted within product innovation. One of the reasons may be that production and product development are rather different in many aspects, and the transfer of methods from one area to another is in no way straightforward.

Besides the big span in the product development concept – there is a big difference between the design of a F-35 fighter with a budget of several hundreds of billions of \$ and a new piece of toy – there are also many characteristic differences between production and product development. In production the linear processes are targeted, in product development it is often re-circulation and iteration. Production works with the five generic performance parameters: quality, costs, speed, flexibility and dependability – in product development focus is on value creation on time and the value concept is broader, including e.g. aesthetic parameters. In production reproducibility creates value – in product development it is the variation that creates value. Production works with fixed specifications – in product development there are substantial degrees of freedom to influence production as well as product development. The main problem in production is the waste of resources – in product development it is lost opportunities for optimal business creation.

Some of the characteristic differences are shown in table 1.

Production	Product development
<ul style="list-style-type: none"> <li>• Focus on costs</li> <li>• Repetitive processes</li> <li>• Waste of time and materials</li> <li>• Linear processes</li> <li>• 5 performance dimensions</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on timeliness</li> <li>• Non-repetitive processes</li> <li>• Waste of opportunities</li> <li>• Non-linear processes</li> <li>• Radical influences (design)</li> </ul>
	Broad value concept

Table 1. Point of differences between production and product development

### 4 DIFFERENT APPROACHES

The above mentioned differences have resulted in different approaches. It goes without saying that it is expedient to apply a situation-specific approach. Maybe e.g. the customer value, for example, is not very relevant when developing an F-35 aircraft as the specifications are fixed but waste and flow orientation could be useful, and perhaps the opposite is the situation when developing a piece of toy or a pair of sneakers.

If we look at some of the influential players in the field of efficient product development who have been leading in the USA in the application of lean principles, first of all we have MIT with their Lean Aerospace Initiative, in which a broad range of lean principles has been investigated with a predominant flow and waste orientation.

Ward, a member of the original MIT team, and one of the first who applied lean product development on a consultancy basis worked with a broad range of lean tools. But other influential players work with more narrow approaches. R.G.

Cooper, who is well known for his Stage-Gate model, is predominantly waste-oriented. Reinertsen, for many years active in efficient product development has a lean approach that is mainly flow-oriented. Liker, also a member of the original MIT-team, has been active in the area of the set-based part of the Toyota Production System, in other words a design orientation.

Two different approaches have been reported, namely a process and a design approach. In the process approach focus is on creating stability, flow and reduction of waste by applying Value Stream Mapping and other tools from the lean tool-box. In product development the design approach often has a more radical impact than in production because, to a certain degree, product development works with open specifications and consequently makes it possible by design decisions to create leanness in the product development as well as in the production process. Thus, the design approach can be divided into the methods which predominantly create leanness in the product development process and those which create leanness in the production process.

As set-based design creates stability in the product development process, it could be perceived as a design tool for design for lean product development – the same goes for modularization which also creates efficiency in the production process and therefore is a tool in the toolbox for DFM. Table 2 shows this division.

Design for lean product development

- Set-based design
- Modularized platform architectures
- Design for lean manufacturing
- Modularized platform architectures
- DFM

Lean product development flow

- TPS-tools
- Concurrent engineering
- Optimization of activity chains (value and waste)

Table 2. Approaches in lean product development

### 5. THE CONCEPT OF VALUE IN PRODUCTION AND PRODUCT DEVELOPMENT

Two of the five TPS principles are value and the corresponding value creating activity chain. Some studies indicate that the TPS works with value-creating activities in 80% of the time, and that in medium sized Scandinavian countries 40% is typical. This was confirmed when we conducted a small study in a Danish electronics company, which showed that the engineers were engaged in value creating activities 50% of their time. A further analysis of the interview data shows however, that it was rather uncertain what the respondents meant with their answers and that the value concept is difficult to communicate, especially if a substantial part of the product value is of aesthetic nature.

Yet, if one looks on the concept of value as delivered value which means value related to the costs, things looks a bit more clearly, and from a customer point of view it is value for money that is most interesting, and consequently, it is as relevant to reduce costs as increase value. With this understanding we can apply the resource part of the value concept in processes in which this gives most meaning and the absolute value, e.g. during concept development, where this is appropriate.

In this way we are also closer to industrial practice where Value Stream Mapping in production as well as in product development to a great extent is directed towards resources in the form of time and money and the source of waste related to this.

## 6. THE CONCEPT OF WASTE IN PRODUCTION AND PRODUCT DEVELOPMENT

In the traditional understanding of lean manufacturing a range of waste forms, which means activities that are not creating value, is present:

- Motion
- Transportation
- Stocks
- Over production
- Waiting time
- Bad processing
- Inspection

However, as exemplified above, the waste problems related to product development can be a complicated and sensitive area for optimization, and the waste dimension is also unfolded along further parameters than in production.

Waste in production is mainly a matter of materials and time, but in product development the biggest potentials of waste are the overlooked possibilities for business opportunities, resource waste by failed product concepts, unplanned iterations in later stages of the product development process, uncertainty of information and increased cycle time with markedly higher negative consequences than in production. Other examples of sources of waste in product development are bad architecture, rigid systems, linear processes, low reuse, queue forming, limited learning and over-design. What we see is a somewhat broader range of influencing factors some of these with very high potential effects.

## 7. THE CONCEPT OF FLOW IN PRODUCTION AND PRODUCT DEVELOPMENT

In production and in product development flow creates productivity, and bottle necks and queue problems reduce the flow. Similarly to managing assembly lines, where materials and sub-assemblies flowing into the line must be balanced with the capacity of the different operations, here we have a process which could be perceived as a virtual assembly line in which knowledge and information constitute the flow and consequently should be managed in a way to ensure that they are present in sufficient amount, right quality and on time. To do this we must stabilize the partial processes and the total process in order that they operate with predictable outputs.

Flow is essentially about queue reduction, but in product development queues are not as visible as in production. In product development queues, which are only rarely monitored or even recognized, occur because bottleneck activities are often pressured to a very high degree of utility. This combined with the natural variation within product development results in for example partial designs waiting in front of the over-utilized resources and delaying the throughput times with markedly higher business consequences than in production.

The reduction of batch sizes is generally one of the most effective methods to reduce variations in a process flow in production as well as in product development. In product development the concept of batch size means that it is a batch of work containing of knowledge and information which is transported through the system.

Stage-gate models, which require that all work is completed before the next step is started, and with few points of authorization, results in big batches, high variation in receiving speed, big queues and long throughput times. Points of authorization must of course be included, but should be handled with the right trade-off.

Modular architectures, frontloading and set-based design and a process with a progressive freezing of the specifications contribute to a reduction of the batch size, generally stabilize the process and create flow. The same goes for perfection, i.e. high quality development work, as trouble shooting creates a stopping of the virtual assembly line.

The concept of pull is related to flow. In production pull is generally perceived as creating of flow, but with product development one should look at a relatively high planning level before something analogous is seen. A product introduction plan including fixed times for introduction of new variants, will, of course, create activity flow, but the question is whether such a strategic planning level is too far away from the relatively operational approaches by which the lean philosophy is known in practice.

## 8. CLOSING REMARKS

After this we are able to summarize by saying that the road to Lean Thinking in product development mainly encompasses a tool box consisting of relatively well-known instruments, but adjusted to the fact that substantial differences exist between many of the processes in production and product development, and that in product development opportunities are present that have very profound impact on the processes in production as well as in product development.

And despite the fact that it is rather difficult, it is attractive because there is a high potential for improvement and many interesting results have been reported. It is for example estimated that by the development of the F-18 Super Hornet fighter, cost savings of 5 billion \$ were produced due to the application of lean product development.

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# Costs of occupational accidents - effects of occupational safety on company business a research and development project

**Markku Aaltonen<sup>1</sup>; Kimmo Oinonen<sup>2</sup>; Jari-Pekka Kitinoja<sup>3</sup>; Jorma Saari<sup>4</sup>;  
Mika Tynkkynen<sup>5</sup>; Henriikka Virta<sup>6</sup>**

<sup>1</sup> Team Leader, Finnish Institute of Occupational Health, markku.aaltonen@ttl.fi

<sup>2</sup> Assistant researcher, Finnish Institute of Occupational Health, kimmo.oinonen@ttl.fi

<sup>3</sup> Research engineer, Finnish Institute of Occupational Health, jari-pekka.kitinoja@ttl.fi

<sup>4</sup> Professor, Finnish Institute of Occupational Health, jorma.saari@ttl.fi

<sup>5</sup> Research scientist, The Federation of Accident Insurance Institutions, mika.tynkkynen@vakes.fi

<sup>6</sup> Research engineer, Finnish Institute of Occupational Health, henriikka.virta@ttl.fi

**Keywords—occupational safety, productivity, costs of accidents, Internet concepts, accident research**

## 1 INTRODUCTION

The costs of occupational accidents could be cut by effective preventive measures, and at the same time productivity could be improved. Usually safety measures are considered only from the medical or technical points of view. The economic viewpoint widens the basis for decision making so that it is possible to arrive at the most productive safety solution with respect to the available economic resources. [1]

The European Commission is concerned about the costs of 'non-social policy' for Europe. The Community Strategy on Safety and Health at Work for 2002–06 [2] has set the development of knowledge about economic and social costs arising from occupational accidents and illnesses as one of the top priorities. Work-related accidents are still a major safety and health problem in Europe. Every year, approximately 5 500 people are killed in accidents in their workplace. Probably around 150 million working days are lost each year due to work-related accidents. Eurostat has estimated that accidents at work incurred costs of 55 billion euros in 15 EU Member States in 2000. This estimate corresponds to 0.64% of the GDP of about 8500 billion euros for these countries. [3] This is a huge cost for businesses and a huge cost in terms of human suffering for the victims and their families.

According to research findings there exists a clear link between a good working environment and the performance of a company. [4] A number of different success factors have been identified in the literature, namely:

- combining business targets and human resources activities, in order to achieve better results;
- taking a wider approach to health promotion to include

not only health conditions but also employee attitudes and corporate culture;

- using occupational safety and health (OSH) improvement programmes, as they seem to provide better results than implementing only specific prevention measures;

- including technical innovations and organizational improvements;

- carrying out measurement and evaluation. Demonstrating return on investment, both prospectively and retrospectively, is needed.

Figure 1 presents one model to describe how successful safety activities can promote economic performance of a company. At the same time when accidents costs will decrease, it is possible to increase productivity and to improve quality when the production is running smoothly without interruptions. According to the model, accident prevention can have benefits in the form of reducing anticipated losses, savings in expenditures or additional gains. Often additional (or unintended positive side-effects of prevention) benefits are even more important than the benefits that are directly related to reduction of sick leave and disability. [5]

Thus, occupational safety and health can affect company performance in many ways. Healthy workers are more productive and can produce at a higher quality. Fewer work-related accidents and diseases lead to less sick leaves. In turn this results in lower costs and less disruption of the production processes. Equipment and a working environment that is optimized to the needs of the working process and that are well maintained lead to higher productivity, better quality and less health and safety risks. Reduction of injuries and illnesses means less damages and lower risks for liabilities. [6]



Figure 1. Economic effects of safety and health at company level [5]

In a Finnish research project, there was a statistically significant correlation between the TR Index and the contribution margin of the construction sites. The study consisted of 142 different construction sites. The TR safety observation method is a reliable tool of evaluating the safety level of a construction site [7]. On the basis of the study it was concluded that construction sites with a poor working environment (i.e. low TR Index) could seldom achieve good margins. The study showed also that a good safety level (i.e. high TR index) could even be used for the prediction of future profitability of that site. [8]

This paper introduces the ongoing research and development project "*Costs of occupational accidents - Effects of occupational safety on company business*" and its preliminary results. The project is carried out by the Occupational Safety Team at the Finnish Institute of Occupational Health (FIOH). It was ordered by the Finnish Federation of Accident Insurance Institutions, but also the Finnish Ministry of Social Affairs and Health and the Finnish Work Environment Fund are funding the project. Four main Finnish insurance companies are involved in the project as well.

The project is an integral part of the nation-wide programme entitled "Prioritizing occupational safety - occupational accident prevention programme". The core idea of the programme is to promote adoption of a high-standard safety culture and the "vision zero" concept in all sectors of Finnish working life. [9]

The project started in 2005 and it will finish 2007.

The project has the following goals:

- to provide new practical methods and information about costs of accidents and economic importance of occupational safety and health;
- to investigate cost information needs of different personnel groups related to OSH;
- to calculate costs of accidents in companies according to the Eurostat method [3];
- to explore effects and costs of accidents in supply chains of subcontractors;
- to develop an accident scenario model for accident investigation;
- to establish a framework for continuous follow-up of information in the economic aspects of occupational safety and health;
- to enhance safety management by utilizing accident cost information;
- to enhance productivity, quality and competitiveness of the workplace by improving working conditions.

### 3 PROJECT LAYOUT AND METHODS

The project consists of six research modules, which are being carried out in different time periods.

The research module 1 has consisted of a study on information needs on accident cost information among different interest groups (company management, safety personnel, occupational health personnel, purchasers, etc.). In total, personnel in 23 companies have participated in the inquiry and in-depth interviews. Table 1 presents the sectors of the participating companies.

TABLE 1  
NUMBER OF COMPANIES PARTICIPATING IN THE PROJECT

Sector	N	%
Manufacture of goods	11	48
Electricity, gas, steam and hot water supply	4	17
Construction	4	17
Municipalities	2	9
Wholesale and retail sale	1	4
Health and social work	1	4
Total	23	100

Table 2 shows the number of persons who have responded to the questionnaire. The inquiry was organized by using the web-based information system Digium. Preliminary results of this questionnaire are presented in the following chapter 4.

TABLE 2  
NUMBER OF RESPONDENTS IN THE INQUIRY

Personnel group	N	%
Top management	9	6
Line management	71	46
Specialist in book keeping	4	3
Specialist in production/purchasing	11	7
Other specialist	8	5
Safety officer	19	12
Safety representative	21	13
Other safety specialist	4	3
Employee	3	2
Other	6	4
Total	156	100

The research module 2 includes a literature survey on latest research findings and practical information in the economics of OSH. It includes also the development of an Internet site for this topic. The concept of this site is presented in the following chapter 4 as well.

The research module 3 consists of a data collection of accident cost information at company level and calculation of these costs. It is carried out by using the Eurostat method [8]. Data collection is currently being carried out in the participating companies by using the Digium system.

In the fourth research module, a method is under development, where accident scenario models are applied for accident investigations. The model is tested by using information from serious forklift accidents. These accidents have been investigated by the Finnish Federation of Accident Insurance Institutions.

The research module 5 explores the effects and costs of accidents in the supply chain of companies. Accidents increase costs of production, which are added to prices to next customer in a supply chain. Finally, the total price of the product includes the costs of accidents in the whole supply chain. Accidents may cause also disturbances in supply chain, when delivery times are very tight. The Cost Management Centre of the Tampere University of Technology is collaborating with the FIOH in this module.

The research module 6 covers dissemination and utilization of the project results and products. These include training courses and training packages, information packages for media, and scientific and popular articles related to economics of OSH.

## 4 PRELIMINARY RESULTS

As the project is still ongoing, some preliminary results are presented in this chapter from research modules 1 and 2.

### 4.1 Survey on safety information needs

Table 3 presents the use of different performance indicators in the participating companies (n=23). Each of them is following the amount and frequency of accidents and results of well-being surveys. However, only half of them are investigating the accidents. Instead, 61% of respondents are following the costs of accidents and 57% the costs of sick leaves.

TABLE 3

USE OF PERFORMANCE INDICATORS IN THE PARTICIPATING COMPANIES (N=23)

Indicator	N	%
Amount of accidents	23	100
Accident investigations	11	48
Number of reported near-accidents	20	87
Accident frequency	23	100
Severity of accidents	15	65
Use of different indexes, e.g. housekeeping index	8	35
Number of risk assessments	10	43
Number of safety audits	12	52
Number of safety initiatives	8	35
Number of accomplished safety measures	4	17
Results of well-being surveys	23	100
Costs of safety activities	5	22
Costs of accidents	14	61
Costs of sick leaves	13	57
Others	1	4

Every fourth out of five respondents were considering that the safety information flow in their workplaces is running well. However, every third person was responding that they do not utilize safety cost information enough. Almost all respondents (92%) agreed that there is a clear connection between the quality of working environment and productivity. But only 54% of respondents said they have enough cost information when making decisions about safety activities. Also, 40% of respondents agreed on the statement that OSH activities and investments are not considered generally productive in their company.

Electronic mail messages were the most common way to receive safety information of the company (82% of all respondents). The intranet system of the company was also

commonly used (69%). Safety meetings (70%), safety bulletins on paper (71%) and bulletin boards (50%) were also used in safety communication.

Respondents provided also a large number of individual comments and initiatives about safety information flow. Safety campaigns were considered as an important way to activate safety work. Line management should be informed better about safety-related matters. Intranet systems, electronic bulletin boards, in-house TV systems and push technology applications, including text messages of mobile phones could be utilized more in safety work. However, personal face-to-face communication, informative meetings and safety training were also mentioned as an effective way to influence on safety behavior.

#### 4.2 Development of the web feature

Under the second research module, a special web feature on "*Economic aspects of occupational safety and health*" has been developed. Currently the information is fragmented in various web sites and it is difficult to get an overview of existing information. This feature aims to provide complete set of information related to the topic. The language of the feature is Finnish.

The development has been carried out in close cooperation with the Occupational Safety and Health Department of the Finnish Ministry of Social Affairs and Health. The Department is managing the Finnish Focal Point of the European Agency for Safety and Health at Work. Finland has its own Internet site as a part of a European network established by the European Agency. The aim of the network is to collect and disseminate information throughout the European Union in order to encourage improvements in the working environment. The Finnish site (figure 1) provides information of occupational safety and health in Finland. The new web feature will be an integral part of the Finnish Internet site and it will be located at the "Good practice" section.

The concept of the new web feature consists of seven main chapters (table 4). Each chapter consists of a number of sections consisting of a full-text description, list of references and list of links related to the topic of the section. At the moment, the web feature includes more than 60 pages.

TABLE 4

CONCEPT OF THE NEW WEB FEATURE FOR "ECONOMIC ASPECTS OF OCCUPATIONAL SAFETY AND HEALTH"

Main chapter	Sections	Subsection
General introduction to the web feature	--	--
Responsible company business	Corporate social responsibility	--
	Legislative requirements to working environment and well-being at work	--
Measures for improving the working	Introduction	--
	Improvement of work organization	--

environment	Good practice management	--
	Ergonomics	--
	Work planning and design	--
	Working hours	--
	Maintenance of work ability	--
	Training and orientation	--
	Tidiness and housekeeping	--
	Quality	--
	Economic incentives and payment by results	--
	Innovations	--
	In-door environment	--
	Purchasing	--
	Measures of well-being at work	--
	Management of human resources	--
Costs of occupational safety and health	Introduction	--
	Costs at company level	Introduction
		Costs of accidents and occupational diseases
		Costs of sick leaves
		Costs of disability pensions
		Costs of personnel turnover
		Costs of presenteeism
		Costs of safety activities and investments
	Costs at society level	Introduction
		Costs of accidents and occupational diseases
		Costs of disability pensions
	Costs at individual level	Introduction
		Consequences to persons
Productivity	Introduction	--
	Importance of productivity to company business	--
Insurance systems	--	--
Materials and methods	Calculation models	Accident costs
		Costs of sick leaves
		Costs of personnel turnover
		Costs of disability pensions
		Costs of proactive safety actions
		Methods for cost-benefit analysis
		Methods for Human Resources Accounting
		Training materials
	Case studies	--
		--
	Literature	--
	Links	--

Existing information already available in the Finnish Internet site are being utilized by interlinking them to the



new feature. Within the web feature the user may find the relevant information by accessing it from different access points. E.g., when looking methods for accident cost calculation one may enter to this topic accessing from "Costs of occupational safety and health" -chapter or from "Materials and methods" -chapter. It is intended to test the usability of the web feature during the project period as well.

The main user groups of the web features will be line managers and OSH practitioners at the workplaces, OSH specialists working in administration, insurance companies and safety business, trainers and researchers in OSH and general public. The updating and maintenance of the web feature will be organized after the project has ended

The web feature will be open to public in autumn 2006.

## 5 DISCUSSION

The connection between good working environment and productivity was understood very well at least among the respondents in the participating companies. However, 40% of respondents agreed on the statement that OSH activities and investments are not considered generally productive in their company. More information about positive effects of good safety level is still needed in companies.

Cost information was available to some extent but it could be utilized better in decision making. Emails and safety intranets are already commonly used, but new developments are still needed, e.g. push technology applications.

The development of the new web feature economic aspects of OSH is about to be completed. The user feedback of the usability of the system is important and is needed for further enhancements.

More results originating from the project will be published after finalizing the research modules.

## ACKNOWLEDGEMENTS

The project is funded by the Finnish Work Environment Fund, the Finnish Ministry of Social Affairs and Health, the Finnish Federation of Accident Insurance Institutions and the Finnish Institute of Occupational Health.

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The screenshot shows the main page of the Finnish Internet site for occupational safety and health. The page is titled "European Network - Finland" and includes a navigation menu on the left. The main content area features a "Welcome" message, a "List of Focal Points" section, and a "National Focal Point Network in Finland" diagram. The diagram illustrates the structure of the network, showing the hierarchy from the European Agency for Safety and Health at Work down to various expert working groups and advisory groups. The right sidebar contains "Agency Information", "Uutis" (News) with dates from 10.07.2006 to 14.06.2006, and "Tapahtumia" (Events) with dates from 04.07.2006 to 03.07.2006.

Figure 1. The main page of the Finnish Internet site for occupational safety and health at <http://fi.osha.europa.eu>

# Networks between Finnish construction and service companies in the lifecycle of buildings

Teemu Surakka

Researcher, TKK / BIT Research Centre, [teemu.surakka@tkk.fi](mailto:teemu.surakka@tkk.fi)

Facing an increasing competition from their foreign counterparts, Finnish Architecture, Engineering and Construction (AEC) industry is utilizing value networks in their operations and trying to make the most of their knowledge about the end users and the lifecycle management of buildings. However, the knowledge management and networking practices in the industry are still in its infancy in many respects and this creates possibilities for competitive advantage and new business opportunities for specialized companies. The focus of this paper is on the management of building specific knowledge and value networks as a source of competitive advantage in AEC industry. This paper is based on literature and the viewpoints of the companies operating in the different parts of the lifecycle of buildings. These viewpoints were collected in 17 semi-structured interviews during August 2005 and June 2006. A broad coverage of the important interest groups, in the field of construction and maintenance of buildings, were fairly included in the interviews in order to construct comprehensive picture of the networking practices and possible business opportunities related to them during the lifecycle of buildings.

**Keywords**—value networks, AEC industry, lifecycle management, emerging opportunities.

## 1 INTRODUCTION

The Finnish Architecture, Engineering and Construction (AEC) industry is facing an increasing competition from their foreign counterparts in the competitive bidding of construction projects. Facing this fierce competition, some of the companies working in this industry are trying to incorporate value adding services to their products or make the most of their knowledge about the end users and the lifecycle management of buildings. These operational improvements usually require networking between construction companies and service companies operating in different parts of the life cycle of a building. However, according to literature, AEC companies have been slow to adopt new business models, working methods and technology in these respects [1].

The focus of this paper is on the interorganizational networks and transfer of lifecycle related knowledge as a source of new business opportunities in AEC industry. This paper is based on literature review and on the viewpoints of the industry representatives. These viewpoints were collected in 17 semi-structured interviews,

conducted in two separate stages during the years 2005 and 2006.

This study is a part of a research project DESNET that is carried out in collaboration between VTT (Technical Research Centre of Finland) and TKK (Helsinki University of Technology, BIT Research centre). The research problem of this research effort is formulated in the following way: To identify the most advantageous model of networking, in respect to possibilities to support new information and communication solutions for the product specific knowledge management along the life cycle of a building. This paper reports the findings of BIT Research Centre's part of the study and, in particular, findings related to networking practices that support the management of lifecycle information.

This paper is structured in the following way:

- “The source of competitive advantage” paragraph places this paper within the broader research streams in knowledge management, network analysis and strategy,
- “The characteristics of the Finnish AEC industry” section describes the business, networking and knowledge management environments the industry is facing according to literature,
- “Networks in the AEC industry” section narrows the focus even further to the issues related to interorganizational networks in the context described in the previous sections.
- After the literature review sections, these viewpoints from the literature are contrasted with those of the practitioners (11 interviews), in order to construct comprehensive picture of the networking practices in AEC industry.
- As a conclusion this paper reports the results of the second round of interviews, in which these new networking practices and new business opportunities related to these practices, were presented to practitioners (7 interviews).

## 2 THE SOURCE OF COMPETITIVE ADVANTAGE

Interest by social scientists in the firm as an institution has been stimulated by the question of why firms exist at all. The transaction cost theory of the firm focused upon the relative efficiency of authority-based organization (hierarchies) with contract-based organizations (markets). The resource-based view perceives the firm as unique bundle of idiosyncratic resources and capabilities where the primary task of management is to maximize value through optimal deployment of existing resources and capabilities,

while developing the firm's resource base for the future [2], [3]. This theory emphasizes the fact that most products require the services of several resources (information, money, power, or material aid) and most resources can be used in several products. Looking outside single firm, resource-based view can also be used to describe situations where it is preferable to share knowledge resources in inter-organizational networks in contrast to building in-house resources.

The emerging knowledge-based view is not, as yet, a theory of the firm, but to the extent that it focuses upon knowledge as the most strategically important of the firm's resources, it is an outgrowth of the resource-based view of the firm [2]. The greatest downfall of the knowledge-based view so far can be said to be the difficulties researchers face when trying to estimate the impact of knowledge on performance. This paper follows the connectionist stream of network studies [4] in the attempt to supplement the viewpoints of the resource / knowledge-based view. In this perspective an actor is successful, because she or he can draw on the knowledge that is controlled by different networking parties - in contrast to structural viewpoint, where the emphasis is on the position the actor has in the network. In this respect, network perspective can help the present discussion by providing a relative measure of the impact of knowledge resources

### 3 THE CHARACTERISTICS OF THE FINNISH AEC INDUSTRY

The Architecture, Engineering and Construction (AEC) industry in general creates and maintains the facilities for every day living and economical activities – for example all the buildings and the infrastructure needed to support them. In Finland the products of this single industry comprises over 70% of the national assets and also the industry employ 500 000 workers, which is about 20% of the whole working force in Finland. [5]

However, at the same time AEC industry in Finland is also very heterogeneous group of companies in respect to resources available and specialized knowledge they possess and use [6]:

- Of the roughly 27 000 companies operating in this industry, only 157 can be considered large (over 250 employees or turnover over 43 MEUR) in Finland.
- Companies are usually highly specialized with workers usually belonging to equally specialized crafts (architects, structural engineers, consultants, contractors, facility managers, etc.).

The AEC industry on the whole has been criticized for inefficiency and for the lack on innovativeness in the construction process. Some of the characteristics of the industry act as underlying reasons for these industry-wide problems – for example, mainly due to the mandatory bidding of the projects, the AEC industry is highly competitive in nature and it is consequently characterized by low levels of trust between different actors [7]. This low level of trust affects horizontal networking in the industry,

but also the development of long-term relationships between main contractors and key suppliers [8]. Together with the project-based nature of the industry, this lack of trust and lack of networking hinders standardization, innovation, and organizational learning in the industry [9].

At the same time the environment, where companies operate, is changing quite rapidly in Finland. According to industry's own analysis there are four trends shaping the environment and the industry operating in this environment [5]:

- 3.1 *Companies and their customers have become international even faster than anticipated, which has affected in many ways the market structure, business concepts and also the every day life of the local actors.*

Customers operating globally expect that Finnish AEC companies follow them abroad to support their activities. As the markets converge in this industry, EU directives are increasingly affecting companies operating in different countries, but also the local actors in Finland. And of course, this trend is not one-way transition only – while Finnish companies go abroad, foreign work force and companies increase their presence in Finland too. Especially international investors have increased their share in Finnish real estate trade to almost 50% in recent years.

- 3.2 *The whole economy in Finland is turning into service economy – the increasing importance of networked services is one of the strongest trends in AEC industry.*

Services constitute already 70% of the GNP in Finland today. Companies in the AEC industry are focusing on their core competences, which have led these companies to outsource much of their supporting activities. This has increased the importance of network economy, partnerships and close interaction. Also public sector is facing strong demands for increasing the productivity of their own services and this has also increased the use of networked service providers in the industry.

Services and service business require different kinds of knowledge, competences and infrastructure than traditional industrial activity and this means that AEC industry is facing strong transformational forces. The new competences and knowledge needed in this transition has lead into a birth of a whole new business: service integrators or managers that manage the operational service procurement for their customers in this industry. Especially in the office building sector, the new found interest on user services and the increase in foreign investors in the sector have together increased the use of these service providers. This trend has also enforced the in-house development of competencies and knowledge associated with network management and with the lifecycle management of a building.

In house building sector this trend has been strengthened by the increase in customer needs both in the building of new houses and renovating old houses. Also the share magnitude of future need for renovation in housing sector



increases the need for resource allocation between different actors.

*3.3 The importance of knowledge management and knowledge transfer in the improvement of the service capabilities, quality and productivity increases. The digitalization of information management creates new possibilities to offer even better service solutions to customers.*

Internet has changed the way procurement is done – products and services are offered and bought internationally and in real time. Also improvements in information and communication technologies (ICT) have changed the way work is done nowadays and so ICT have influenced the office building sector in AEC industry with increased user needs in this sector.

ICT is no longer seen as a driving force of the needed change in the industry, but as a tool and service instrument facilitating that change. Basic ICT technology is well used in the sector and in the use of computer aided design and building information models (BIMs) Finland is one of the leading nations. However, the challenge is still to get the right information to right place at the right time – knowledge management and transfer practices have remained relative undeveloped, especially when networking between companies has become necessity for companies – only recently have actors in the industry started to think about the value that information and technological solutions add to process and who actually pays the bill when these solutions are developed.

*3.4 The significant rise in the price of energy has increased the urgency to found new solutions, service concepts and business models that lower the lifecycle costs and the environmental impact of the buildings.*

As the price of energy rises, energy efficiency is increasingly important part of the eco-efficiency, which is about producing services, products and well-being with minimal use of natural resources. When thriving for long term cost improvements and eco-efficiency, the suitability and proper functioning of the buildings is one of the most important factors in AEC industry.

The incentives for change in these environmental issues have come mainly from outside of the industry, but there are also indications that initiatives from inside the industry are increasing. The new regulations and industry initiatives demand for new knowledge management and competence improvements from all the actors in this industry and closer networking between these actors.

#### 4 NETWORKS IN THE AEC INDUSTRY

Historically companies have always been dependent to some degree on products and services produced by others – only the make-or-buy ratio has varied between companies and industries, but also between time periods.

Current trend in AEC industry is for companies to focus on core competences and customers. This has led these

companies to outsource much of their supporting activities, resulting, in some degree, increase in collaborative and networking activities. Researchers around the world have identified several reasons for the increase in subcontracting and outsourcing in the industry and these reasons apply for the situation in Finland also: Company specialization, discussed in the previous chapter, increases outsourcing [10], [11]; construction is so much a project based activity [12], [11] that subcontractors may be used case-by-case basis depending on the needs of the particular project [8], [13]; industry suffers from high fluctuation in the demand for their products that is associated with the rise and fall of the public economy [6], and subcontracting is used as a buffer for this fluctuation.

However, outsourcing and networking hasn't always been the operating model in the industry and still there is a lot of room for improvements. Especially interaction and leadership competencies have to be developed throughout the companies in order to improve customer, partnership and lifecycle focus in the industry. Customers, investors and property management companies, with their increased demands, have started the change in the real estate sector towards true network economy, where the goal is to seek win-win situations for companies and mutual improvement in service capabilities instead of simple cost saves. However, the construction sector seems to have troubles moving away from the simple subcontracting / supply chain management mode of operating. [5]

So, even though cross-company collaboration has long been the industry's pattern of day-to-day trading relationships [9], it has been suggested by researchers and practitioners alike that the industry should replace its supply chains with more permanent and close partnership in networks. The more traditional and simple approach to organizing the construction process into supply chains can work for relatively simple and slow projects, but in complex or rapid projects or projects in uncertain environment, the coordination of the needed specialists becomes more challenging. The usual pool of specialist consists of architects, structural engineers, mechanical and electrical engineers, contractors, sub-contractors, material and construction plant suppliers, which can be all employed by different organizations [8], [14]. As a result, project workflow can face major interruptions, increasing possibilities of conflicts, time and cost over-runs and quality problems [9] especially if companies in the supply chains have conflicting interests [15].

The network form of operating, on the other hand, differentiates itself from the more traditional vertical relationships by promoting good communications between contractors, clients and design teams, which is critical for construction of a building that meets the specifications, time and budget when finished [16]. Efficient information flow in construction networks is also important to the building of trust [17], which has been seen as one of the obstacles in the development of further knowledge management and collaboration practices. The usual



marching order in collaborative development applies also in AEC industry: Since there are various obstacles in deep knowledge sharing [14], trust have to be developed first through cognitive and behavioral learning [8]; [18] after which performance improvements can be achieved through more open communication [19], [20].

Several characteristics or dimensions of a business network can be identified from the literature [21], for example:

- “External network” – independent companies are dependent on common, external actor (such as public authority) or participate in common development activities (such as industry wide development project without formal agreements)
- “Local network” – group of companies in a certain geographical area, joint with geographical activities, common interests and common product- or resource pool
- “Vertical network” – group of companies specialized in certain part of the supply-chain, and organized with buyer-supplier contracts
- “Horizontal network” – companies operating in the same industry are trying to find synergies between themselves
- “Lateral network” – cooperation between companies aimed to produce new product combinations or benefits in lateral production
- “Focal network” – group of companies organized around a focal company
- “Technological network” – group of companies using or sharing common technological solution
- “Opportunity network” – group of companies trying to solve customer’s problems and create market potential by replicating the solution with other customers”

These eight dimensions or styles of business networks are supplemented in the following discussion by the “Service integrator network”, described in previous chapters and in Marja Toivonen’s dissertation [22]. Toivonen describes these “meta-KIBS” (Knowledge Intensive Business Services) as being companies that give guidance to clients in the use of other KIBS or provide planning services for outsourcing.

Comparing these different styles of networking with each other, with the help of the viewpoints presented in the literature, we can narrow the set of dimension to a more feasible group – feasible in respect to our initial research problem. According to the literature, the typical model of networking in AEC industry is based on vendor and supplier relations and contracts [23]. In this type of relationships the contractor delegates as much responsibility as possible to the subcontractors in a game of transferring the risk further up or down the supply chain [15]. As was discussed before, in the highly competitive environment, these construction parties only pay attention to conforming to contractual requirements and do not collaborate or share knowledge beyond that [24]. Clearly this mode of networking is the result of “Focal network”, where power distribution is typically unequal. Thus this

characteristic of a network can be ruled out when thriving for more efficient way of networking.

“Vertical network” may or may not suffer from similar inefficiencies as “Focal network” – it all depends on the power distribution of the companies. However, “Vertical network” in AEC industry context represents a traditional way to organize construction projects, which are characterized by long supply chains that extend across different product/service types and commercial interests. This is the main reason for many contemporary problems including poor delivery to time, cost and quality that are the end result of the fragmentation of designs and construction responsibility. For inter-organizational sharing of resources and competencies to occur, communication and coordination must be improved [25]. Thus, “Vertical network” can be ruled out from our set of feasible characteristic.

The environment of the building industry has changed rapidly as was discussed in the previous chapter. This changing environment has already changed the strategies, hierarchies and roles of firms involved in different stages in the building process. In the past, companies in the AEC industry could only compete on price, because so many things in their processes were prescribed by governmental regulations. However, new regulations and technologies, combined with an increasing variety of building materials and competencies, provide opportunities to achieve a superior position in building processes. Designers, contractors and suppliers may pursue not only cost leadership but also product differentiation strategies in order to strengthen their positions in the building process [26]. This viewpoint is interesting from the connectionist point of view also – “Lateral network” and “Service integrator” are the two dimensions or characteristics of a network that describe this change in roles and strategies.

Some researchers have studied informal alliances, found in the AEC industry, that have a virtual and dynamic structure. These informal structures facilitate information sharing as all parties are coordinated horizontally and personally [24]. These networks are more social and entrepreneurial than contractual and legal. The glue that holds this “quasi-fixed” network together is the promise of collective rewards [23]. “Horizontal network” and “Opportunity network” describe best this kind of networking in the vocabulary of this study. These informal networks in general have preferable qualities in respect to the research problem of this study [27]. However, when promoting industry wide solutions for efficient lifecycle management, these networks are too opportunistic and dependent on one “killer application” to work well in this complex environment [28]. A “killer application” developed by these kinds of informal networks would be probably welcomed by the companies in the industry, but companies operating in this industry won’t hold their breath while waiting for it.

As a summary of the literature reviewed, it can be said that even though new systems and technologies for

knowledge management and sharing, such as BIM, have been slow to spread into wider use, they have been seen as holding future potential. The industry has already seen a birth of an entirely new business potential in “Service integrator” activities and it also expects knowledge-based services to strengthen their position both abroad and in domestic markets. The biggest stumbling stone towards maximum utilization of lifecycle knowledge in the AEC industry might not be technology, but rather the willingness of the AEC professionals to revise existing knowledge management and networking procedures.

## 5 INITIAL VIEWPOINTS FROM THE PRACTITIONERS

The first round of interviews was conducted between August 2005 and January 2006. The interviewed professionals (11) were selected based on the suggestion of their networking partners or based on active contribution to industry related publications or seminars. Each interview was recorded, transcribed and later analyzed to construct a comprehensive picture of the knowledge transfer practices and possible business opportunities related to them.

In this initial round of interviews, representatives of selected companies were asked during semi-structured interviews about three broad topics:

- Challenges and changes the industry is facing in the foreseeable future and the drivers behind these changes.
- Challenges and possibilities of value networks in the Finnish AEC industry.
- Knowledge creation and transfer practices during and between different stages in the building’s lifecycle.

Concerning the issue of industry wide changes and drivers behind these changes, these interviews didn’t bring up any new insights in respect to industry’s own analysis described in “The characteristics of the Finnish AEC industry”-paragraph of this paper. The only difference was that the professionals interviewed in this study emphasized the possible loss of expertise as more people are retiring every year. This is, of course, an important aspect especially from the networking point of view since this tacit expertise in interorganizational networks is hard to replace.

Generally speaking, value networks were seen as important and increasingly so in the future. Many interviewees stressed the importance of clear roles for the success of collaboration. The transparency of roles, responsibilities and interdependencies between companies, was seen important from the point of view of collaboration, but especially from customer’s point of view. In this respect, it was a little surprising that when the company representatives were asked to describe value networks they were participating (according to pre drawn schematics that were presented to the interviewees), even the company representatives collaborating in the same established value networks, described these networks differently – from their own company’s point of view and usually in contradicting ways. This implies that the management and working practices of these networks are still quite vague, although

companies in AEC industry have traditionally relied quite much on outside resources. The most common styles of networking in this sample were “Lateral network” and “Service integrator network”, described earlier in this paper.

Considering knowledge creation and transfer practices, the lack of agreements and established knowledge transfer practices hindered knowledge sharing between companies. These problems with knowledge transfer practices were amplified even more when knowledge and information was transferred between parties operating in different parts of the lifecycle of building. Current information technology solutions build around BIM / IFC (Industry Foundation Classes standard) weren’t seen as a feasible solution for the knowledge transfer problems at hand, but they remain a promise for the future. Also in the future, new business opportunities were seen in the management and development of lifecycle related knowledge – especially when this knowledge isn’t the core business of the property owner (for example, companies owning their facilities, but operating in other industry than AEC). One of the big challenges for the use of lifecycle knowledge is to combine the so called “passive” and “active” knowledge. Much of the information about standard components provided by manufacturers for various AEC disciplines is now available in electronic format. These parts libraries represent “passive” information in contrast with the “active” information created and communicated throughout an AEC project [12], [29].

Combining these viewpoints with the findings from literature we can construct a comprehensive picture of the networking practices and possible business opportunities related to them during the lifecycle of buildings (Figure 1). This model strives to take into account several issues discussed above:

Starting from the bottom of the picture, this model suggests that the most efficient way of networking during the lifecycle of the building is probably mixture of different network configurations. There should be an external organization providing product specific passive information to different actors (RaSi / RT in Figure 1). RaSi (Finnish Hardware Association) and RT (The Confederation of Finnish Construction Industries) were selected on the basis of ongoing development activities in this area, but commercial solutions may emerge also, if they add sufficient value to these already initiated non-profit services.

Depending on the capabilities of the customer, two different market sectors should be differentiated. Customers, who possibly lack the expertise for procuring services, will probably utilize the services of a specialized integrator, such as facility or property managers providing service packages to their customers (“Outsourcing” in Figure 1). Examples of such customers are housing sector, buildings owned by foreign investors in the office building sector and some of the municipalities in the public sector. Customers, who have in-house capabilities for service procurement or service production, will probably combine

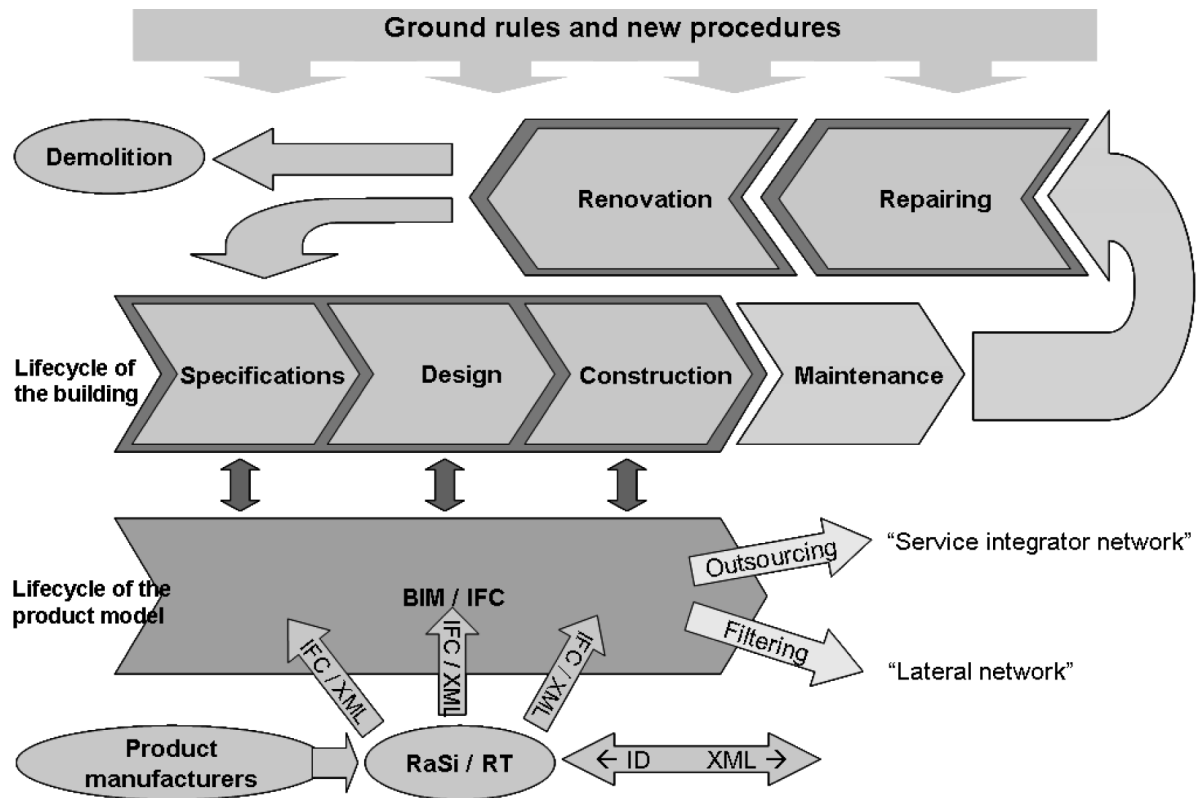


Figure 1 Proposed ideal model for networking and knowledge transfer in the Finnish AEC industry

the services of specialized service providers to match their needs. Their interaction with service providers is characterized by more formal knowledge transfer from the building information models they own to the service providers (“Filtering” in Figure 1).

“Local networks” characterized by joint geographical activities, common interests and common product- or resource pool will continue to exist – however, as a industry wide networking model they are less efficient than configurations described above.

Building information model and IFC standard will be at the heart of the lifecycle related knowledge management in the future – especially during the construction process (specifications – design – construction). Since specialized ICT solutions are still used during the lifecycle of the building (especially during maintenance), it is not economically feasible to throw existing solutions to the waste bin. These solutions may not support IFC standard, so there will be a gap in the lifecycle of the product model after the building is constructed. However, new networking practices can help overcome this knowledge management problem (see [30] for full description). According to the interviewees new business possibilities are enhanced, if neutral information representations (IFC / XML or similar) are used in knowledge transfer – when property owners aren’t restricted any more to legacy solutions and/or single service provider and in the future, the industry will probably see more and more outsourcing of the maintenance of BIM to specialized service provider (KIBS).

## 6 EVALUATION

The second round of interviews was conducted between May 2006 and June 2006. The interviewed professionals (7) were once again selected based on the suggestion of their colleagues in other companies or based on active contribution to industry related publications or seminars.

In this evaluation round of interviews, representatives of selected companies were presented the main results of the first round of interviews and the idealistic and incomplete model, presented above, as a food for thought and discussion. The semi-structured interview had two main topics, namely challenges and possibilities of presented networking model in the Finnish AEC industry and knowledge creation and transfer practices in the presented way networking. Questions ranged from the valuation of lifecycle knowledge to the possible leadership challenges in interorganizational network, but mainly the interviews were steered to get critique and improvement suggestions to the presented model.

The main critique in these interviews concerned the lack of immediate feedback channels between maintenance and different stages and parties in construction process. According to the interviewees, this way of getting valuable user feedback through partnering service companies (or in-house service departments) is becoming more common in the industry and should be included in any attempts to improve networking practices. Also, company representatives shunned the clear cut division of market segments presented in the model – there seems to be as

many reasons for outsourcing or not outsourcing as there are property owners. While our academic guess was of the target with the nature of these markets segments, the two presented networking types were seen as feasible ways of promoting lifecycle knowledge in the future.

Surprisingly, the companies interviewed in the second round were generally more optimistic about the industry wide adoption of BIM. Some of the property owners interviewed were still a little skeptic, but others presented viewpoints that the knowledge gap presented in the picture is slowly dissolving as collaborating parties get more benefits from using common technological solutions.

RaSi / RT combination as an external actor received a great interest in solving the integration of passive information to active product specific information. In addition to already suggested cost savings in the industry level, this way of collecting passive product information into single repository was seen important in preserving valuable information about different building products for the whole lifecycle of buildings.

## 7 CONCLUSION AND DISCUSSION

As a concluding remark for the future of networking in AEC industry, it may be necessary to refer to Gulati [31], who claims that firms enter new alliances more readily if more network resources become available to them rather than less. The only feasible way to courage the forming of AEC networks may be by ensuring that AEC companies are acquainted with the network approach and given opportunities to engage in long-term strategic alliances – you cannot just tell the AEC companies to start networking and building trust in collaboration, since networking is established between people and only over longer periods of time. Having said that, this study shows that the magnitude and importance of networking will increase throughout the industry and especially “Service integrator” companies to become more and more common in the customer interface. In addition, while there is always a chance that truly new and radical innovation (product or service innovation) changes the business landscape, we anticipate that an external player, who stores and disseminates product specific lifecycle information, is needed while waiting for the necessary IFC –standards to come true.

This study was concentrated on the knowledge / resource networks in the AEC industry in the search for efficiency. Other forms network studies, such as social network studies, have been applied successfully in Finnish context [32] - for example communication or trust networks studies describe current state of the networks well, but they don't have as good explanatory / behavior changing power as the chosen approach [33]. Due to the restriction of this paper, the discussion of these social networks is left out of this essay. Furthermore, as described earlier, the discussion is mainly limited to the connectionist viewpoint of

knowledge / resource networks. This choice has been made to clarify the theoretical standpoint of this paper, but also since there is some evidence that the characteristics of the network ties have a bigger, direct, influence on performance than the pure network structure [34] – however, it has to be remembered that structure has also influence on performance [35], [36].

This study has several limitations – 18 interviewees with such a broad set of topics is a very limited number although a fair coverage of different players in the lifecycle of buildings was included in the interviews. In addition, this study focuses closely on the situation in Finland and networks in AEC industry and can't be generalized to other markets or industries too well.

## ACKNOWLEDGEMENT

This paper reports some of the findings of a research project DESNET, which is funded by the Academy of Finland (decision number 212038).

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# Trust, identity, and effectiveness in virtual organizations

Marko Hakonen<sup>1</sup>; Jukka Lipponen<sup>2</sup>; Matti Vartiainen<sup>1</sup>; Niina Kokko<sup>1</sup>

<sup>1</sup> Helsinki University of Technology, Finland, *firstname.lastname@tkk.fi*

<sup>2</sup> University of Helsinki, Finland, *firstname.lastname@helsinki.fi*

**Keywords**—virtual organizations, trust, identity, perceived effectiveness.

## 1 INTRODUCTION

Different forms of virtual organizations (VOs) have been a topic of researchers' and practitioners' growing interest for over a decade [1], [2], [3]. The possibilities provided by information and communication technology have paved the way for working from distance. Experts can work flexibly on their sites around the globe, near the customers, and traveling costs can be reduced.

Since control is impeded from distance numerous authors have suggested that trust is a key success factor and the “glue” that binds VOs together [4], [5], [6]. Correspondingly, many authors have stressed that formation of group identity is crucial for virtual organizations because it provides a sense of belongingness despite the relative lack of face-to-face interaction [7], [8], [9]. The claim that trust and shared group identity are the keys to success of virtual organizations implies that these concepts are positively related to group effectiveness. In this paper, we test this proposition using a survey data from 13 virtual teams and projects, that is, virtual groups. We use the social identity approach [10] to explain the dynamics of trust, identity, and effectiveness in virtual settings.

### 1.1 Virtuality

In the VO literature, one of the elementary debates concerns the definition of virtuality. The recent reviews of the VO literature concur in the notion that virtuality is a matter of degree [2], [3]. Indeed, there are more and less virtual groups, and we also share the view that virtuality should be seen as a continuum rather than as an absolute state. In addition, different authors name different aspects of VOs as definitional. Our definition highlights two points. Firstly, for a group or an organization to be virtual we follow most authors in stating that at least one of its members must work in a different location from others [2], [11], [12]. In our study, this means minimally working in different towns. Secondly, we take the stance (see [3], [9], [13], for similar views) that the amount of face-to-face meetings is the second definitional feature of virtuality. Many authors include also other features like crossing temporal, cultural, and organizational boundaries into their definitions of a VO [1], [12]. However, we consider these

as non-definitional, but potential attributes causing contextual complexity to VOs [14]. Similarly, the use of technology is usual and important feature of VOs but as some authors have found out collocated groups may use as much technology in their communication as VOs do [15]. Thus, we treat the use of technology as contextual complexity attribute but not as a definitional feature of VOs.

### 1.2 Trust

Trust has been studied from different viewpoints. These include social psychology, philosophy, economics, and management research [16]. Hence, no consensus exists on the definition of trust. Trust is usually associated with risk taking, positive expectations and vulnerability [17]. We study trust within group (interpersonal trust) from the social psychological perspective and consider it as a psychological state, which is a part of group processes. We follow Boon and Holmes [18] and define trust as “*a state involving confident positive expectations about another's motives with respect to oneself in situations entailing risk*”. Some contemporary trust researchers have claimed that this definition is not so much about trust but about trustworthiness and that trust has a behavioral dimension [19], [20]. This view can lead into problems since the inclusion of different behaviors into the concept of trust complicates its content and it may be difficult to differentiate trust from its consequences.

Trust in organizations has been a topic of growing interest for researchers [21], [22]. Trust has also been one of the key interests areas of VO researchers [4], [6], [23]. However, there is still lack of studies in real organizational settings [2], [3].

Most authors seem to agree that trust is generally beneficial for organizations [24]. Studies have demonstrated that trust has multiple positive outcomes in organizations varying from increased commitment to organizational citizenship behaviors [25]. According to Bijlsma and Koopman [26], it is also commonly agreed that trust is positively related to cooperation. It has been noted that trust becomes more important and even partially replaces traditional mechanisms of control in new, virtual work settings [27], [28]. Monitoring is strongly impeded from distance but cooperation is still indispensable in virtual collaboration.

Many traditional conceptions of trust formation view it as a time consuming process in which parties gradually gather information from each other [17], [29]. This is seldom possible in Vos, but trust is still needed in order to get the work done. The development of trust in virtual settings has been explained using the model of swift trust [6], [30]. Meyerson et al. [30] suggest that swift trust develops depersonally. If the common task requires trust but the parties cannot become acquainted with each other, trust is built on role-based interaction and prototypical categorizations. Other members of a dispersed workgroup are not considered primarily as personalities but as specialists acting as representatives of a prototypical role. Role-based trust is swift because it is grounded on implicit assumptions, predispositions, and prototypes, which already exist before the actual relationship. People act as if trust would be there from the outset.

### 1.3 Trust and effectiveness

Researchers often assess effectiveness by measuring dimensions of performance or attitudes towards a group or an organization [31]. Here we assess effectiveness as perceived task performance and coordination.

In collocated settings, trust-effectiveness relationship has been frequently studied. In their meta-analysis, Dirks and Ferrin [25] report 21 studies, in which the weighted mean correlation between trust in leadership and job performance was .16. As our focus is slightly different (trust within virtual group), these meta-analytical findings are not directly applicable to our study but are still indicative of a general trend.

The findings regarding the relationship between trust within group and group effectiveness are somewhat contradictory. Dirks [32] found the relationship to be non-significant. On the other hand, Costa [19] found a significant positive relationship between team trust and perceived task performance. The differences may be due to different conceptualizations of trust. Costa [19] defines trust as a multi-component variable consisting of propensity to trust, perceived trustworthiness, cooperative behaviors, and monitoring behaviors. Dirks [32], like us, uses a conceptualization of trust as an unidimensional psychological state. The rationale for the expected trust-effectiveness main effect behind the unidimensional approach is that high trust increases probability of risk taking (e.g. cooperation without certainty of reciprocity), which in turn leads to high effectiveness [19].

Direct empirical tests on how trust affects effectiveness in virtual settings are quite rare. Ishaya and Macaulay [5] found in their qualitative study of virtual student teams that high trust groups outperformed low trust groups. In their quantitative study Aubert and Kelsey [4], however, found no support for their hypothesis that trust within virtual team would be positively associated to effective performance. Despite these inconclusive findings, we hypothesize as follows:

*Hypothesis H1: Trust within a virtual group has a positive main effect on group effectiveness.*

### 1.4 Social identity

The social identity approach provides a theoretical framework for the relationship between an individual and a group. Specifically, it consists of two distinct theories: the original social identity theory [10] and the more recent self-categorization theory [33]. Despite certain differences, both theories share the same fundamental assumption that individuals define themselves in terms of their social group memberships and that group-defined self-perception produces distinctive effects on social behavior and inter-group relations [34], [35]. This means that the more an individual conceives of him or herself in terms of membership in a group or, in other words, identifies with the group, the more his or her attitudes and behavior are governed by this group membership [34], [36].

During the past ten years, social identity principles have been increasingly applied to the study of organizational psychological processes [37], [38]. In this context, organizational or team membership is understood to reflect on the self-concept in the same way as other social memberships do [38], [39]. Thus, organizational identification is often defined as “*the perception of oneness with or belonging to a group*” [39]. Moreover, this group-based self-conception is proposed to lead to activities that are congruent with this identity.

According self-categorization theory [33] different levels of self-definition (e.g., self as an individual or self as a group member) should be related to distinct set of needs or motivators. When people categorize themselves at personal level they should be motivated to do those things, which promote their personal identity as individuals (e.g., personal advancement and growth to other group members). When social identity is salient, it should be associated with motivation to do things, which promotes their social identity as group members, for example, through cooperation and enhancement of group goals. Accordingly, empirical studies have shown that group identification is linked to various important outcomes such as high levels of extra-role behaviors [40], [41], support for the organization [42], and performance [43]. Based on above reasoning, we hypothesize:

*Hypothesis H2: Identification with a virtual group has a positive main effect on group effectiveness.*

### 1.5 Moderating effects

Dirks and Ferrin [24] have proposed that in addition to main effects on performance trust may also moderate the relationship between certain motivational constructs and performance. This proposition is based on an idea that trust may have an indirect effect by providing an assessment of the potential behaviour of one's work partners. In line with this idea, Dirks [32] found that motivation had significant positive effects on group performance in the high-trust condition but no effect on performance in the low-trust condition. Similar proposition can be made concerning the link between identification and effectiveness. Identification

with the group is a strong motivational force which may provide the drive for group-serving behaviours (e.g., cooperation between group members and enhancement of group goals), while trust helps to facilitate such behaviours because under high trust a person believes that the others are also willing to cooperate and promote the group goals. In addition, Dirks and Ferrin [24] suggest that the moderation model of trust could be especially applicable to virtual settings. In virtual groups, there are few cues about others' motivations and behaviours and trust may "provide a lens through which action is interpreted and responded to". Therefore, our hypothesis is:

*Hypothesis H3: In virtual groups, the relationship between group identification and group effectiveness is moderated by trust within the group: the more people trust each other the stronger the relationship between identification and effectiveness.*

## 2 METHODS

### 2.1 Data

The data were gathered from eight companies, which participated in a research project carried out by Helsinki University of Technology. The companies came from different branches ranging from consultancy to paper mills construction. The web-based questionnaires were sent to the members of the 13 virtual groups in the participating companies. All the groups consisted of specialists conducting non-routine tasks. The respondent groups were selected in collaboration with the contact person in each company and with the agreement of the group leaders. The minimal condition for selection was that the members or subsets of the groups worked in a dispersed manner, that is, they were located in different towns and communicated mainly via ICT during the survey. The nature of the project and the selection procedure determined that the data were more like a specimen than a random sample. Altogether 343 respondents received individual e-mails with an introduction to the study and a web address, through which they could confidentially fill in the questionnaire. In the e-mail and in the questionnaire the respondents were prompted to answer all the questions relating to their named group. It was stressed that even though in the items the term 'team' was consistently used, the respondents should think about their group named in the e-mail and in the start page while answering. 211 acceptable questionnaires were returned, a response rate of was 62%. Participants were predominantly male (74.0%), with an average age of 42.3 years ( $SD = 10.5$ ). Their mean

company tenure was 12.0 years ( $SD = 11.2$ ), and the group tenure was 11.4 months ( $SD = 9.3$ ). Only 6.2% of the respondents had never had face-to-face meetings with their dispersed co-workers. The respondents represented 17 nationalities (36 non-Finns) and came altogether from 33 towns in three continents.

### 2.2 Measures

Trust was assessed using a five-item version of the measure used by Costa [44]. The original items were taken from the short version of the Organizational Trust Inventory [45]. Due to space limitations, Costa's [44] analyses guided the selection of items. The items asked for opinions about the trusting the other group members. Items were scored on a 5-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (5). Cronbach's alpha for the scale was .82.

Group identification was measured with a modified version of organizational identification scale developed by Mael and Ashforth [42]. One original item regarding public opinions was not used since groups seldom reach such publicity as whole organizations. In addition, the questions were modified to assess the identification with the group. The response scale ranged from (1) 'strongly disagree' to (5) 'strongly agree'. The five-item scale achieved an internal consistency of .74.

Perceived group effectiveness was assessed with three-item self-report measure adapted from Connolly, Jessup, and Valacich [46]. The response scale was similar to the group identification measure. Cronbach's alpha for the scale was .73.

Age (in years) and gender (1 = female, 2 = male) were used as socio-demographical control variables. Moreover, goal clarity was used as a control variable because it might affect effectiveness. The reasoning was that the more salient the goals are, the easier they are to reach effectively. Goal clarity was assessed with single item: "My present goals in my team are completely clear to me". The responses were scaled from (1) 'strongly disagree' to (5) 'strongly agree'.

## 3 RESULTS

The scrutiny of zero-order correlations revealed quite expected pattern of results (Table 1). As expected, trust correlated positively with perceived effectiveness ( $r = .19$ ,  $p < .01$ ). Correspondingly, group identification was positively related to effectiveness as we anticipated ( $r = .41$ ,  $p < .001$ ). Of the control variables, only goal clarity had a significant, positive correlation with effectiveness ( $r = .31$ ,  $p < .001$ ).



TABLE 1  
DESCRIPTIVE STATISTICS AND PEARSON CORRELATIONS AMONG THE VARIABLES

Variables	M	SD	1	2	3	4	5
1. Age	42.31	10.54					
2. Gender <sup>a</sup>	1.74	0.44	.13				
3. Goal clarity	4.03	0.87	.14*	.15*			
4. Trust	3.85	0.81	.01	-.03	.07		
5. Identification	3.66	0.69	-.01	-.04	.25***	.18**	
6. Effectiveness	3.26	0.75	-.01	.03	.31***	.19**	.41***

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ;  $N = 211$ .

<sup>a</sup> Coding: 1 = female; 2 = male

TABLE 2  
HIERARCHICAL REGRESSION PREDICTING PERCEIVED EFFECTIVENESS

	Perceived effectiveness			
	Step 1 <sup>a</sup>	Step 2 <sup>a</sup>	Step 3 <sup>a</sup>	Step 4 <sup>a</sup>
Independent Variables				
Age	-.05	-.05	-.04	-.04
Gender	-.02	-.01	.01	.01
Goal clarity	.32***	.30***	.22**	.22**
Trust		.17*	.11	.11
Identification			.34***	.34***
Trust X Identification				-.02
Totals				
R <sup>2</sup> <sub>change</sub>	.10	.03	.10	.00
F <sub>change</sub>	7.37***	6.40*	26.93***	.06
Adjusted R <sup>2</sup>	.08	.11	.21	.20

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ;  $N = 211$ .

<sup>a</sup> Standardized regression coefficients ( $\beta$ s) are reported.

The hypotheses were tested with hierarchical regression analysis (Table 2). In the first step, the control variables were entered in the equation. Only goal clarity had a main effect on effectiveness ( $\beta = .32$ ,  $p < .001$ ), and it accounted alone for the significant equation ( $F = 7.63$ ,  $p < .001$ ,  $R^2 = .10$ ). In the second step, trust was added to the regression. As anticipated in hypothesis H1, trust had a moderately positive main effect on perceived effectiveness ( $\beta = .17$ ,  $p < .05$ ). In addition, the equation accounted significantly for more variance of effectiveness than in the first step ( $F_{\text{change}} = 6.40$ ,  $p < .05$ ,  $R^2_{\text{change}} = .03$ ). However, after group identification was added into the equation in the third step, the main effect of trust disappeared ( $\beta = .11$ , n.s.) and identification turned out to have the strongest main effect on perceived effectiveness ( $\beta = .34$ ,  $p < .001$ ). This pattern, together with the scrutiny of zero order correlations, revealed that group identification mediated the effect of trust on perceived effectiveness. No further tests were needed to meet the mediation criteria suggested by Baron and Kenny [47] since the zero-order correlation between trust (independent variable) identification (mediator) was positive ( $r = \beta = .18$ ,  $p < .05$ ). The third equation added significantly the amount of variance explained ( $F_{\text{change}} = 26.93$ ,  $p < .001$ ,  $R^2_{\text{change}} = .10$ ). The moderation hypothesis (H3) was tested in line with recommendations by Baron and Kenny [47] by adding the interaction term to the equation in last step. Moderation was not found ( $\beta = -.02$ , n.s.) and the equation yielded no additional explanatory power ( $F_{\text{change}} = .06$ , n.s.,  $R^2_{\text{change}} = .00$ ).

#### 4 DISCUSSION

Our finding, according to which trust within group does not have a main effect on perceived group effectiveness (contrary to H1) illustrates that trust dynamics in virtual settings are not as straightforward as many authors imply [1], [12]. The result demonstrating that group identification mediates the trust-effectiveness relationship sheds light on how trust and identification interplay in virtual workgroups. The mediation suggests that trust enables not so much group favorable behaviors and effectiveness *per se*, but that trust lubricates the formation of group identity, which in turn motivates group members to cooperate and share information in an effective way.

Interestingly, the main effect of trust on effectiveness (before identification is entered) is exactly same as the one reported by Costa [19] despite the different conceptualizations of trust. The scale that Costa [19] used for assessment of perceived task performance does not remarkably differ from our self-report measure of effectiveness. Thus, one could speculate that had Costa [19] measured identification the mediation could have been found also in her data.

Contrary to trust we found, as anticipated based on social identity approach that workgroup identification has a strong positive main effect on effectiveness (H2). This is intelligible despite the findings and the above discussion regarding trust. Literature suggests that strong and positive workgroup identity should promote group effectiveness

[43]. Indeed, identification seems to be a powerful motivator for cooperation and strive towards group goals as research in other settings has demonstrated [40]. Hence, our findings support the applicability of social identity approach also to virtual settings.

The fact that the moderation hypothesis (H3) did not get support in our study suggests that trust in virtual settings is not such a powerful “lens” or interpretative tool as Dirks and Ferrin [24] suggest.

Goal clarity was found to have a strong main effect on effectiveness in all steps of the regression model. This is quite intelligible since many authors stress the importance of shared and clear goals in VOs [2], [3], [48]. For example, Aubert and Kelsey [4] found that the low performing virtual group members had different perceived goals. Goal alignment and clarification are especially important in virtual settings where the corrections are harder to make than in collocated work.

The use of self-report measures of effectiveness is a clear limitation of this study. However, self-assessments have been found to correlate strongly with objective measures of effectiveness [49]. It is also quite difficult to establish a comparable and reliable objective measure for group effectiveness because the studied groups vary from task force projects to permanent follow-up teams.

The reader should be cautious in making inference from individual level data into group level phenomena. Our data simply did not allow group level analysis (13 groups) but it may still be that the variance of, for example, effectiveness estimates within a group may be quite high. If so, what is actually the group effectiveness? As a partial precaution, we tested the regression models for different types of groups and the results remained essentially the same.

It is also important to note that we cannot infer the causal direction of the variables in correlational studies like this one, especially when self-reports are used. For example, we hypothesized that identification enhances effectiveness. However, in principle this causal direction can also be reversed. Social identity approach [18] holds that identification with a certain group is closely linked to motivation to achieve a positive self-evaluation. Based on this line of reasoning, it is in principle possible to think that group effectiveness increases identification because effective groups are generally considered as more prestigious and therefore they may boost individual’s self-esteem. However, given the evidence from controlled laboratory experiments [43] that have established the causal link from identification to performance, we consider this idea of reversed causality as possible but quite unlikely.

When companies use continuously more different types of VOs, like virtual teams and projects, as the means of organizing work [50], the empirical research of these new organizational forms becomes increasingly important. This study demonstrates that conventional wisdoms and practice-based canons, like “trust is the key to success”, are often oversimplifications of the reality. The slow but careful

study of the interplay and the relationships between different variables in novel contexts helps both academics and practitioners to understand and finally to manage these rapidly emerging new forums of work.

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# Studying the relationship between indoor air and productivity: theoretical discussion and empirical experiences

Riikka Antikainen<sup>1</sup>, Sanna Lappalainen<sup>2</sup>, Antti Lönnqvist<sup>1</sup>,

*Kati Maksimainen<sup>2</sup>, Kari Reijula<sup>2</sup>, Erkki Uusi-Rauva<sup>1</sup>*

*1 Tampere University of Technology, riikka.antikainen@tut.fi*

*2 Finnish Institute of Occupational Health, sanna.lappalainen@ttl.fi*

**Keywords**—productivity, indoor air, assessment of productivity changes

## 1 INTRODUCTION

Indoor air is an essential part of working place environment. Workplaces are becoming more and more an office-like environment even though the work operation may differ a lot from office work. Problems associated to indoor air can cause health hazards to people working in those premises, but they may affect also the functioning of the whole organisation. Indoor air is formed by a mix of chemical and biological compounds as well as many physical factors. Sometimes these factors may lead to indoor air problems for example due to dampness in a building or poor ventilation.

The connection between serious indoor air problems and productivity are undeniable. Indoor air problems can cause significant costs to companies and through that to the whole society. A simple example is a situation, where an employee has to stay on sick leave due to health problems caused by indoor air. This causes a loss of working hours, higher medical costs, increases in other employees' work load as well as higher costs instead of determining rapidly the origin of problems and fixing it. However, also smaller improvements in indoor air can increase productivity, e.g. controlling of indoor air temperature: too high indoor air temperature has been asserted to decrease the productivity of workers in many line of business [1]–[4]. The benefits of indoor air improvements are always monetary but relate to changes in quality, health and satisfaction [5].

In general, it is approved that improving indoor air has a positive effect on the comfort of personnel [2], [6]. However, this seldom is a sufficient argument for investments in improving buildings. The managers often require positive cash flows to cover the investment costs and therefore concrete proofs about productivity increases might support these investments. This is also one reason why building managers and developers of indoor environment have shown interest in the productivity assessments [7]–[8].

However, in practise the connection between indoor air and productivity is complicated. Several studies examining

different elements of indoor air and their effects on productivity have been taken. Even when the mechanism behind productivity has been known, the empirical assessment of productivity effects has been difficult. There has also been a lack of uniform methods for connecting productivity and indoor air quality, and future studies are required to confirm the positive effects of investments in indoor air on productivity [5, pp. 108–109, 125].

The aim of this paper is to focus on these difficulties and to summarise what has to be taken into account when productivity effects are studied. We also provide an overview on the mechanism through which the elements of indoor air affect productivity.

Since productivity gains of indoor air investments are of interest for many researchers, the results of this study should provide utilisable information for them. Hopefully the results will prevent researchers from making the same mistakes again in designing research settings.

Even though the challenges are acknowledged, several studies have been taken in order to find out how indoor air affects productivity. There seems to be a consensus among the researchers on their reliability and it is common not to question the usability of these results in further analysis. Therefore, at least an awareness of issues that complicate productivity measurement should be established so that the biggest pitfalls can be avoided.

## 2 RESEARCH APPROACH

This research can be characterised as conceptual. Some conclusions of previous scientific papers have been included in this paper. However, it is based not only on previous literature but also on several empirical research projects. The relationship between working environment, such as increased temperature or noise control, and productivity has been studied in these intervention projects. The interventions have been assessed both in laboratory settings and in real working situations.

The authors have conducted several projects where connection between indoor air and productivity has been studied. Some of them have concentrated directly on studying effects of indoor air improvements on productivity



in actual buildings with indoor problems. In other projects these issues have been studied as a part of a larger project.

In addition to these projects also experiences from scientific research papers about the issue have been analysed in order to determine what have been the main problems.

### 3 KEY CONCEPTS AND THEIR EXPECTED RELATIONSHIPS

#### 3.1 *Indoor air problems and health effects*

The indoor air consists of variable elements:

- physical - such as temperature, relative humidity of air, air movement, noise, light;
- chemical - such as carbon dioxide and monoxide, volatile organic compounds, ammonia, formaldehyde, radon, ozone;
- biological and particulate factors - such as allergens, fungi, bacteria, pollens, endotoxins.

The status of these factors determines the indoor air and distortions in them can cause indoor air problems.

Working in buildings with indoor air problems often cause respiratory symptoms (stuffy and irritated nose, rhinitis, cough, sore throat, and shortness of breath), skin symptoms as well as general symptoms (fatigue, headache, fever), all of which are typical to the sick building syndrome (SBS) [9]-[11]. According to the current understanding, SBS is a multifactorial problem that can be caused, e.g., by dirt in the air-conditioning channels or emissions from construction or surface materials. The psychosocial atmosphere of the work community also partially affects the prevalence of SBS and the solving of the related problems [12].

For the time being, there is very little information on the causal relations of indoor air problems and the mechanisms behind them. Occasionally, it is easy to find the cause of an indoor air problem in a targeted building when, e.g., the air conditioning is not working properly or if there are obvious moisture damages or mould growth in the structures of the building. However, quite often the situation is far more complex. Previous experience has shown that even extensive technical and microbiological studies, or clinical examination of the employees, have difficulties in confirming the exact problem area in the building. Systematic investigations of the work environment, combined with information gathered from the employees with interviews or questionnaire surveys, form a basis for further investigation and restorative measures.

According to a recent questionnaire survey [13], the most common environmental problems in Finnish offices were dry air (35% of the respondents), stuffy air (34%), dust or dirt (25%) and draught (22%). The most common environmental problems were varying room temperature (53%), too low temperature (51%), too high temperature (48%), unpleasant odours (46%) and draught (44%).

The most common indoor air-related symptoms were irritated, stuffy or runny nose (20%) and itching, burning or irritation of the eyes (17%). When looking at the reported symptoms, which included both work-related and other

symptoms, the most common symptoms were nasal symptoms (29%), fatigue (28%), dryness of the hands (26%), symptoms of the eyes (22%), as well as hoarse or dry throat (20%). [13]

Proactive action is the best way to prevent indoor air problems. However, some indoor air problems usually occur in an almost every workplace. In addition, several psychological factors can add up to the experienced indoor air problems [14]. It is important to solve the problems reliably and without delays in order to hinder adverse effects (welfare in work and productivity). Therefore, the resolution of the process must be carefully planned so that the management will be successful - especially when the case is extended and complex. The operation is recommended to be based on the Indoor Air Group that consists of occupational safety and health care personnel, building maintenance and management personnel, work managers and those who occupy the premises (workers). The group is responsible for the whole indoor air process from beginning to end. The tasks of the group consist of carefully planning a time-table, specifying the problems, setting the aims, risk evaluation and management, follow-up studies and communication strategy. [15]

#### 3.2 *Productivity and business performance*

Productivity is an important success factor for all the organisations. Improvements in productivity have a major impact on many economic and social phenomena, e.g. economic growth and higher standard of living. (See e.g. [16]-[17].) At organisational level productivity is one of the factors that define its ability to thrive in competition.

A simple way of defining productivity is to describe it as a ratio between the output (e.g. products, services and activities) and the input (e.g. material, labour, capital and energy) that is used to generate the output:

$$\text{Productivity} = \text{output} / \text{input} \quad (1)$$

Sometimes the productivity concept is understood narrowly so that it only deals with the amounts of input and output. This interpretation is similar to efficiency. However, in this research productivity is considered to consist of both the quality and quantity aspects. This means that productivity can be improved by making more output in relation to the amount of input used and by making output with better quality (e.g. less defective products).

Productivity is closely related to profitability. Profitability of a company is affected by its productivity and also by the changes in input costs and output prices. While productivity deals with the amount and quality of input and output profitability is examined in monetary terms.

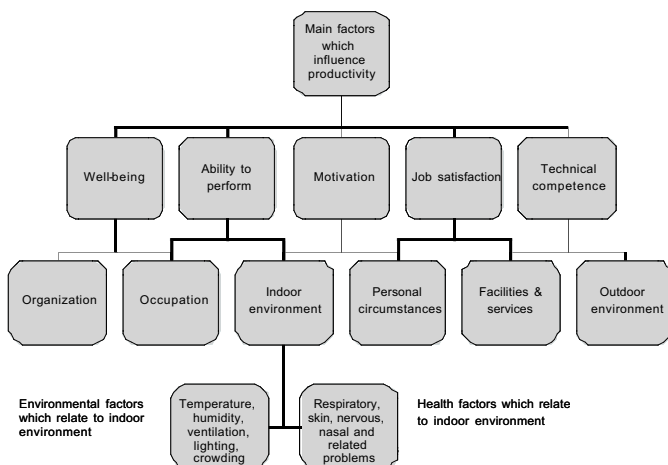
Another key concept related to productivity is business performance. Business performance refers to a multi-perspective interpretation of the success of an organisation [18]-[19]. Profitability and productivity are important

components of business performance but there are also others. Other key components of business performance include, e.g., customer satisfaction and loyalty, employee welfare, competencies, product quality, lead time, delivery efficiency, brands, corporate culture, market share etc.

Performance and productivity can be examined at different organisational levels. For example, we can discuss the profitability or the image of a company and we can examine the efficiency or the motivation of an individual employee. It is the sum of all individuals' actions that can ultimately also be seen in terms of the company's financial results. Thus, many of the business related factors are somehow connected to each other (e.g. there is a link between product quality, customer satisfaction, market share and profits). Some factors can be regarded as drivers of productivity. It may be possible to observe changes sooner in these drivers than in, e.g., financial results. [18], for example, state that financial measures provide information about past actions while customer and process related measures describe the status of the ongoing situation.

### 3.3 Relationship between indoor air and productivity

Indoor air can affect productivity through many different routes. In order to determine the impact of indoor air on productivity it is necessary to find out what is the mechanism behind the relationship. In Figure 1 can be seen the analytic hierarchy process originated by Saaty (1972, 1988) [20, pp. 132-134], which provides a suggestion for the mechanism.



**Figure 1 Analytic hierarchy process of relationship between indoor air and productivity [20]**

The mechanism can be described as follows. In the working place there are several indoor elements (physical, chemical and biological). They may sometimes cause health effects to workers (respiratory, skin, nervous, nasal and related problems) and they can also hinder the fluency of work. At extreme cases, usually when serious indoor air problems have occurred for a long time, they can also decrease employees' motivation.

These effects on employees may in turn cause changes in

business outcomes. These changes may realise in various ways, e.g. in input usage, output quantities, work quality, expenses, which are well known factors of productivity.

If productivity is impeded, the organisation can search for factors to be developed from both the working place factors and the employee factors. Sometimes improvements in indoor air elements can release a notable amount of employee potential, especially if the problems have been severe. On the other hand, even small improvements can help improving productivity in such proportions that it is economically arguable.

## 4 DIFFERENT APPROACHES TO MEASUREMENT

### 4.1 Indoor air problems and workers' health

Indoor air factors can be detected by direct or indirect measurements. Many physical factors (e.g. temperature, air movements, light, noise) and some chemical factors (e.g. carbon dioxide) are usually measured directly. Some factors (e.g. particle matter) can be detected both ways. Instead, most of biological factors (e.g. fungi and bacteria, mycotoxins) are analysed from indoor air by indirect measurements. The indoor air measurements are only one part of the process of assessing workers' exposure to indoor air impurities and possible health effects. In many cases there is a lack of information on dose-response connection to indoor air impurities and health effects. The assessment of workers' exposure might sometimes be based on the source description, e.g. the size of damage area, the leakage of surface material and pressure conditions in the case of mould damages in building.

The recovery of the substance studied depends on the method used. Furthermore, the concentration range of impurities in indoor air might be very wide due to many factors: source factors (e.g. humidity, material – emissions), work operation, building and maintenance factors and weather conditions. Still, only a limited number of the samples can be collected due to costs of collection and limited amount of resources available. Therefore, the sampling strategy must be carefully planned and the aims of the measurements clearly determined. Systemic (e.g. the quality of media used for the growth of micro-organisms) and random (e.g. error range in air flow rate of the samplers and pumps) errors must be managed during the process. [21]-[24]

In addition to certain uncertainties, there does not exist enough methods to measure or analyse all possible harmful substances in indoor air. In fact, all of those substances are not even yet recognised or very little is known about the consequences of interaction between several indoor air agents. It has also been suggested that psychosocial aspects should be more strongly considered in the assessment of indoor air quality. [25] presented a new approach to evaluating the environment of buildings with OCA scale (olfactory comfort awareness), in which indoor air quality is evaluated with a numerical scale and the scale takes into account also the occupant's mood.

The health effects of the workers must be emphasised in risk assessment of indoor air problems even if "the cause-effect" connection must be examined and described as carefully as possible. The health effects of perceived work environment can be studied by MM40 indoor air questionnaire in big organisations or by interviewing workers in small organisations. Both the quantity and the quality of the symptoms are needed when assessing workers' health. The results of questionnaire can also be used to localise the problem area as well as to indicate the extent of the problem. Medical surveys are usually needed in cases of severe indoor air problems. Absence due to the indoor air related sickness can also be used to assess the extent and the severity of the problem.

#### 4.2 Productivity

Total productivity is the catch-all productivity concept. It consists of the relationship between total outputs and total inputs:

$$\text{Total productivity} = \text{total outputs} / \text{total inputs} \quad (2)$$

The formula may seem simple, but it is extremely difficult to measure total productivity because the inputs and outputs are often commensurable, i.e. they cannot be summed up. Since productivity is related to the real process instead of monetary process, the units of inputs used and outputs generated cannot necessarily be totalled and compared similarly to monetary values.

Other considerable difficulties in measurement of total productivity are caused by the time delay between the use of inputs and the completion of outputs. If the output is realised a long time after the use of inputs, it can be impossible to level them to each other. Due to these problems we often have to compromise the theoretical definition of total productivity and use other approaches to measure productivity.

There are several possible methods available for productivity measurement. No doubt the most common methods are the **objective measures** or task performances. They concentrate on observing the actions of employees or the outcome of production and thereafter determining the quantitative outcome.

One example of objective measures is the use of *partial productivity measures*. Partial productivity ratios can be calculated by dividing total output by some input factor. For example, labour productivity is the ratio between total output and labour input. If partial productivity ratios cannot be calculated because the total output cannot be determined, even more simple method is to use *physical productivity measures*. They are obtained by dividing some typical output (e.g. number of serviced customers or production amount of main product) by an essential input (e.g. machine hours or labour hours). (See e.g. [26])

Another approach to productivity assessment is the use of **subjective measures**. They are based on the personnel's, management's or customers' perspectives that are collected

by interviews, rating scales and questionnaires. Instead of quantifying the amount of outputs subjective measures often aim at defining the outcome in qualitative terms or at pinpointing the problems in performance. The use of subjective measures has been criticised for lack of validity and claimed to be soft and easily impacted by different biases. On the other hand their use has been defended by the claim that subjective measures are most appropriate since people are likely to work in accordance to how they feel and overlook the physiological facts or objective conditions. [20]

Both objective and subjective measures can focus either on measuring the productivity directly or indirectly (see Figure 2). *Direct measures* follow the traditional productivity measurement and look for ways to describe the actual phenomenon. *Indirect (or surrogate) measures* instead include factors and managerial ratios that are not included in the concept of productivity, but are known to correlate with it [16]. They are often used in cases where it is impossible to get the data needed for partial and physical productivity measures. In other words, the idea behind indirect productivity measures is that certain symptoms or phenomena are related to problems in productivity. They include, e.g., high defect rates, machine defects, unused capacity, high material scrap, unnecessary transports, poor atmosphere and long waiting times. [26]

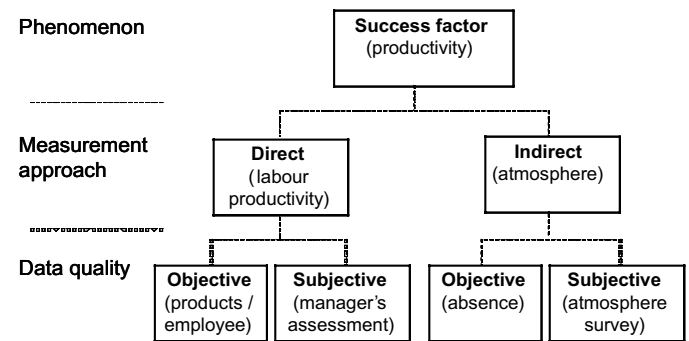


Figure 2 Different dimensions of measurement. [27]

Indirect productivity measures focus on these factors related to productivity. The factors are identified and measures are designed for them case by case. Examples of indirect factors affecting productivity are work habits (absenteeism), work climate (job satisfaction), feelings or attitudes (favourable reactions), new skills (decision made), development or advancement (request for transfer), initiative (successful completion of projects) and physical work environment. [26], [28]-[29]

By measuring the surrogate factors, which are (supposed to be) closely related to productivity, one can get practical, surrogate productivity measures. These provide indirect information about productivity, which can also be used to explain the causes for the changes in productivity. [27]

In addition to these more traditional approaches to productivity assessment, some researchers have used *physiological methods*. They concentrate on measuring physiological changes in human body that result from



altering environmental elements around the test person. Their use is based on an assumption that increase in nervous system activities leads to increase in stress. However, these measures have been criticised for insufficient evidence of relationship between physiological symptoms and actual performance. They may also affect the performance by disturbing the test person. Finally, physiological measures have turned out to be rather difficult to apply to certain jobs, wherefore situations where they are practical are limited. [20, p. 130]

## 5 IDENTIFICATION OF IMPACTS OF INDOOR AIR FACTORS ON PRODUCTIVITY

### 5.1 Theoretical limitations

There are some theoretical limitations to assessing the effects of indoor air on productivity. *Firstly*, when assessing productivity we should be able to determine which factors cause the alterations in productivity level. When altering the quality of indoor air in real life situations other alterations might also take place at the same time. In such cases it may be difficult to determine which part of a productivity change is caused by indoor air aspects and which by other factors.

*Secondly*, it might take some time before the impact of interventions is realised. An improvement in air quality (e.g. reduction in detrimental particles in the air) might not take place immediately after the development actions. This may cause problems in productivity assessment especially if it is done in real premises and not in laboratory settings. This lag may also lead to situations, where the observed alterations in productivity are caused by changes in some other factors which are just not detected. On the other hand, the changes caused by improvements in indoor air might not have realised before the assessment of its effects on productivity. Therefore the real implications cannot be noticed until later.

*Thirdly*, in addition to indoor environment there are several different aspects that influence productivity, e.g. management and organisation, job content, motivation and training. [30] This imposes a problem of eliminating the other aspects when evaluating the effect of alterations in indoor air. Also, the effects of other factors can be considerably greater than those of indoor air factors. The most common method of dealing with this problem is the assessment of productivity effects in laboratory settings. They allow controlling many of the affecting aspects such as environmental conditions, working environment, workload, and in some cases also personal factors. In field studies control of these factors is much more difficult. [31, pp. 31-32] This approach however poses another problem of confirming the applicability of results to real life situations.

Another problem related to this is the inability to conduct studies where several aspects of indoor environment can be taken into account at the same time. It is argued that many studies focus on single aspects of

indoor environment and if they deal with multiple aspects, they often are too general and qualitative [6].

*Fourthly*, differences in jobs can impose another problem on productivity measurement. The effects of changes in indoor air might vary in different jobs. For example, [3] have concluded that higher temperatures affect more the jobs that include thinking (i.e. knowledge work) than the “typing” jobs. On the other hand the productivity assessment cannot follow similar routes in dissimilar jobs. Therefore same methods cannot be automatically applied to all studies, just like all assessment methods cannot be applied to each organisation. This may make it difficult to compare the research results between different jobs and require modification of measurement methods to each situation. Also, the generalisation of the results is limited in such studies because they are performed for a too specific population [6].

### 5.2 Empirical experiences

The authors have taken part in several research projects where connection between indoor air and productivity has been examined (e.g. [4], [7], [32]-[33]). Most of the studies have been conducted as field studies in the actual working premises and the applied productivity measures have been chosen individually to each organisation. The most apparent problem with these studies has been the non-existence of proper productivity measures. In many cases the organisation either did not monitor its productivity before the research project or it was impossible to apply any objective measures. In those cases, a variety of subjective measures based on questionnaires have been used. Also certain surrogate measures, such as absence due to sickness have been applied.

The non-existence of productivity measures has been a result of many factors. Many of the case organisations have been non-profit institutions, their outputs immeasurable and the tasks under examination knowledge work orientated, or the tasks within organisation have differed from each other. All these aspects have complicated the measurement and the comparison of productivity assessments between different tasks, organisational units or time periods.

In most studies these problems have been attempted to overcome by using subjective measures. They have turned out to work rather well, although there is only limited experience from their use and many researchers are critical towards their reliability. However, they seem to offer a rather good means to examine employees’ perceptions about surrogate factors of productivity and especially their comfort in workplace. [34] On the other hand, the information they provide might not provide sufficient evidence of productivity effects, since it might be difficult to separate productivity effects of indoor air improvements from other factors also when subjective methods are used.

Even though there is quite a long tradition of assessing productivity, objective measurement is more than often judged to be difficult also in other studies. [31] have



analysed several studies that examine the effect of ventilation on performance and conclude that in only few cases objective measures have been used. It seems to be easier to use them when studying clerical-type work, but subjective methods seem applicable to more diverse work. They also state that relevant objective measures are rare. The most used of them seems to be speed of work (e.g. average time per certain task) but it does not fit to jobs where tasks regularly differ from each other. However, they argue that use of subjective methods expose productivity measurement to expectations or biases and therefore deliver more unreliable data.

Most striking problem in several of the empirical studies is related to the laboratory settings where certain imaginary and mostly mechanical tasks are used to imitate real working situations (see e.g. [3], [6], [35]–[37]). Observation of these mechanical tasks gives information about indoor air effects on them but not necessarily about working processes which consist largely of brainwork. For example, noise is known to impede brainwork (see e.g. [37]). However, these effects might not be observable, if we measure the productivity in laboratory conditions with predefined tasks instead of real working situations where tasks may differ, sudden changes are probable etc.

Nevertheless, these laboratory settings have not been abandoned by researchers, but are instead seen also as a possibility. [36] report on an indoor environment chamber and field experiment offices where certain single or combination of indoor environment parameters can be controlled. They see this unique and idealised form of experiment laboratories, where one can study the effect of alterations on indoor parameters on productivity. The above discussed problem of laboratory settings still remains - applying these laboratory circumstances to ever growing knowledge work is difficult, since there are several other factors that affect the performance more than the indoor parameters. It is often impossible to create such a realistic environment that includes all the other factors and the only alterations are made on indoor air.

## 6 CONCLUDING REMARKS

Studying of the effects of indoor air on productivity of work has proven to be of both researchers' and building managers' interest. The problems of these projects have been discussed in this paper. Here we conclude, what actions should be taken in each such project in order to avoid repeating these most common mistakes.

*First*, the research frame has to be carefully planned. In order to actually study productivity effect one has to make sure that there are applicable productivity measures on which the comparisons can be based. Many of the problems faced in research projects have related to the fact that there has been no real experience of productivity measures and therefore application of theoretically suitable methods has proven impossible in practice.

In an ideal situation the organisation already has a tradition in productivity measurement and uses certain

measures for continuous measurement. These measures have been proven applicable to the organisation under study and will provide the productivity information required to enable comparison between different time periods. However, it is more than probable that this ideal situation might be impossible to achieve. In any case, it should be kept in mind that making conclusions based mainly on indoor air assessments and only partly on uncertain productivity assessments will not lead to reliable results. Therefore careful consideration of applied measures is essential.

*Second*, each project should be started by defining the presumed path of from an indoor air improvement to employee's perception and from there to improvements in productivity or performance. This defined path of causes and effects can assist in recognising factors in which the positive impacts of indoor air improvements are most likely seen. These presumptions can further be used when determining the surrogate factors that should be monitored.

*Third*, it can often be easier to detect the effects of indoor air improvements by monitoring surrogate factors (e.g. absence due sickness, motivation) than by traditional direct productive measures. It might even be impossible to detect the direct effect on productivity, because it might be relatively small in the short run and therefore other factors that affect productivity or performance can overshadow them. The indoor air factors are known to affect first the perceived comfort of employees and only when problems are prolonged, they gradually affect also the performance. Therefore the surrogate factors should highlight changes in factors of productivity even before they have caused irreversible reductions in productivity.

*Fourth*, from the indoor air measurement's perspective, technical indoor air measurements are not unambiguous. Therefore also subjective methods with psychosocial aspects to evaluate the quality of indoor air are recommended to develop and test in the future. The results of technical indoor air measurements and subjective evaluation might clarify more also the connection of indoor air quality and productivity.

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# Has cross-border merger affected well-being at work? A follow-up case from banking industry

Miruna Rusu<sup>1</sup>; Asko Miettinen <sup>2</sup>; Anita Varjonen<sup>3</sup>

*1 Tampere University of Technology, miruna.rusu@tut.fi*

*2 Prof., Tampere University of Technology, asko.miettinen@tut.fi*

*3 Tampere University of Technology, varjonen\_anita@kolumbus.fi*

**Keywords—** job satisfaction, antecedents of job satisfaction, mergers and acquisitions.

## 1 INTRODUCTION

Increased market share and shareholder value, synergy realization, and risk sharing are only some of the aspects that make mergers and acquisitions (M&As) attractive. In the banking sector, the boom of M&As activity was in part the consequence of deregulation, which gradually opened national markets to foreign players. Increased competition and the developments in communication technology urged financial institutions to consolidate, in an attempt to increase market share by offering new products, attracting new customers, and penetrating new geographical markets.

M&As in the service sector are very sensitive to human related aspects – the so called “soft trap” [1]. Employees’ technical expertise and their strong relationships with customers are essential to the success of the merger or acquisition. Therefore, it is important to be able to keep talented people within the organization after a merger or an acquisition.

Human related aspects pose even more challenges in the particular case of cross-border M&As. Merging companies from two different countries involves not only different organizational cultures, but also different national cultures and possibly different national languages.

Depending on their type and the extent of integration, M&As involve changes in the organizational structure, value-creating processes and activities, and in the cultures of the two organizations [2]. They have a strong impact on people and sometimes these changes, if not handled properly, can lead to “we versus them” attitude, hostility among employees from the two organizations, lack of cooperation, higher turnover and absenteeism, psychological withdrawal from work, which affect employee performance and eventually organizational performance [3]-[5].

Most studies in this area are based on qualitative research, with a focus on the impact that M&As have on employee attitudes in the short run. With respect to well-being at work, except for few studies, there is mostly anecdotic evidence suggesting a decrease in job satisfaction

after a merger. Moreover, antecedents of job satisfaction received little attention (see [6]).

Our aim is to assess the impact cross-border mergers have on employee well-being at work in the long run. The paper encompasses a brief review of previous work on M&As in the area of human related aspects and on antecedents of well-being at work. Research methodology and background information on the case study are presented. Further, main findings are examined and a discussion is attempted on the implications of M&As on employee attitudes. Concluding remarks and suggestions for further research are posted.

## 2 THE IMPACT OF M&AS ON EMPLOYEES

In the area of human resource implications of M&As, cultural integration received most attention. [7] focused on the process of acculturation, developing a model based on the characteristics of the companies involved in the merger/acquisition. Lack of cultural fit was shown to lead to organizational conflicts [8]. Cultural differences at top management level and how these differences influence M&As performance, defined as shareholders’ gains, were analyzed by [9]. It appears that organizational culture differences negatively influence top managers’ cooperation, commitment, and increase their negative attitudes toward the merger/ acquisition [10]. Other researchers focused on consequences of top management culture clashes [11], on top management turnover and its effect on merger/acquisition performance [12].

Employee reactions and behavior following a merger or an acquisition have been analyzed mainly based on qualitative data. Reactions such as fear, distrust, stress, hostility, “we versus them” attitude were suggested in the literature [5], [13], [14]. Employees are interested in obtaining information about the consequences of the merger/ acquisition which will affect them directly: job security, immediate manager, autonomy, career prospects, transfers, new working environment, new corporate culture etc. Therefore, formal internal communication with employees during and after the merger/ acquisition becomes an important aspect in managing the merger/ acquisition process [4]. As [14] suggested, realistic communication can

help employees better cope with the changes determined by M&As and thus reduce the negative impact that the merger/acquisition has on organizational effectiveness.

Another area of interest for research is related to employee attitudes and behaviors, such as turnover, satisfaction, and commitment to the organization. It was suggested that following a merger or an acquisition employee motivation and commitment, as well as satisfaction decrease [5], [14]. Moreover, based on the type of merger or acquisition, a certain degree of voluntary and involuntary turnover (at both employee and managerial level) is expected (see [3] pp. 60-74, [4], [15]).

Even though M&A have mostly negative effects on employees, there are several researchers who suggested positive influences of M&A on employees. Thus, M&A could be seen as an opportunity for new responsibilities, advancement, or development [3], [16], [17], increased job security, greater job satisfaction or more varied work tasks [4].

While HR issues started to receive more attention from researchers focusing on M&A, there are still gaps in research, some of them due to methodological issues. When quantitative data were used, focus has usually been on the effects of M&A after a relatively short period of time [4], while organizational integration might take several years to complete.

### 3 WELL-BEING AT WORK

In the field of economics job satisfaction has been generally identified with well-being at work [18]. Nevertheless, in the field of psychology most researchers consider job satisfaction as one aspect of well-being at work, together with measures of emotional exhaustion and work motivation [19]. In this paper we take economists' view on well-being at work and consider it to be synonym with job satisfaction. There are different definitions of job satisfaction, but they all come down to the same issues: a positive state of mind derived from one's evaluation of the job [20], [21].

The study of job satisfaction is important for several reasons. First, job satisfaction was shown to have an impact on customer satisfaction, which is extremely important in the service sector [22] - [24]. Satisfied employees are likely to be more involved with their job and to put more effort into increasing service quality, thus leading to increased customer satisfaction.

Second, previous research suggests job satisfaction is related to several employee behaviors, such as turnover, absenteeism [25]-[27] and organizational outcomes, such as productivity and profitability [23]. While the impact of job satisfaction on turnover is more easily acknowledged through the impact job satisfaction has on intention to leave the organization, the relationship between job satisfaction and organizational performance is more controversial. It was argued that, by employing human resource practices focused on increasing employee skills and their motivation to work, and offering them the opportunity

to take initiatives, they would work harder, and put in their discretionary effort for the benefit of the organization [28]-[30]. As a consequence, an increase in quality and financial performance will follow. Thus, appropriate HR practices would induce positive employee attitudes and behaviors, which in turn would affect organizational outcomes (productivity, quality, service), and further on, financial performance (return on assets, profitability) [31]. The problem with these relationships is reverse causality. A company enjoying high performance is likely to invest in its people and offer them more benefits, which in turn will have a positive impact on job satisfaction and organizational performance [32]-[34].

Another controversy refers to the causal order between job satisfaction and organizational commitment. Most studies found that job satisfaction precedes organizational commitment [35], [36]. There are few studies which suggest a reverse causal effect [37]. Other studies imply that job satisfaction and organizational commitment are reciprocally related [38] or that there is no causal relationship between the two constructs [26], [39], [40].

Besides organizational commitment, whose causal relationship with job satisfaction is not entirely clarified, several other antecedents of job satisfaction can be identified in the literature. The largest part refers to work-related aspects: daily work (autonomy, role ambiguity, routinization, workload, physical working environment etc.) co-workers and superiors (cooperation, support, feedback), financial incentives (salary and other benefits, distributive justice of pay), job security, and career opportunities [18], [26], [27], [36], [41]. Organization-related aspects (organizational culture and sub-cultures, leadership style, were also considered as potential antecedents of job satisfaction [42], [43]. A third category of antecedents refers to demographics and individual characteristics, such as age, gender, race, tenure, and education [27], [44]. Despite the fact that different models are based on similar underlying constructs, there is a variety of measures for antecedents of job satisfaction, making thus difficult a comparison of results from different studies.

### 4 JOB SATISFACTION DURING POST-MERGER INTEGRATION

#### 4.1 Research question and hypotheses

Our aim is to assess the impact cross-border mergers have on employee satisfaction. Moreover, we are interested in studying how the influence of several antecedents on job satisfaction changes over time, as the integration process unfolds.

Previous research offered evidence for a positive influence of task variety, interesting job, financial rewards, promotional opportunities, job security, feedback on performance, and cooperation with co-workers on job satisfaction [18], [26], [27], [36], [41], [45]. We will therefore expect to obtain similar results.



H1: Daily work characteristics, remuneration, development opportunities, cooperation, job security, and feedback on performance will have a significant positive impact on job satisfaction.

As already mentioned, following a merger employees fear loss of autonomy or power they previously had within the organization, decline in career prospects, or loss of job. Job security was identified as one of the most important factors for employees during a merger or an acquisition [46]. Therefore it is expected that immediately after the merger employees will be concerned about their position in the new organization. Later during the integration process, after the changes involved by the merger or acquisition took place and their position in the new organization is known, their concern is likely to shift from job security to career prospects.

H2: During the first years after the merger, job security will have a larger contribution to job satisfaction and development opportunities a lower contribution. During the following years the contribution of job security to job satisfaction will decrease in favor of development opportunities.

Feedback on performance was also identified as very important to employees following a merger/ acquisition [46], not only as a form of recognition or reward but also as a way of reducing incertitude with respect to one's position in the company. Being acknowledged as a good performer means lower chances of losing the job. Thus it is expected employees will be more interested in getting feedback on performance in the period immediately following the merger.

H3: Feedback on performance will have a larger contribution to job satisfaction during the first years after the merger. During the following years its importance in explaining job satisfaction will gradually diminish.

In order to facilitate integration it is recommended to encourage cooperation between the employees from the two organizations, to create joint problem solving teams and encourage knowledge transfer between the organizations. Generally, co-workers' support has been shown to have positive influence on job satisfaction [36]. During post-merger integration the need to cooperate with new persons might be felt as a pressure, which adds to the stress generated by merger. Therefore, it is likely for the overall effect of cooperation on job satisfaction to be smaller in the first post-merger years (as the positive aspects of cooperation are counterbalanced by the stress of working with new people). As people begin to know each other, and establish relationships with the new colleagues, the positive effects of cooperation will increase [17].

H4: In the first years after the merger cooperation will have a smaller impact on job satisfaction. During the following years its contribution to job satisfaction will increase.

Remuneration was suggested as one of the primary concerns of both managers and employees following a merger [47]. Therefore we expect that remuneration will have an important influence on job satisfaction during the first years of integration. As financial rewards were shown to be an important determinant of job satisfaction [18], we expect that remuneration will have a constant impact on job satisfaction during the four years of analysis.

H5: Remuneration will have an important and constant impact on job satisfaction during the integration period.

Previous work in the area of M&As does not focused on daily work related aspects, therefore we cannot define a pre-test hypothesis regarding its impact on job satisfaction.

#### *4.2 Research methodology and data*

A case study approach is used in this paper, focusing on a division of a multinational operating in the financial sector. The division is profit-oriented, having departments geographically spread in Finland, Sweden, Denmark, and Norway. Moreover, it employs highly educated people, and therefore intellectual capital aspects are much more of an issue than in other divisions.

We take a longitudinal approach, performing a five-year analysis. Quantitative data span from 2001 to 2005 and are based on the results of employee satisfaction surveys carried on within the division. Both employees in managerial and non-managerial positions participated in the surveys. The respondents were allowed to give an answer on a 100-points scale, where 1 is the lowest and 100 is the highest. They were guaranteed anonymity, and therefore our sample is based on unit level data.

Job satisfaction was measured by a single item: "How satisfied are you with your work situation as a whole". Several other studies have measured overall job satisfaction by means of a single item [18], [48]. Moreover, the unit level data obtained by aggregating individual level scores generates quite reliable single item indices [23].

As antecedents of job satisfaction we employed measures of work tasks, remuneration, development opportunities, cooperation, feedback on performance, and job security. The decision to choose work-related variables was supported by research of [41], who argues that, in the Nordic countries conditions of work (referring to daily tasks, pay and benefits, job security, and development) contribute 60% to job satisfaction and motivation. In addition, we included a measure of performance feedback received from immediate manager, as [46] argued it is of crucial importance during a merger. Except for job security and feedback on performance, which were measured by a single item, scales were created to measure the other antecedents. The items

included in each scale, as well as scales' reliabilities are presented in Appendix. The lowest value for Cronbach's alpha is 0.786, which is higher than the recommended limit of acceptability of 0.7 [49], p.88.

#### 4.3 The Nordic Champion division

The focus of our research is a division (hereafter called The Nordic Champion) of a multinational company activating in the financial sector. The Nordic Champion is organized as a product responsible division in the business area of corporate and institutional banking. It employs around 2.5% of the total number of the organization's employees and it generates around 10% of the operating profit.

Immediately after the merger The Nordic Champion underwent major changes. A new business model was adopted, with the purpose of creating a coherent Nordic business process, rather than maintaining earlier country based operations. The purpose was to benefit from cost synergies by eliminating overlapping functions and to provide income synergies through strengthened competencies, sheer size, and improved market position.

The HR department took an active role in supporting the implementation of the new business model, by defining a HR strategy aimed at creating a unique organizational culture to support the business function.

#### 4.4 Results

First, the evolution of job satisfaction over the five years of post-merger integration was analyzed using repeated measures ANOVA. Due to the large number of missing values in year 2001 sample the imputation of missing values was not considered appropriate, opting instead for listwise deletion. As opposed to previous research suggesting a decrease in job satisfaction after the merger, it appears that employee satisfaction was not negatively affected by the merger (Figure 1). It stayed approximately at the same level over the past 5 years ( $F(2.475, 59.410) = 1.087, p > 0.05$ ). Our results confirm previous suggestions made in the literature regarding positive effects of M&As on employees [4].

Next, structural equation modeling was employed to study the impact several antecedents have on job satisfaction. Due to the large number of missing values in year 2001 data, only years 2002-2005 data were studied using path analysis. Missing values were replaced by mean of the item. The model is presented in Figure 2.

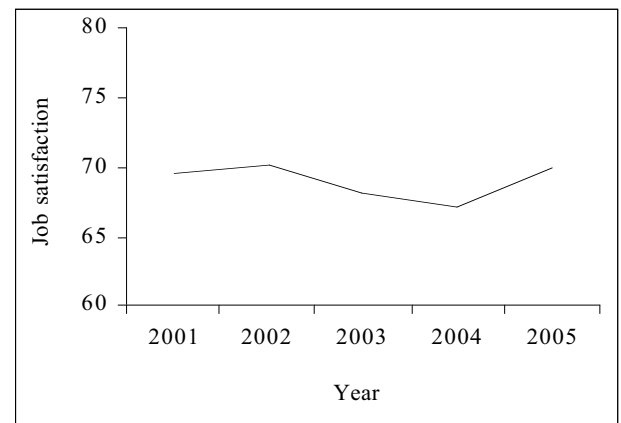


FIGURE 1  
EVOLUTION OF JOB SATISFACTION

The model is just-identified, thus it is not possible to calculate overall fit indices. Nevertheless, the use of structural equation modeling has the advantage of taking into account the correlations between exogenous variables and the measurement error, in the case of latent variables.

We propose that daily work, remuneration, development, cooperation, job security, and feedback on performance received by employees influence job satisfaction. Job security, feedback on performance, and job satisfaction are manifest variables (empirically observed measures), whereas the others are latent variables (theoretical concepts, which cannot be measured directly, but are measured by one or more variables). Exogenous variables are allowed to co-vary.

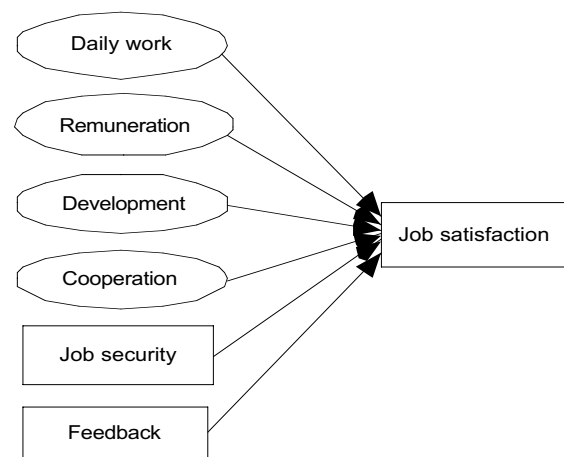


FIGURE 2  
MODEL OF JOB SATISFACTION

Due to the small sample size (55 observations) we used single indicator latent variables. We averaged the items of each scale to create a single indicator variable to load on each latent variable. The reliability alpha of the scale was used to fix the indicator variable loading on the latent variable and the variance of the indicator's error term. There are several studies which employed this technique [35], [39].

Prior to path analysis, the means, standard deviations and Pearson correlations were computed. Table 1 presents the regression coefficients for the model in each of the four years of analysis. These data show that daily work and remuneration related aspects significantly influenced satisfaction. As suggested by other authors [18], [50], daily work aspects seem to be the most important determinant of job satisfaction. It appears that employees are highly concerned with job contents and daily tasks in the first phases of the integration process. This evolution might be explained by the fact that organizational changes generated by the merger are likely to affect the position or the status one had in the old organization. Fear of losing one's status increases the importance job contents, the degree of challenge, and task variety have on job satisfaction.

TABLE 1  
REGRESSION COEFFICIENTS

	2002	2003	2004	2005
Daily work	0.575***	0.455***	0.322***	0.252*
Remuneration	0.220*	0.234***	0.249***	0.297***
Development	-0.026	0.063	0.122(*)	0.108
Cooperation	0.112	0.218*	0.182*	0.231*
Job security	0.141(*)	0.048	-0.059	0.054
Feedback	0.152*	0.007	0.106*	0.120(*)

\*\*\* p<0.001, \* p<0.05, (\*\*) p<0.1

The contribution of the other four antecedents (development opportunities, cooperation, job security, and feedback on performance) varied in significance during the period of analysis. Therefore we find only partial support for Hypothesis 1.

Contrary to our expectations, job security did not significantly contribute to job satisfaction (except for year 2002, when the regression coefficient is significant at 10%). Moreover, compared to the coefficients of daily work and remuneration, the coefficients of job security are rather small, and close to 0 from 2003 to 2005. The results could be explained by the characteristics of labor markets in the Nordic countries. Being highly regulated, with more restricted employer autonomy and difficult firing and hiring decisions, employees in Nordic countries are guaranteed a certain degree of job security [51]. Moreover, the particularities of the division's business area (equity trading, foreign exchange, money market and derivatives transactions etc.) offer their employees a high employability. High performance traders can always find another (usually) better paid job. The events following year 2000 merger might also help explaining the minor impact job security has on well-being at work. Most redundancies were made immediately after the merger, thus by year 2002 most people were certain about their position in the organization. During the past five years, significant changes were made to the organizational structure in order to better support the division's strategy, but they did not involve layoffs. Even though these organizational changes might have increased uncertainty, they probably did not affect job security.

Development opportunities had a small and insignificant influence on well-being at work (except for 2004 when they significantly contributed to job satisfaction). Given the low impact of job security on satisfaction, one would expect development possibilities to have a major contribution to job satisfaction. It appears that there is partial support for Hypothesis 2.

Feedback on performance given by immediate manager had a significant contribution to employee job satisfaction in 2002. During the last years of the analysis its contribution to job satisfaction decreased, except for year 2004, when it significantly influenced job satisfaction.

Cooperation had a significant impact on job satisfaction starting with year 2003. Its importance as a determinant of satisfaction fluctuated over the years, which allows only a partial confirmation of Hypothesis 4.

Remuneration is the second most important antecedent of job satisfaction. Its importance as a determinant of job satisfaction steadily increased through the integration period. The results suggest that employees are first interested in securing their position in the new organization and then concern themselves with financial rewards and career opportunities. It appears that Hypothesis 5 is not fully supported.

Table 2 presents the squared multiple correlation ( $R^2$ ) of the latent endogenous variable (job satisfaction).  $R^2$  expresses the proportion of variance explained by the structural relationships.

TABLE 2  
SQUARE MULTIPLE CORRELATIONS

	2002	2003	2004	2005
Job satisfaction	0.779	0.788	0.848	0.693

Daily work, remuneration, cooperation, development opportunities, job security, and feedback on performance explained more than 70% of job satisfaction variance every year.

## 5 DISCUSSION

Our hypotheses are only partially supported. Development possibilities and job security did not significantly influence job satisfaction. The impact of cooperation on job satisfaction increased from 2003 on, except for 2004. Feedback on performance became less important in explaining job satisfaction, except for 2004, when it significantly contributed to job satisfaction. It appears that year 2004 results do not fit the general trend suggested by the other years. Moreover, job satisfaction, even though on a general positive trend, registered a decrease in 2004 (Figure 1).

There are several merger-related aspects which help explain why our hypotheses were partially rejected [52]. First, the inclusion of a new department within the Nordic Champion division (inclusion welcomed by neither the department nor the division) created tensions and stress which reflected on cooperation. The positive influence of

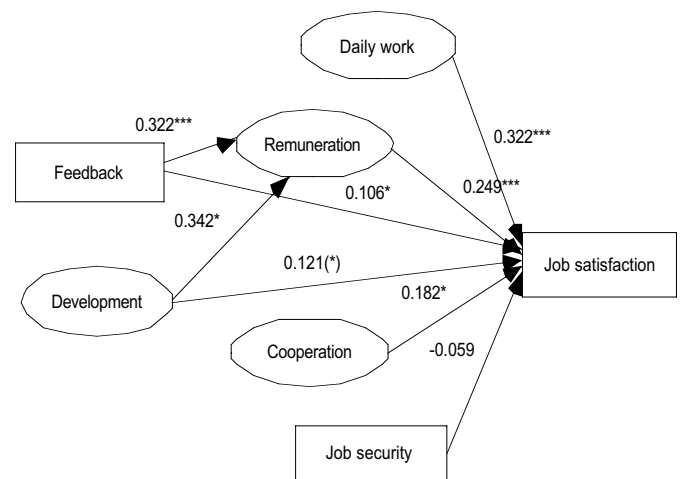
working with old colleagues was counterbalanced by the tensions of collaborating with the new employees of the division. Thus, the impact of cooperation on job satisfaction diminished in 2004.

Second, it appears that during 2004, there were rumors about a change in the remuneration model (more exactly a worsening of the bonus system), change that was not implemented after all. Within the Nordic Champion division bonus is decided based on performance and thus, such rumors are likely to lead to questions related to performance. Hence, an increased interest in getting accurate and constructive feedback on performance and consequently an increased influence of feedback on well-being at work.

Bonus-related rumors can also help explain why development opportunities appear to significantly influence job satisfaction in 2004. Development opportunities facilitate career advancement, which in turn are likely to imply higher remuneration. The rumors related to the worsening of the bonus system made employees more interested in their development possibilities, as a means to increase remuneration (to cover up for the possible bonus decrease). As remuneration significantly impacts on job satisfaction, development possibilities also became a significant antecedent of job satisfaction.

In order to find support for our explanation we proposed an alternative model for year 2004 data. We hypothesized that development opportunities and feedback on performance influence job satisfaction both directly and indirectly, through the impact they have on remuneration (in other words we assumed that development possibilities and feedback are also antecedents of remuneration).

The chi-square statistic for the model is  $\chi^2 = 6.790$ ,  $df=3$ ,  $p=0.079$ . The test statistic is not significant at 5% significance level, meaning that the model is not rejected. Tucker-Levis Index (TLI) is 0.884, Normed Fit Index (NFI) is 0.973, Adjusted Goodness-of-Fit Index (AGFI) is 0.695, Comparative Fit-Index (CFI) is 0.983 and Root Mean Square Error of Approximation (RMSEA) is 0.153. [49], p. 656 suggests that TLI, NFI, AGFI, and CFI values of 0.90 or greater indicate a good fit. For RMSEA [49] suggests value at or below 0.08 as indicator of a good fit for the data. Some of the overall fit indices are within the recommended limits, while others are not. It is not possible to compare the two models to assess which one better fits year 2004 data. Nevertheless, the high values of NFI, CFI, and TLI offer some support for the alternative model.



\*\*\*  $p < 0.001$ , \*  $p < 0.05$ , (\*)  $p < 0.1$

FIGURE 3  
REGRESSION COEFFICIENTS OF ALTERNATIVE MODEL

The regression coefficients of the alternative model and their significance levels are presented in Figure 3. As it can be observed, both feedback and development opportunities significantly influence remuneration, supporting thus our explanation.

## 6 CONCLUSIONS

The purpose of our research was to analyze the evolution of well-being at work following a merger in the financial sector. Moreover we were interesting in studying the impact of several work related aspects on job satisfaction throughout the years, as the process of post-merger integration unfolds.

The results suggest that the impact of work related aspects on job satisfaction changes as the integration process unfolds. Different integration phases will imply a different impact of work related aspects on job satisfaction. During the first one or two years after the merger (the acclimatization phase, as identified by [17]) communication and thus cooperation is difficult, employees are concerned with their position in the new organization, hence the importance they give to job security and performance feedback. Moreover, fear of losing status/ position makes them sensitive towards job assignment and contents, and daily tasks. During the following two years (the transition period) people start to know each other, relationships are created and tension and conflicts disappear, thus giving way to the benefits of cooperation. As their position in the new organization is known, employees are less worried about job security or daily tasks. Following this period, cooperation extends at all levels, involving most part of the employees. Cooperation becomes essential for performing one's tasks, therefore its impact on employees' well-being at work increases.

Even though we only found partial support for our hypotheses, the present study represents a first step in explaining how and why the impact of work related aspects



on job satisfaction changes during post-merger/acquisition integration.

We were limited in our choice of items to be included in the analysis by the questionnaire used within the division to measure employee attitudes. Thus some of our variables were measured using only one item. Even though several researchers showed the high reliability of single items indices, it should be interesting to develop more extensive measures of employee attitudes. In addition, the use of self-reported measures can generate common method bias.

Future research should focus on re-confirming and improving present results. The small size sample did not allow us to test the measurement model. The study should be reproduced on a larger sample, in order to test the measurement model before evaluating the structural model. Moreover, different types of mergers/acquisitions should be considered. It is expected the results to be different in the case of a vertical merger.

The model could be extended to incorporate other employee attitudes and behaviors, such as commitment, motivation, and turnover and to assess their impact on merger/ acquisition performance.

## APPENDIX

TABLE 1  
ITEMS INCLUDED IN THE CONSTRUCTION OF INDICES

Index	Item
Daily work	How varied work tasks are
	Degree of challenge of work tasks
	Job assignments and contents
Remuneration	How the terms correspond to your work performance
	Salary compared to similar position elsewhere
	Benefits compared to similar position elsewhere
Development	Possibility for professional and personal development
	Possibility for new duties and/or increased responsibility in your present position
	Focus given to your development
Cooperation	Professional cooperation with colleagues
	Climate among colleagues

TABLE 2  
RELIABILITY COEFFICIENTS

Index/Year	Cronbach's alpha			
	2002	2003	2004	2005
Daily work	0.881	0.874	0.927	0.914
Remuneration	0.865	0.856	0.849	0.893
Development	0.895	0.916	0.909	0.924
Cooperation	0.889	0.822	0.804	0.786

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# Well-being at work

**Kirsti Launis**

Senior Researcher, Finnish Institute of Occupational Health, [kirsti.launis@ttl.fi](mailto:kirsti.launis@ttl.fi)

**Keywords:** *Organizational Change; Production and Service Concept; Disturbances; Well-Being*

## 1 ON THE SHOP FLOOR

Employee talked to me on the shop floor, May 2005:

*"I have worked for this company for over 20 years. (...) More than five years ago it was still nice to come here to work every day. My job was very interesting, I enjoyed it, and ... you know ... you could do it in peace. Today, and over the last five years, new IT-systems have been implemented, and you feel like you work - or run - according to machines, and your work load increases because the number of people has decreased. It starts to stress you out, although I didn't think that I had a short fuse, but nowadays, oh hoh.*

*Anyhow, my job is interesting, and I like learning new things all the time, and they are interesting to learn, but ... I think that many of my colleagues share my feelings today: in the morning when you approach your workplace, your spirits sink ... again you have to come here, but ... there are not so many workplaces for a guy like me, this is a specialized job: I am only qualified for this . You have your family and everything ... you can't just leave.*

*Nowadays the worst is the atmosphere. (...) There come problems from above every day, they (managers) pile new things on us, and we complain. Every day there are plenty of little annoying things. This is absolutely the worst problem. Due to that we have lots of sick leaves, lately also burnouts. This tells you something about our jobs, but it also affects our workplace in a negative way ... in many ways ... I think that in the long run this all costs the firm a lot of money.*

## 2 INTRODUCTION

### 2.1 Changes in production and service concepts

In order to survive in the market, organizations are constantly striving for more functional and cost-efficient models [1], which Launis and Pihlaja [2] call the production or service concept. By production concept they mean the production logic, the whole pattern of the production and service entity, which includes the financial

principles, technology, division of labour, management system, etc. Changes in production and service concepts occur both in private and public sector. The work units and individual workers take these transformations as challenges but also see them as problematic [2]. The transition from an old concept to the new one makes organizations more layered and complex. The dynamics of these increasingly quick transformations are not well understood from the perspective of either the organization's or the individual's everyday work.

Recurrent transformations, although necessary for productivity, at the same time seem to increase time pressure, stress, sickness symptoms, sick leaves and safety problems of workers [3], [4] - and problems for productivity. Doherty et. al. [5] suspect that something went wrong at the beginning of 1990s in particular, when the intensity of work increased. One example has been the implementation of information technology, which does not automatically increase human productivity at work but causes new problems and requires many management and social innovations simultaneously.

### 2.2 OHS-expert models and the ongoing change

Organizations have specialists in occupational health and safety and ergonomics, as well as in personnel development. In spite of their good intentions, these experts seem to have no powerful tools to understand or prevent the increasing problems. Sometimes, through their measures, they may even add to the confusion in rapid change situations. When for example trying to reduce individual stress or risk factors at work, or cure separate environmental problems with single measures, the professionals may deepen the problems of organizational transition.

Hatchuel and Weil [6], in analyzing expert functions in organizations, depicted how mass production type production concept in work life has rationalized expert work. Organizational models have divided experts into narrow, specialized turfs within each specialist area - with no connections to the strategies and aims of the organization. As regards mass production concepts, experts in occupational health and safety have developed, for instance, their own tools and models according to their own different theoretical basis. Despite good intentions, collaboration and a common language between different

experts and between the management of organizations are still lacking.

Is the problem merely the lack of collaboration models and a common language, or do the problems also lie in experts' theoretical understanding of work and especially the change logic in work systems? For example, theoretical models of occupational health (e.g. the central issue of different types of load factors and their effect on employees' health) originate from epidemiological tradition, where work is understood as different types of load factors [7], not as a different logic in the production and service for customers. Part of the problem lies in the theoretical and methodological basis of expertise.

### 2.3 What is the problem?

When solutions are sought for work-related well-being problems in a situation of rapid change, they are often caught in the entanglement of the transition processes of production concepts and the meanings that employees place on their daily work life. Our previous research has shown the strong connection between work-related well-being, an individual's occupational identity and the transformation of the production and service concepts of the organization [7], [2]. This means that both the traditional employee questionnaires, and technical and economical analysis of production processes are insufficient because they do not combine human and production. New qualitative methods to analyse people in the production process are required.

Part of the problem in work place expertise stems from the own theories, models and tools of those experts. There is need to construct new methods in understanding and reconceptualising the complicated transition process so, that individual and organizational points of view will be woven together in situations where change cycles at the workplace are continuously accelerating. When solutions are sought for work-related well-being in the situation of rapid change, they are found in the entanglement of the transition processes of production concepts and of the meanings the employees pose on their daily work life. One should have both theoretical and practical tools, and versatile everyday work data to understand change cycles based on marketing logic.

## 3 AIM AND METHODS OF THE STUDY

The aim of this paper was to develop methods for understanding transitions in organizations so that single measures would be reasonable, and to promote and support the development of new and productive concepts in the organization, as well as the work-related well-being of employees.

In the five-year research project (2005-2009) based on Activity Theory and Developmental Work Research [8], [9], occupational health specialists of eight Finnish work

organizations and researchers from three research units will develop new methods and collaboration models to understand and promote work-related well-being in the ever increasing cycles of change processes. One basic idea is to develop versatile methods to analyze what is going on in the organization, and to find situations to focus on more closely. We based methodological development on ethnographic approach [10], [11], and on the historical development of production and service concepts [12], [13].

### 3.1 From epidemiology to ethnography

Epidemiological methods have an important role both in public and occupational health. They have also provided a theoretical background for occupational health and safety practices, recently in particular, in evidence-based practices. Scientific uses of epidemiology include the study of the causes of diseases, evaluation of the efficacy of treatment, and the study of the efficacy of preventive trials [14]. Theoretical bases of epidemiology, the so called "person-environment paradigm", are still the base of several measures of occupational health (e.g. stress inventories) as well as risk analysis of occupational safety experts. The result is that we now know much about health problems at the work place but we are powerless to prevent them. Theoretical problems of epidemiological approach in prevention of well-being at work, especially in stress research, have been analyzed by Mäkitalo [7].

To attain the multi-layered transition process in work organization we need both a new theoretical basis of work, and new methods to understand the intertwined change cycles. In our research project, based on the Activity Theory and Developmental Work Research, e.g. [8], [9], we started to use and develop ethnographic methods to understand and improve change processes in several organizations. The idea was that the developed methods would not only be useful for the researchers but also for the use of occupational health and safety professionals to start and maintain dialogue with the management and the personnel, and direct their attention *towards their changing work activity*

We carried out a series of focused studies to gain the general picture of the change situation in the organization. The developed method in data gathering was based on four principles: 1) to find out the historical development of the production and service concepts, 2) to keep everyday situations and events in the temporal and local context, 3) to give personal mind and actor interpretations to everyday (disturbance) situations and events and 4) to depict or trace the developmental paths of everyday events.

### 3.2 Production concept as a unit of analysis

The key method in analysis of the data was based on the historically changing work types described by Victor and Boynton [12] and Pihlaja [13]. By using these historical types of work activity we gave context to interview data. These work types represent different principles according to which production is organized (Table 1).



TABLE 1  
THE FEATURES OF PRODUCTION AND SERVICE CONCEPTS

Craft production	Standard. mass prod.	Flexible mass production	Custom. mass production
<b>Value produced by novelty</b>	<i>Commodity</i>	<i>Quality</i>	<i>Precision</i>
Fluid, adaptable Highly informal <b>organized.</b>	Bureaucratic, functionally defined, hierarchical vertical integration. Top-down.	Team-based, horizontal org. Value-chain integration; knowledge overlap; Bottom-up	Dynamic network, renewable, virtual integration, cohesive. Highly responsive
<b>Managers</b> not purely managers	Managers as thinkers	Managers as coaches	Managers as "traffic cops "
<b>Workers</b> not purely workers	Workers as doers	Workers task- and team oriented	Workers as hubs in a complex web of activities
<b>Process flow</b> Independent work, decentralized to specialized groups and individuals.	Serial, linear; executed to plan; centralized control, information-specialized	Intensive and reciprocal within teams	Modularized, linkages integrated into customer/product-unique value chains
<b>Tacit knowledge</b> transfer through on-the-job training.	Articulated knowledge, which resides with the firm, transferred through training	Practical knowledge flows constantly from employee to firm	Architectural knowledge dynamic networks, and flexible combinations.
Development and distribution of customized <b>information systems</b>	Automation of manual process to achieve cost-justified efficiency enhancement; vertical information control	Design of cross-functional information and communications systems that support micro-transformations.	Integration of constantly changing network information-processing and communicating requirements

As data in this case analysis, I have used: 1) different documents concerning the late development of the organization, 2) documented descriptions of the service processes in the organization (quality documents), 3) short (one day) ethnographic observations at the workplace according to work process, 4) audio taped meeting of the management team, and 5) group interviews of five employee groups (25 employees altogether).

### 3.3 The case organization

The case organization in this paper is a private service organization. It provides services for several companies and their customers. The company has a staff of approximately 800, and it serves over 8 million single customers annually. The past five year period has been a turbulent phase in the organization. Many organizational and functional changes have been carried out, and top management has changed frequently. During the past few years team work modes have been launched, and multiprofessional skills have been developed, although many units have retained the traditional organizational

culture on the shop floor. According to the atmosphere questionnaires carried out by occupational health experts, employees perceive their work load as having increased, and many health problems were reported. Sick leave absence rates were also high. Single measures to reduce employees' work load have not been successful.

## 4 RESULTS

### 4.1 Asynchronies in the change process

The organization was in turbulence. For financial reasons, the management had been looking for new and economical service concepts since the year 2002 in particular (documents, interviews). There had been several organizational and technical changes over the past few years (documents, interviews). I was talking with the management about the service concept they were hoping to work on or to develop in the near future using Table 1 as a basis.

The supervision model of the organization seemed to be problematic. The personnel described (interviews) number of problematic stories about their everyday work. In order to be classed as *disturbance situations*, the criteria of told stories and situations were that employees described problems in their well-being, such as negative atmosphere, fatigue, aggression or feelings of stress. The described situations were especially linked with supervision of the work, which did not seem to be in line with the service concept developed by the management to be competitive in the market.

The management team described (using Table 1 in their meeting with the researcher) to be striving for a flexible service concept, and their plans for management training program confirmed this. Management complained that workers were uneager to take responsibility according to the team work model, although training was arranged by the personnel department, and several development groups had been founded.

The told stories about disturbance situations showed that supervision of everyday work seemed to be in line with the mass production concept (see Table 1), and it caused disturbances and breakdown of communication between workers and their foremen. Both experienced that they got very little or no positive feedback on their work, because their interaction was mainly restricted to problem situations. This was also expressed strongly in their answers in the previous atmosphere questionnaires. What was the talk of the team work in the organization?

These situations were perceived as frustrating and tiring, and they were also seen to lower the production. Launis & Pihlaja [2] call these situations *asynchronies in the change process*, and these asynchronies seemed to be the main cause of personnel's problems in work related well-being and stress. Table 2 shows the asynchronous situation in the supervision of work and the planned service concept.

TABLE 2  
ASYNCHRONIES IN SUPERVISION OF WORK

Type of work feature	Craft service	Standard. mass service	Flexible mass service.
Specific kind of value produced			Service concept was based on <i>new quality</i> demands of the clients
Managers		Foremen planned the tasks to the employees using computer-based IT-system	<i>Foremen were trained for coaches but they could not act like that in everyday work</i>
Workers	Experience based professional identity	Seen as doers through supervision systems	<i>Employees had expectations for more independent work</i>
Manager-worker relations		From top-down	<i>Supposed to be active and creative team players</i>
Threats of well-being		Motivation problems, task pressure	

According to ethnographic observations and interviews, the management systems and used information technology system were maintaining the mass service concept. This asynchrony prohibited workers from acting as a team, and their foremen from working like coaches, i.e. they were giving no kind of positive feedback to the employees. This change asynchrony also caused *disturbance load* [7] for both the employees and their foremen. The disturbance load caused increased time pressure, stress, poor individual relationships and experiences of burnout. In the interviews the employees and the foremen reported frustrating situations, and these were analyzed and interpreted within the framework of the development of the service concept. The propositions for solutions were neither individual training, traditionally ergonomic nor occupational health interventions measures, but rather solutions to develop the whole middle management system to promote the flexible service concept in the organization.

## 5 DISCUSSION

On the basis of analysis, three main interventions for further measurements were planned: 1) renewing the middle management system in the organization, 2) further research on disturbance load of the change to find solutions within the framework of the service concept in the organization, 3) further analysis and development of the collaboration models and forums in the organization to discuss and solve everyday disturbances.

The analysis launched an overall process where personnel management, occupational health, management and personnel of the organization started to create collective understanding, tools and dialogue arenas of their service (business) concept to create also a new joint approach to the changing work.

The results of this case give evidence that changes in production and service concepts are a prominent cause for the problems of work-related well-being. Model of the development of production and service concepts (Table 1) seems to be a good tool to analyse and understand *asynchronies of the change* as the roots of current problems of work-related well-being [2]. This kind of approach still requires new theoretical concepts, new intervention methods and also new ways of collaboration between the experts and personnel of the work organizations.

The talk of concept changes and asynchronies between the management, production designers, health and safety specialists, and local work communities raises new possibilities of encounters and alliances. The experts need to cross boundaries [15] and to question their own expert practices. We need more than just a common language; we need shared arenas for dialogue [16], and above all, shared tools to conceptualize the ongoing change processes in organizations to develop new perspectives in each expert area. Creating novel collaborative models and tools is not an easy process, and it cannot proceed if experts try to develop their models and tools only within their own expertise.

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# Do immigrants have more accidents than Finnish workers?

**Simo Salminen, Maarit Vartia, Terhi Giorgiani**

*Finnish Institute of Occupational Health, e-mail: simo.salminen@ttl.fi*

**Keywords– foreign workers, occupational accidents, bus drivers, cultural differences**

## 1 INTRODUCTION

The workforce in western countries is ageing, as the post-war baby boomers approach retirement age. To increase productivity, these countries require more immigrants. However, a high incidence of occupational injuries among immigrants could decrease the contribution of foreign-born workers.

The number of foreigners living in Finland at the end of 2004 was 108,346, which was 2.1 % of the entire 5.2 million population. The largest groups were Russians, Estonians, Swedish and Somali refugees. There were more foreigners of working age than there were Finns, but twice as many were unemployed [1].

The first study on immigrants and accidents was carried out by Collins in 1959 [2]. At the naval shipyard in Singapore he found that Chinese workers had more accidents than Malaysian workers. Later Bong, Chao and Lee [3] showed that the fatality rate of foreign workers was three times higher than that of original Singapore citizens. Foreign workers sought help from emergency services for work-related injury 1.6 times more often and were hospitalised twice more often [4].

The next studies were conducted in the United Kingdom. Factory workers from Asia had higher accident rates than British workers [5]. Asians in a large vehicle manufacturing company were more often involved in occupational accidents than whites [6].

In the USA, most studies with migrant workers were carried out with seasonal farm workers. The accident rate of migrant farm workers in California was three times higher than that of the general population [7], and male migrant workers had similar accident rates to other hired farm workers in South Carolina [8]. Children of migrant farm workers in rural South Texas had 2 to 4 times more often occupational injuries than other students [9]. Immigrant Latino workers in Virginia had a higher accident rate than that of the general population [10], and foreign-born workers were more often involved in fatal occupational accidents than native-born American workers [11]–[13].

In Switzerland also, foreign construction workers had more accidents than Swiss workers [14], and in Sweden, foreign workers at an automobile and truck factory had fewer accidents than Swedish workers [15]. The disability risk of Turkish scaffold workers was double that of Dutch scaffold workers [16]. In Germany, foreign construction workers had fewer accidents but were killed by falling objects four times more often than German workers [17]. Ethnic German immigrants from the former Soviet Union had an increased risk of accident fatality in North Rhine Westphalia [18]. Similarly in Oslo, workers speaking languages other than Norwegian were involved in 30% of hospitalized injuries, whereas their proportion of the workforce was only 12% [19]. In the Lazio Region on the other hand, immigrant workers were not significantly more often involved in hospitalized work injuries than Italian workers [20], but in Spain, the risk of fatal occupational injury was six times higher for foreign female workers and four times higher for foreign male workers [21]. Ethnic minorities also had an increased risk of fatal injuries in the Netherlands [22].

Migrant workers in Alberta, Canada had a higher accident rate than the general population of employed people [23]. Foreign workers had an accident rate three times higher than Bahrain workers [24], and foreign workers in Al-Khobar City, Saudi Arabia were involved in occupational injuries 4.4 times more often than Saudis [25]. In Taiwan, however, foreign workers did not have a higher accident frequency than native workers [26]. Fatalities at work among overseas-born rural and mining workers were higher than among Australian-born workers [27].

The excess fatality rate of migrant workers disappeared in five years in Australia [27]. Also in the Swedish automobile plant, the higher accident rate of foreign workers decreased after the first five years [15]. However, half of the injured foreign workers in Singapore had worked at least two years [28].

We can conclude that the majority of studies showed foreign workers to have higher accident frequency than native workers. Exceptions were in Sweden, Italy and Taiwan, where foreign workers had fewer accidents than the native population. On the other hand, studies showed that the higher accident frequency of foreign workers disappeared during five years, perhaps because foreigners learn the language, which in turn fosters safer work. The aim of this study is to examine, whether immigrant workers have more occupational accidents than Finnish workers.



## 2 METHOD

Helsinki Bus Transport (HBT) is the main traffic operator in the Helsinki capital area of about one million inhabitants. The company has 1,300 bus drivers altogether of which about 400 are foreign-born. The first foreign drivers were Finnish speaking from Ingermanland near St. Petersburg (so called homecoming movers).

A total of 769 questionnaires were mailed to the home addresses of bus drivers of Helsinki Bus Transport. We received 302 completed questionnaires, thus the total response rate was 39.3%.

Based on random selection, every second Finnish-born drivers received the questionnaire. A total of 421 letters were mailed to them. The drivers returned 173 questionnaires, thus the response rate was 41.1%.

Supervisors pick up all foreign drivers. They found 348 drivers altogether, who had received the letter. The foreign drivers returned 129 questionnaires altogether, so that the response rate was 37.1%.

One question in the larger questionnaire concerns occupational accidents: "Have you been involved in an accident at work or while commuting during the last 12 months?" The subject chose zero if he/she was not involved or alternatively reported the number of occupational accidents. The Finnish-language questionnaire was translated into English, Russian, Estonian and the Somali languages.

## 3 RESULTS

Foreign-born bus drivers were slightly but not significantly more often involved in occupational accidents than Finnish-born drivers (12.3% vs. 9.4%,  $\chi^2 = 0.3$ ,  $df = 1$ , n.s.). Because of many accident-repeaters among Finnish-born drivers, the accident frequency (accidents per 1,000 work years) was higher among Finnish-born drivers (172.4) than among foreign-born drivers (147.5).

## 4 DISCUSSION

There was no difference in the occupational accident rate among Finnish and foreign-born bus drivers in Helsinki, Finland. Although this result goes against the majority of previous studies, it is in line with the results from Sweden, Italy and Taiwan. There were also no difference in the severity of occupational injuries between Lebanese and foreign workers in Lebanon [29].

The study is based on the self-reported accidents of foreign and Finnish bus drivers. However, previous studies showed that migrant workers significantly underreported their work-related accidents [30]. This is one possible explanation for the fact that we didn't find any differences between foreign and native workers in this study.

Another shortcoming of this study is that the recalling period was 12 months. Previous studies have shown that people forget about 30% of their accidents over the duration of a year [31]. However, twelve months is the usual recalling period in the Finnish studies, and moreover, an accident is such a rare occurrence that there would not be enough observation material in a shorter recalling period.

One possible explanation for the higher accident rate of migrant workers is that they were overrepresented in

dangerous jobs [32]. Another possible explanation is the lack of congruence between a migrant's culture and workplace culture, for example different languages [23]. This language barrier can render traditional safety training useless [33].

We will later analyze the difference between foreign-born and Finnish bus drivers in occupational accidents based on company records. It is a more objective method for measuring accidents than the self-reporting used in this study. Perhaps we will also have the opportunity to measure the safety climate in the company, as an earlier study [34] showed that perceived safety climate was related to company differences in accident rates among Latino poultry workers in North Carolina.

There are also cultural differences among how people react to the accidents. For example, injuries affected the male identity and pride of migrant Latino day labourers in San Francisco, because it prevents them supporting their family and ruins the reputation of being a tough worker, which is important in their culture [35]. Thus Latinos fear employer punishment and seldom reported workplace injuries [33].

## ACKNOWLEDGEMENT

This study has been funded by the Finnish Work Environment Fund and Finnish Ministry of Labour.

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# Measuring effects of ethical operations

**Dr Donarski Jerzy**

Dean of Management Department, The Bogdan Janski Academy, e-mail: donarski@nkp.pl

**Keywords—ethicality, social gains, competitive productivity, EC1000**

## 1 AIMS OF THIS RESEARCH

### 1.1 Measuring is still a problem

Measuring the effects: the number of social gains and the competitive productivity of ethical operations, require still empirical research. Social gain is simply the consequence of ethical operation. To manage successfully the implementation of the Lisbon strategy and Corporate Social Responsibility - CSR strategy, practical methods and tools for managers are required.

Measuring requires ethical values and principles to be used as yardstick-model for measuring, as ethics for making ethical operations. What are the ethical values and principles can be used by decision makers and employees in Europe? What is the impact of attitude ethicality of decision makers on social gains and on the influence power for competitive productivity?

### 1.2 Three aims of this research

**Practical aim:** To prepare for managers a method and tools for measuring the effects of ethical operations, to plan and monitor the pro ethical activity (operations).

**Didactic aim:** to communicate and embed ethical values and principles into the organisation.

**Theoretical aim:** To prove the hypothesis: "Attitude ethicality of the decision makers has an impact on effects. The higher the attitude ethicality is – the higher the consequence-effect: Number of Social Gains per one stakeholder and these in turn leading to the achievement of competitive productivity. It can be measured.

## 2 METHOD AND TOOL FOR MEASURING

### 2.1 The method

The method is simply based on collection of opinions from two groups of respondents: the stakeholders (internal) and decision makers. The opinions of stakeholders are on decision making process ethicality and in matrix relation are on the attitude ethicality of decision makers. This means *ex post* the relation - the social gains versus attitude ethicality to conclude, using the reversible connection, *ex ante* the attitude recommended to be taken by decision makers to achieve higher social gains and competitive productivity. The decision makers select the ethical value system for their own company, taking into consideration internal and external conditions for the decisions to be taken.

### 2.2 The indicators measuring the effects

Two main indicators are proposed for measuring the effects:

- ❖ NSG - Number of Social Gains per 1 stakeholder-respondent. It is the ratio of the sum of stakeholders opinions "YES" which of ethical principles are applied in the company, divided by the number of respondents. It range is from "0" to the number of the full set of principles.
- ❖ CP – Competitive Productivity. Productivity is competitive if the Productivity Operation Surplus POS of the particular analyzed company is bigger than the POS of the whole competitor's branch at the home market (or at markets from other countries the company likes to enter - what is an essential question raised at the EPC 2006). Productivity Operation Surplus per 1 hour of presence at work of the total number of employees is calculated from productivity P minus "wages and salaries" in the particular analyzed company.

"Ethicality" please understand simply as the degree of conformity to ethical principles (drawn as analogy to the definition of "morality is the degree of conformity to moral principles" published in: "The Concise Oxford Dictionary", Oxford at the Clarendon Press, seventh edition 1982, p. 657.)

### 2.3 The model of 197 criterions for the evaluation of ethicality of operations in a company (decision making ethics)

To measure the number of social gains we have to have a model of ethical principles, which, when followed by the decision makers (and remaining crew members of the company), will contribute to creation of social gains or even common good. Such a model was proposed by the author, who has prepared a list of 197 ethical principles mainly from three European sources mentioned in TABLE 1

TABLE 1  
SOURCES FOR DECISION MAKING ETHICS

The source and kind of main document	Number of principles
John Paul II, Encyclical letter Centesimus annus, Libreria Editrice Vaticana, Vatican 1991, [1] ch. IV- V.	64+28
European Commission, Employment and social affairs, Partnership for a new organisation of work. Synthesis of responses, Manuscript completed in 1998, [2] pp. 5-19.	41
European Association of National Productivity Centers, Productivity, Innovation, Quality of working Life and Employment. Memorandum, Brussels, February 1999, [3] pp. 7 -14.	64
TOTAL:	197

Source: Own Doctoral Dissertation [5] p. 17

### 2.3. The matrix of 9 relations: Decision makers – Stakeholders for measuring the impact

To prove empirically the impact of attitude ethicality of decision makers on social gains the 9 relations of evaluation of the : “Decision-makers versus Stakeholders” matrix of. Professor T. Pietrzkiewicz is used. He is the co creator of the method presented in this paper. The matrix he has published in his book, 2002 [4] p. 27, and under the title: *Rationality and Ethics of Economic Decisions*, has published ,in the scientific journal, periodical “Praxeology”, Warsaw: The Polish Academy of Science, pp.175-184.

This matrix is based on three kinds of ethical attitudes: Self-interested – I, not self-interested (rational) -N and self sacrificed – Explanation: Self-interested - he is guided mainly by his personal interest; Not-self-interested – he is guided mainly by the decision making procedures; Self - sacrificed – he is guided mainly by the interest of COMMON GOOD. [4] p. 59. Each of these kinds of ethical attitudes is causing three different consequences, such as social gains or social losses or neither losses nor gains.

### 2.4 The design of the matrix tool for research

The questionnaire was designed as a matrix described in 2.4. Vertically in the tool are specified the 197 ethical principles and horizontally – the three kinds of ethical attitude..

TABLE 2  
SCHEME OF THE DESIGN AND CONTENTS OF THE MATRIX TOOL

DECISION MAKING AREAS	PRO-BLEM FIELDS	ETHI-CAL PRINCI-PLES	“+” “-” “0”	VALU ES (WEIGH OUT OF 1000)	COM-PETI-TIVE POW-ER
1	2	3	4	5	6
MISSION	4	34			
PRODUCT	5	26			
TECHNOLOG Y	7	22			
PERSONAL POLICY	6	90			
FINANCIAL POLICY	7	25			
TOTAL	29	197			

SELF-INTERESTED	NOT-SELF-INTERESTED	SELF-SACRIFICED

RESOURCE: DOCTORAL DISSERTATION, [5], p. 49

The stakeholders-respondents, in column 4, are expressing their opinion which of the specified 197 ethical principles are applied (+) or not (–) or he doesn’t know (0).

The respondent has to express, after each decision making area his opinion on the ethical attitude of decision makers, marking I, or N or S.

The decision makers, in column 5, express their weight(out of 1000) each principle has in the decision making process, taking into consideration internal and external conditions of particular company. They have no upper limitation, so, for example in the research done

several decision makers have given up to 90 points to some particular ethical principles. Point “1” means that this ethical principle has no meaning in this particular company. It is an important feature of this method – each company has its own ethical value system.

This method and tools were labeled: E1000 (Ethicality) and after inclusion of the search for competitive productivity labeled EC1000 (EthicalCompetitiveness).

## 3 RESEARCH FINDINGS, YEAR 2004, 2005, 2006

### 3.1 The social gains and competitive productivity in six enterprises in Poland, Year 2004.

This research was done in 2004, in the scope of doctoral dissertation of the author and accepted in June 2005 [5]. Stakeholders in a total number of 167 were involved as respondents working in six industrial enterprises named A,B,C,D,E,F. This means 167 x 197 ethical principles –altogether above 32 thousand opinions had been collected in the 167 questionnaires. Nine decision makers have selected their own ethical value system. The collected opinions of the stakeholders, after aggregation (aggregation is possible because all principles-questions are formulated positively and thus can be added as a sum for the whole company) are presented in TABLE 3

TABLE 3  
SOCIAL GAINS (SG) IN POINTS OUT OF 1000 POINTS

	Companies in sequence of Social Gains					
	C	A	D	B	E	F
TOTAL Social Gains	486	597	639	717	835	846
Consequence from “I”ethical attitude	238	252	277	260	222	225
Consequence from “N+S”ethical attitude	248	345	362	457	613	621

COMPETITIVE PRODUCTIVITY (all data in \$/1hour)

Productivity	6	n.d.	9	13	18	28
Wages and salaries	4	n.d.	4	4	4	4
POS -Productivity Operation surplus	2	n.d.	5	9	14	24
Productivity of the competitive branch	11					10
Wages and salaries in the c. branch	4					4
POS b. Productivity Operation surplus of the c. branch	7					6
Competitive Productivity should	14					already

Source: Own research [5] p. 97. For the Branch it is a recent simulation done, to show the method proposed.

The first conclusion can be drawn: the number of social gains (in points) doesn’t depend on the consequences from the “self-interested - I” ethical attitude of decision makers – but depends on the consequences of the “not self-interested + self-sacrificed – N+S” . More - the consequence from “self-interested” has a tendency to be constant (it is 222-260). It has an important meaning for the practical application by managers – There will be no need in the future to ask stakeholders of a company. on the delicate question what the ethical attitude of their decision makers

is. It can be an contribution to the management theories development.

The second conclusion that can be drawn is: the higher the social gains the higher the productivity and competitive productivity.

The above conclusions were seen, in the doctoral dissertation, only as initial confirmation of the hypothesis. Therefore further research in more enterprises had been started in the year 2005 and 2006.

### 3.2 The social gains from the decision area: MISSION, in 176 enterprises. Fundamental values. Year 2005

This research had the aim to check if the tendency of consequences from “self-interested” ethical attitude of decision makers keeps the tendency to be constant. The respondents were employees of 176 business organizations master degree students of management departments on the Bogdan Janski Academy and the Warsaw University The research focused on the decision making area: MISSION of the company, as whole and on the problem field: “Fundamental values of the company” in the breakdown into 8 ethical values and principles according to the social teaching directed by John Paul II to the entrepreneurs and employees in companies.

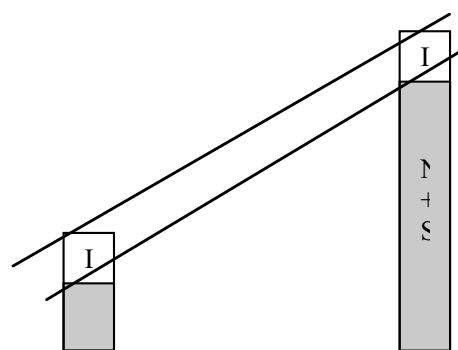
The “Discrimination power” concept was applied for the aggregation of the collected opinions on the questionnaires E1000 MISSION. Therefore from the 176 questionnaires were separated two groups of companies - those with the highest number of applied ethical principles, and those with the lowest number. The findings are presented in TABLE 4.

TABLE 4  
SOCIAL GAINS IN 50 COMPANIES WITH HIGHEST AND 50 LOWEST NUMBER OF APPLIED ETHICAL PRINCIPLES

Name of indicator:	50 companies with lowest ethicality	50 companies with highest ethicality
TOTAL NUMBER SOCIAL GAINS - NSG	8/ 1 stakeholder	25/ stakeholder
from “self-Interested” attitude of decision makers	5/ 1 stakeholder	5/ 1 stakeholder
from “Not-self-interested + Self-sacrificed attitude of decision makers	3/ stakeholder	20/ stakeholder
Indicator E-SG - the impact of attitude ethicality on NSG	3:34 x100= 9 %	20:34 x100= 59 %
Ethicality - E	8:34x100= 23 %	25:50x100= 73 %

Source: Own research from 176 companies [6]

Graphically the different Number of Social Gains from “I” and from N+S can be presented as follows:



Interpretation - the hypothesis has again been confirmed in this research: Not the number of 5 social gains from the “self-interested” attitude have made the number of 25 TOTAL SOCIAL GAINS but the 20 from the “non-self-interested + self-sacrificed” attitude. Again the number of “self-interested” attitude demonstrates to be constant - it is 5 in the 50 companies with lowest number of social gains as well 5 in the 50 with highest number.

The question arises – which ethical principles out of 34 in the decision making area MISSION are making the high Number of Social Gains? The answer is: some fundamental values of the company have high frequency of opinion “YES”, what means that this principles is applied and gives him social gain

TABLE 5  
SOME FUNDAMENTAL VALUES OF THE COMPANY

ETHICAL VALUES AND PRINCIPLES (selected from the research tool E1000) [4] p. 216	YES in 50 compa-nies with lowest	YES in 50 compa-nies with highest
1.6.a. Recognition of the legitimacy of workers' efforts to obtain full respect for their <b>dignity</b> and to gain broader areas of <b>participation</b> in the life of industrial enterprises (CA 43)	6 %	90 %
1.8. In the company has to be recognized that <b>MAN</b> is more important than thing (	10 %	88 %
1.6.e. My right to <b>freedom</b> as well as <b>duty</b> of making responsible use of the freedom	16 %	88 %
1.2. A common tendency of the CREW towards the <b>continuous development</b> has to be the basis for the MISSION being implemented	22 %	82 %
1.6.f. Determining is the role of a disciplined and <b>creative work</b> of the company's CREW and, - as an essential part of this work – the role of capability to initiatives and <b>entrepreneurship</b> (CA 32)	43 %	82 %
1.3. The creation of more dignity in the live through <b>solidarity at work</b> , specifically contribution to strengthen the dignity and development of the <b>capabilities of each person</b> – is the principle to be implemented by our CREW (CA 32)	12 %	76 %
1.6.c. <b>Profit</b> is a regulator of the life of the business, but it is not the only one; other human and <b>moral factors</b> be considered, which, in long term are at least equally important for the life of the business (CA 35)	20 %	76 %
The principle that MAN, member of the company's CREW, is the main wealth of the firm has to be taken into consideration in the mission, by the Board of Management (CA 32)	6 %	70 %

Source: John Paul II, encyclical letter Centesimus annus [...]



### 3.3. 2006 .Measuring the influence of ethicality on competitive productivity (bridge coefficient)

This research was done on 220 other business organizations. The respondents were again part-time students who are employees of these 220 business organizations.

To get a wider picture this research covered not only the MISSION , but also the decision area PRODUCT and PERSONAL POLICY. These areas have 150 ethical principles (34+26+90). In this paper again only results for MISSION are presented.

To measure this influence we need a “bridge coefficient - BC”. It is the ratio of influence scale to the maximum of influence possible. This research aims to measure the influence of ethicality on the competitiveness power from ethical principles applied and from not applied, the correlation between ethicality and competitive productivity. The method was simple. To the research tool-questionnaire E1000 was added additional column under the heading - impact power on competitiveness. The respondent , after the identification of ethical principles, applied in his company, had to do to express his opinion which of the applied ethical principles have an influence on competitive productivity. The power of influence is expressed by the respondent marking each ethical principle from 1 to 10. There is the logical assumption that the present level of productivity in each particular company was already influenced by the applied ethical principles. The respondent has received a third task: to analyze the not applied ethical principles in the practice of his company but, which, in his opinion, may influence additionally the present level of productivity and thus contribute to raise the productivity from the present level towards the “competitive productivity.

The data collected from the N = 220 questionnaires labeled now EC1000 (Ethical Competitiveness) of this influence research are presented in TABLE 5

TABLE 6  
ETHICALITY INFLUENCE ON COMPETITIVE PRODUCTIVITY

Name of indicator:	60 companies with lowest NSG		60 companies with highest NSG	
	NSG	Influence on comp. productivity “IC”	NSG	Influence on comp. productivity “IC”
TOTAL	8	17 %	28	63 %
...from “self-interested” attitude of decision makers	4	8 %	4	8 %
...from “non-self-interested +self-sacrificed” attitude of decision makers	4	9 %	24	55 %

Resource: Own research not yet published (Year 2006)

Interpretation: The influence of high attitude ethicality of the decision makers on competitiveness power is much bigger than the influence of low attitude ethicality.

## 4.. SUMMARY CONCLUSION DRAWN FROM THIS RESEARCH

### 4.1. Method and tools for managers

The method and tools can be applied by managers of each companies and serve them to measure the present ethicality, social gains produced and to check if the productivity is competitive or not. The present state will be the basis for planning of the needed multiplication of social gains and productivity level and make the pro ethical operation plan for the company. This tools can serve also to monitor the effects achieved.

Obviously the list of ethical principles in the questionnaire with the now 197 ethical principles for the five decision making areas :MISSION, PRODUCT, TECHNOLOGY, PERSONAL POLICY, FINANCIAL POLICY - will have to be continuously revised and adapted by the decision makers of particular companies to the specific of the company. In some cases the list will have to be increased.

### 4.2 Further applied research with companies is needed

The strength of this method is that it enables to employ the “social dialog” between the decision makers, representing the shareholders and the stakeholders of the particular company. The assumption is that all employees of a company have to have the right to express their opinion on the present state of the social gains and involve all of them into search for ethical operation which may influence the competitive productivity. The total CREW creative involvement ant long life learning are the recently recognized is an important factor for sustainable growth through the Corporate Social Responsible - CSR strategy.

At the Bogdan Janski Academy in Warsaw a government to be financed had been prepared to be conducted with more than 200 companies with two aims *first*: to start pro ethical progress through planning the pro ethical operation and *second* to continue the theory that ethicality contributes to multiplication of social gains, competitive productivity and finally to increase number of better workplaces and higher employment.

### 4.3. Contribution to European ethicality standards

AA1000 AccountAbility standard, British origin, becomes more and more an European standard for ethics and corporate social responsibility. The EC1000 proposed in this paper can be a contribution to the selection of ethical values by company’s decision makers and to the measurement of ethicality.

## ACKNOWLEDGEMENT

This paper is devoted to the memory of Prof. Tadeusz Pietrzkiwicz, co-creator of the method presented, creator of the 9 fields of relations’ evaluation: “Decision-makers – Stakeholders”, great ethical authority. My thanks for the five years of creative guidance, as the thesis director, to develop this method and tools. He passed in October 2005

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# Productivity theory and measurement in business

Seppo Saari

Doctor of Science in Technology at Satakunta University of Applied Sciences, Finland, seppo.saari@samk.fi

**Keywords—** productivity, theory, measurement, business

This paper is based on the book [19] with the same name in Finnish

## 1 INTRODUCTION

The purpose of this paper is to operationalize the concept of productivity in business. Operationalization comprises the following five steps: 1) *Phenomenon description*. The phenomenon of productivity is described as part of economic activity. 2) *Concept formation*. Productivity is defined as a concept in close relation to such concepts as profitability, economic growth, efficiency, surplus value, quality, performance, partial productivity, need, etc. 3) *Modelling*. A model of productivity measurement is presented, based on the most accurate business data. A time series construction for the development of productivity, profitability and production income distribution is suggested. Interpretations of the partial productivity measurement are given. 4) *Horizontal comparison*. The production function-based models for business are compared by identifying their features and evaluating the differences. 5) *Vertical comparison*. Productivity models of a business and a nation are compared by identifying their features and evaluating the differences.

As a result, operationalization of the concept of productivity is presented based on the most accurate business information. A quantitative model is demonstrated. Differences in productivity measurement models are made transparent and evaluated based on the production theory.

## 2 PRODUCTIVITY AS PART OF ECONOMIC ACTIVITY

It is most advisable to examine any phenomenon whatsoever only after defining the entity the phenomenon under review forms part of. Then it will be possible to analyse the phenomenon as part of such an entity. Hence, productivity cannot be examined as a phenomenon independently but it is necessary to identify the entity it belongs to. Such an entity is defined as economic activity. It goes without saying that productivity is a critical success factor of economy in one way or another. To define the way is the object of this study. The next step is to describe the model of economic activity and the concepts involved in it.

### 2.1 Model of Economic Activity

The primary purpose underlying any economic activity is *the satisfaction of human needs*. Welfare can be understood

as an adequate degree of needs satisfaction. Need is either a physical or a mental state in which the lack of something necessary, desired or hoped for is experienced consciously or unconsciously. A need initiates a target-oriented activity towards meeting the need.

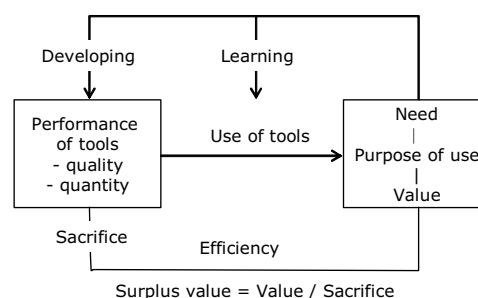


Figure 1. Model of economic activity

Needs are met by means of *tools*. Tools provide some value for their user. Man creates various material and immaterial tools for his use, and tools provide him with some value, need satisfaction. The purpose of use is an idea of how the need is met by means of a given tool. The purpose of use is an idea derived from the qualities of the need and from the characteristics of the tool or it is a more specified plan for the use of the tool and for the value it will produce. Need satisfaction is a result of the value the tool provides, and the degree of need satisfaction varies all according to the success of the tool in its purpose of use.

A basic feature of economic behaviour is the interest to satisfy the needs to the maximum at minimal sacrifice. Here we speak about striving for efficiency which is typical of economic activity. *Efficiency*, in general terms, speaks about the relation between producing a *value* and *sacrifices* made in doing so. Hence, efficiency is at issue when the required sacrifices are being balanced against the value produced. Efficiency is a general concept related to economic activity, and it needs to be given a precise name and a formula case by case. Productivity and profitability are typically such specified concepts of efficiency. The basic idea of efficiency of the tools is that the value they produce is larger than the sacrifices made to provide and use them. The difference or relation between produced value and made sacrifice is *the surplus value*.

The ability of a tool to perform its task is its performance. Performance is a common expression which needs to be further defined in order to understand it exactly. More often than not, performance refers to a tool keeping up with its basic task. The tools' performance depends on their

quality and quantity. Improving the performance takes place by developing their quality and increasing their quantity as well as by evolving the use process. The tools' *quality* means their characteristics. Both quality and quantity are usually developed on the basis of the latest know how and experience, and the work is carried out by means of investment and development projects. The use process of tools evolves over the time through learning.

Based on the distribution of work, economic activity can be identified with *production* and *consumption*. Production is a process of combining various immaterial and material inputs of production so as to produce tools for consumption. The way of combining the inputs of production in the process of making output is called *technology*. Technology can be depicted mathematically by *the production function* which describes the function between input and output. The production function is the measure of production performance.

## 2.2 Economic Growth and Productivity

By help of the production function, it is possible to describe simply the mechanism of economic growth. Economic growth is a production increase achieved by an economic community. It is usually expressed as an annual growth percentage depicting (real) growth of the national product. Economic growth is created by two factors so that it is appropriate to talk about the components of growth. These components are an increase in production input and an increase in productivity.

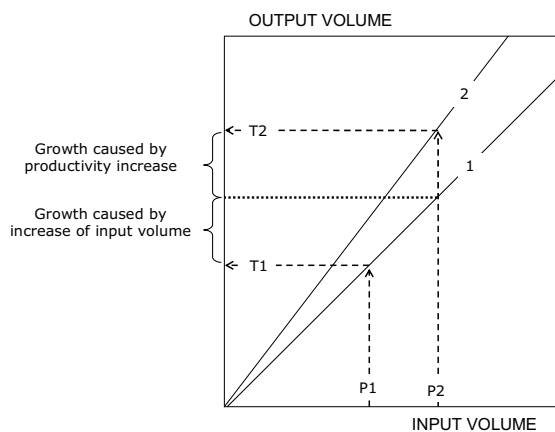


Figure 2. Components of economic growth

The above figure presents the economic growth process. By way of illustration, the proportions shown in the figure are exaggerated. Reviewing the process in subsequent years, one and two, it becomes evident that production has increased from Value T1 to Value T2. Measured in absolute terms, economic growth is  $T2 - T1$ , while proportionally speaking, it is  $(T2 - T1)/T1$ . At the same time, an increase from Value P1 to Value P2 was measured in the use of production input. Now, both years can be described by a graph of production functions, each function being named after the respective number of the year, i.e., one and two. Two components are distinguishable in the output increase: the growth caused by an increase in production input and

the growth caused by an increase in productivity. The growth caused by an increased input is determined by moving along the production function for a respective input increase, i.e. from Value P1 to Value P2. Characteristic of the growth effected by an input increase is that the relation between output and input remains unchanged. An increase in output means a shift of the production function simultaneously with a change in the output/input relation. In other words, the output growth corresponding to a shift of the production function is generated by the increase in productivity.

Accordingly, an increase in productivity is characterized by a shift of the production function and a consequent change to the output/input relation. The formula of total productivity is normally written as follows:

$$\text{Total productivity} = \frac{\text{Output quantity}}{\text{Input quantity}}$$

According to this formula, changes in input and output have to be measured inclusive of both quantitative and qualitative changes [8]. In practice, quantitative and qualitative changes take place when relative quantities and relative prices of different input and output factors alter. In order to accentuate qualitative changes in output and input, the formula of total productivity shall be written as follows:

$$\text{Total productivity} = \frac{\text{Output quality and quantity}}{\text{Input quality and quantity}}$$

Davis [4] has deliberated productivity as a phenomenon in business, measurement of productivity, distribution of productivity gains, and how to measure such gains. He refers to an article (1947, Journal of Accountancy, Feb. p. 94) suggesting that the measurement of productivity in business shall be developed so that it "will indicate increases or decreases in the productivity of the company and also the distribution of the 'fruits of production' among all parties at interest".

Davis regards the measurement of productivity gains distribution as an important part of the productivity phenomenon, and he deliberates the problems related to measuring it at great length. According to Davis, the price system is a mechanism through which productivity gains are distributed, and besides the business enterprise, receiving parties may consist of its customers, staff and the suppliers of production inputs. In this paper, the concept of "distribution of the fruits of production" by Davis is simply referred to as *production income distribution* or shorter still as *distribution*.

## 3 PRODUCTIVITY MEASUREMENT MODEL

First, we describe the main processes of business, and after that, we study in great detail the most interesting processes from the point of view of productivity and the solutions to measure such processes. Productivity as the focus of interest, we must first identify its connection with profitability and only then identify the processes generating productivity and profitability.



### 3.1 Main processes of a company

Business operations can be divided into sub-processes in different ways; yet, the following five are identified as main processes, each with a logic, objectives, theory and key figures of its own. It is important to examine each of them individually, yet, as a part of the whole, in order to be able to measure and understand them. The main processes of a company are as follows:

- real process
- income distribution process
- business process
- monetary process
- market value process

Productivity is created in the real process, productivity gains are distributed in the income distribution process, and these two processes constitute the business process. The business process and its sub-processes, the real process and income distribution process occur simultaneously, and only the business process is identifiable and measurable by the traditional accounting practices. The real process and income distribution process can be identified and measured by extra calculation, and this is why they need to be analysed separately in order to understand the logic of income formation in business.

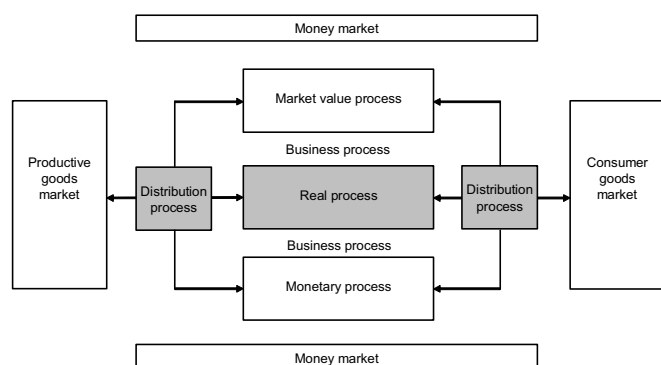


Figure 3. Main processes of a company

*Real process* generates the production output, and it can be described by means of the production function. It refers to a series of events in production in which production inputs of different quality and quantity are combined into products of different quality and quantity. Products can be physical goods, immaterial services and most often combinations of both. The characteristics created into the product by the manufacturer imply surplus value to the consumer, and on the basis of the price this value is shared by the consumer and the producer in the marketplace. This is the mechanism through which surplus value originates to the consumer and the producer likewise. Surplus value to the producer is a result of the real process, and measured proportionally it means productivity.

*Income distribution process* of the production refers to a series of events in which the unit prices of constant-quality products and inputs alter causing a change in income distribution among those participating in the exchange. The magnitude of the change in income distribution is directly

proportionate to the change in prices of the output and inputs and to their quantities. Productivity gains are distributed, for example, to customers as lower product prices or to staff as higher pay.

*Business process* consists of the real process and the income distribution process. A result and a criterion of success of the business process is profitability. The profitability of business is the share of the real process result the producer has been able to keep to himself in the income distribution process. Factors describing the business process are the components of profitability, i.e., returns and costs. They differ from the factors of the real process in that the components of profitability are given at nominal prices whereas in the real process the factors are at fixed prices.

*Monetary process* refers to events related to financing the business.

*Market value process* refers to a series of events in which investors determine the market value of the company in the investment markets.

### 3.2 Surplus value as a measure of business profitability

The scale of success run by a going concern is manifold, and there are no criteria that might be universally applicable to success. Nevertheless, there is one criterion by which we can generalise the rate of success in business. This criterion is the ability to produce surplus value. As a criterion of profitability, surplus value refers to the difference between returns and costs, taking into consideration the costs of equity in addition to the costs included in the profit and loss statement as usual. Surplus value indicates that the output has more value than the sacrifice made for it, in other words, the output value is higher than the value (production costs) of the used inputs. If the surplus value is positive, the owner's profit expectation has been surpassed.

TABLE 1. PROFITABILITY OF BUSINESS MEASURED BY SURPLUS VALUE

	Period 1			Period 2		
	Quantity	Price	Value	Quantity	Price	Value
Product 1	210.00	7.20	1512	247.25	7.10	1755
Product 2	200.00	7.00	1400	195.03	7.15	1394
Output			2912			3150
Labour	100.00	7.50	750	115.00	7.70	886
Materials	80.00	8.60	688	79.20	8.50	673
Energy	400.00	1.50	600	428.00	1.55	663
Capital	160.00	3.80	608	164.80	3.90	643
Input			2646			2865
Surplus value (abs.)			266.00			285.12
Surplus value (rel.)			1.101			1.100

Table 1 presents a surplus value calculation. This basic example is a simplified profit and loss statement used for illustration and modelling. Even as reduced, it comprises all phenomena of a real measuring situation and most importantly the change in the output-input mix between two periods. Hence, the basic example works as an illustrative "scale model" of production without any features of a real measuring situation being lost. In practice, there may be hundreds of products and inputs but the logic of measuring does not differ from that presented in the basic example.

Both the absolute and relative surplus values have been calculated in the example. The absolute value is the difference of the output and input values and the relative value is their relation, respectively. The surplus value calculation in the example is at a nominal price, calculated at the market price of each period.

### 3.3 Production model

The next step is to describe a *production model* [15]-[19] by help of which it is possible to calculate the results of the real process, income distribution process and business process. The starting point is a profitability calculation using surplus value as a criterion of profitability. The surplus value calculation is the only valid measure for understanding the connection between profitability and productivity or understanding the connection between real process and business process. A valid measurement of total productivity necessitates considering all production inputs, and the surplus value calculation is the only calculation to conform to the requirement.

The process of calculating is best understood by applying the clause of *Ceteris paribus*, i.e. "all other things being the same," stating that at a time only the impact of one changing factor be introduced to the phenomenon being examined. Therefore, the calculation can be presented as a process advancing step by step. First, the impacts of the income distribution process are calculated, and then, the impacts of the real process on the profitability of the business.

The first step of the calculation is to separate the impacts of the real process and the income distribution process, respectively, from the change in profitability ( $285.12 - 266.00 = 19.12$ ). This takes place by simply creating one auxiliary column (4) in which a surplus value calculation is compiled using the quantities of Period 1 and the prices of Period 2. In the resulting profitability calculation, Columns 3 and 4 depict the impact of a change in income distribution process on the profitability and in Columns 4 and 7 the impact of a change in real process on the profitability.

### 3.4 Calculation of the income distribution process

The key figures of income distribution can now be calculated from the surplus value calculations in Columns 3 and 4. The difference of 39.00 (unfavourable) between the surplus values indicates the impact on profitability in terms of money. Indexes depicting the change in income distribution can now be calculated by the formulas presented both for output ( $1.003$ ) and input ( $1.018$ ), and as their ratio for the whole business

$$1.003/1.018=0.985.$$

It follows that the change in income distribution means a development in which the quality of output or input stays the same while the unit price changes. A change of price does not involve recompensing for the change in quality. In the short term, price changes do not follow a certain trend, yet, in the long term, the trend is transparent. Consumers benefit from lowering product prices and their buying

power increases thanks to better compensation for selling their work input to production. Production income distribution is the mechanism by means of which productivity gains of the production are distributed to interested parties, and it can be measured by means of price changes.

TABLE 2. PRODUCTION MODEL

		Period 1			Q <sub>i</sub> ×P <sub>2</sub>	Period 2		
		1	2	3		5	6	7
		Quantity	Price	Value		Quantity	Price	Value
a	Product 1	210.00	7.20	1512.00	1491.00	247.25	7.10	1755.48
b	Product 2	200.00	7.00	1400.00	1430.00	195.03	7.15	1394.46
c	Output			2912.00	2921.00			3149.94
d	Labour	100.00	7.50	750.00	770.00	115.00	7.70	885.50
e	Materials	80.00	8.60	688.00	680.00	79.20	8.50	673.20
f	Energy	400.00	1.50	600.00	620.00	428.00	1.55	663.40
g	Capital	160.00	3.80	608.00	624.00	164.80	3.90	642.72
h	Input			2646.00	2694.00			2864.82
i	Surplus value (abs.)			266.00	227.00			285.12
j	Surplus value (rel.)			1.101				1.100
k	Change of distribution (abs.); i4-i3				-39.00			
l	Distribution index of output; c4/c3				1.003			
m	Distribution index of input; h4/h3				1.018			
n	Distribution index; l4/m4				0.985			
Distribution process								
p	Productivity; c4/h4, c7/h7				1.084			1.100
q	Productivity index; p7/p4							1.014
r	Change of productivity (abs.); (q7-1)×c4							41.12
s	Volume index of output; c7/c4							1.078
t	Volume index of input; h7/h4							1.063
u	Change of input volume (abs.); (t7-1)×(i4+r7)							17.00
Real process								
v	Change of profitability; j7/j3							0.999
x	Change of returns; c7/c3							1.082
z	Change of costs; h7/h3							1.083
Business process								

### 3.5 Calculation of the real process

Columns 4 and 7 depict the change in performance in the real process. Surplus values have been calculated at a fixed price, in this case, at prices of Period 2. Fixed-price calculation is a method in which the quantities of the items of different qualities can be measured and added up. This concept is called the volume which is a measure of absolute value. The time series depicting its change is called the volume index.

The surplus value of the real process is called the real surplus value as distinct from the nominal price surplus value of profitability. All changes in the surplus value of the real process are changes of performance. Productivity is the surplus value of the real process proportionally measured. Now it is possible to calculate productivity ( $1.084$  and  $1.100$ ) for Periods 1 and 2 using the formula of productivity output per input, and as their ratio we get the productivity index depicting the change in productivity.

$$1.100/1.084=1.014.$$

As a result, we can calculate the monetary quantity equivalent to the change in productivity, and in this case it is favourable 41.12.

### 3.6 Illustration of the real and income distribution processes

Measurement results can be illustrated by models and graphic presentations. The following figure illustrates the connections between the processes by means of indexes describing the change [12], [18], [19]. A presentation by means of an index is illustrative because the magnitudes of the changes are commensurate. Figures are from the above calculation example of the production model.

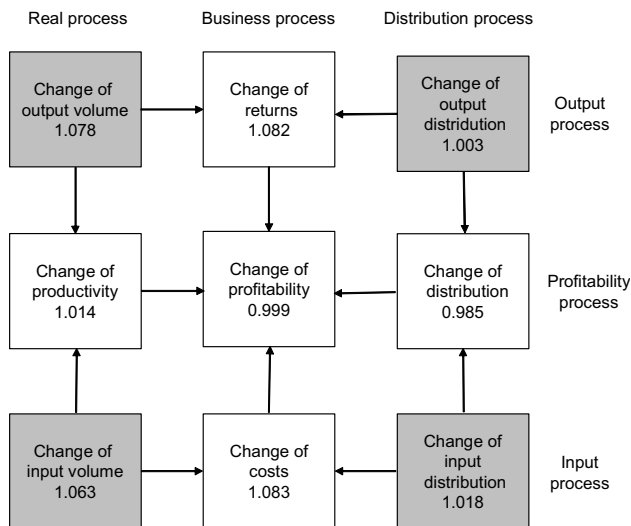


Figure 4. Variables of business performance

The nine most central key figures depicting changes in business performance can be presented as shown in Figure 4. Vertical lines depict the key figures of the real process, business process and income distribution process. Key figures in the business process are a result of the real process and the income distribution process. Horizontal lines show the changes in input and output processes and their impact on profitability. The logic behind the figure is simple. Squares in the corners refer to initial calculation data. Profitability figures are obtained by dividing the output figures by the input figures in each process. After this, the business process figures are obtained by multiplying the figures of the real and income distribution processes.

### 3.7 Depicting the development by time series

Development in the real process, income distribution process and business process can be illustrated by means of the time series. The principle of a time series is to describe, for example, the profitability of business annually by means of a relative surplus value and also to explain how profitability was produced as a consequence of productivity development and income distribution. A time series can be composed using the chain indexes as seen in the following.

Now the intention is to draw up the time series for the ten periods in order to express the annual profitability of business by help of productivity and income distribution development. With the time series it is possible to prove that productivity of the real process is the distributable result of production, and profitability is the share remaining

in the company after income distribution between the company and the interested parties participating in the exchange.

TABLE 3. PRODUCTIVITY AND INCOME DISTRIBUTION INDEXES

	1	2	3	4	5	6	7	8	9	10
Chain index of distribution	<b>1.101</b>	1.084	1.064	1.052	1.042	1.020	0.990	0.970	0.960	0.958
Annual index of distribution		<b>0.985</b>	0.981	0.989	0.991	0.978	0.971	0.980	0.990	0.997
Chain index of productivity	<b>1.101</b>	1.116	1.126	1.155	1.183	1.206	1.209	1.225	1.246	1.257
Annual index of productivity		<b>1.014</b>	1.009	1.026	1.024	1.019	1.003	1.013	1.017	1.009
Surplus value of business (rel.)	<b>1.101</b>	<b>1.100</b>	1.088	1.104	1.121	1.117	1.088	1.080	1.087	1.094

Figures in bold are from the calculation example. They can describe the entire logic of the table. A common starting point for the time series is the profitability of the first period, being 1.101 measured by the surplus value. The profitability of business is presented as an annual relative surplus value. A change in profitability between two periods can be presented using the profitability and income distribution index. For example, the development between Periods 1 and 2 can be expressed as

$$1.101 \times 1.014 \times 0.985 = 1.100.$$

In a market economy the prevailing competition sees to it that the productivity rise achieved in production will be distributed to interested parties sooner or later. This phenomenon can be illustrated by drawing up a chain index of the development of productivity and income distribution. The chain index is drawn up by multiplying the index of previous development by the index of annual change. In other words, productivity is given its first numeral value (1.116) by multiplying the common starting point (1.101) by the annual productivity index (1.014). This is the procedure for dealing with every period, and the formula explaining profitability by means of productivity and income distribution indexes holds to every period.

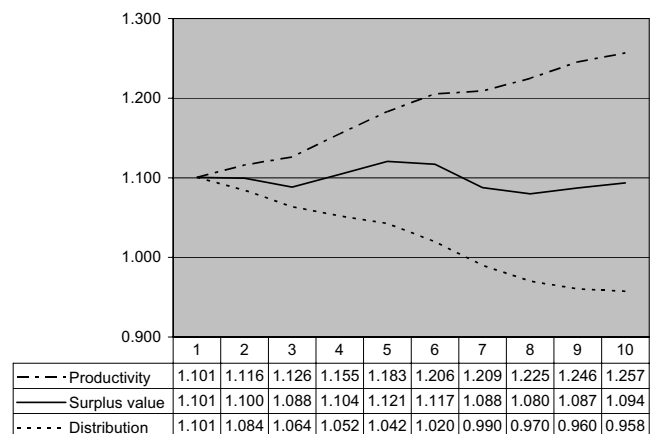


Figure 5. Profitability as a function of productivity and income distribution development

The above graph shows how profitability depends on the development of productivity and income distribution. Productivity figures are fictional but in practice they are perfectly feasible indicating an annual growth of 1.5 per cent on average. Growth potentials in productivity vary greatly by industry, and as a whole, they are directly proportionate to the technical development in the branch. Fast-developing

industries attain stronger growth in productivity. This is a traditional way of thinking. Today we understand that human and social capitals together with competition have a significant impact on productivity growth. In any case, productivity grows in small steps. By the accurate measurement of productivity, it is possible to appreciate these small changes and create an organisation culture where continuous improvement is a common value.

### 3.8 Measuring and interpreting partial productivity

Measurement of partial productivity refers to the measurement solutions which do not meet the requirements of total productivity measurement, yet, being practicable as indicators of total productivity. In practice, measurement in business means measures of partial productivity. In that case, the objects of measurement are components of total productivity, and interpreted correctly, these components are indicative of productivity development. The term of partial productivity illustrates well the fact that total productivity is only measured partially – or approximately. In a way, measurements are defective but, by understanding the logic of total productivity, it is possible to interpret correctly the results of partial productivity and to benefit from them in practical situations. Typical solutions of partial productivity are:

1. Single-factor productivity
2. Value-added productivity
3. Unit cost accounting
4. Efficiency ratios
5. Managerial control ratio system

*Single-factor productivity* refers to the measurement of productivity that is a ratio of output and one input factor. A most well-known measure of single-factor productivity is the measure of output per work input, describing work productivity. Sometimes it is practical to employ the value added as output. Productivity measured in this way is called *Value-added productivity*. Also, productivity can be examined in cost accounting using *Unit costs*. Then it is mostly a question of exploiting data from standard cost accounting for productivity measurements. *Efficiency ratios*, which tell something about the ratio between the value produced and the sacrifices made for it, are available in large numbers. *Managerial control ratio* systems are composed of single measures which are interpreted in parallel with other measures related to the subject. Ratios may be related to any success factor of the area of responsibility, such as profitability, quality, position on the market, etc. Ratios may be combined to form one whole using simple rules, hence, creating a key figure system.

The measures of partial productivity are physical measures, nominal price value measures and fixed price value measures. These measures differ from one another by the variables they measure and by the variables excluded from measurements. By excluding variables from measurement makes it possible to better focus the measurement on a given variable, yet, this means a more narrow approach.

The table below was compiled to compare the basic types of measurement. The first column presents the measure types, the second column the variables being measured, and the third column gives the variables excluded from the measurement.

TABLE 4. COMPARISON OF BASIC MEASURE TYPES

TYPE OF MEASURE	Variables to be measured	Variables excluded
Physical	Quantity	Quality and distribution
Fixed price value	Quantity and quality	Distribution
Nominal price value	Quantity, quality and distribution	None

A *physical measure* can measure the quantity of a variable with unchanged quality. Using a physical measure provides that the quality of the measurement object has been specified and the quality remains homogeneous. If the presumed unchanged quality is not realised, the measurement gives results which are hard to interpret. In this case, the results are affected by changes in both quantity and quality but in which proportion is unknown. Values of the objects being measured are by no means related to the physical measures, hence, changes in prices do not affect the measurement results. Normally it is not possible to combine physical measures. They are best suited for narrow-focused measurements without any quality or value alterations. Therefore, physical measures are best for measuring the real process, and this is why they are used a lot as tools of operative management. Typical ratios in a real process are capacity, efficiencies, lead times, loads, faults, product and process characteristics, etc.

A *fixed-price value measure* is used to measure changes in quality and quantity. True to its name, prices are kept fixed for a minimum of two measuring situations. For this reason, it is possible to define the changes in quality and quantity of a most varied and wide range of commodities, keeping apart the changes in income distribution. Fixed-price measures are suited for wide-ranging measurement because it is possible to combine different commodities based on their value. In a fixed-price measurement, a change in quality means that the relative quantities and relative prices of various commodities change. The best known applications of this are the productivity formula and the production function. The production function is always presented with fixed-price ratios, i.e., its variables, productivity and volume, are fixed-price values.

The most common figures in measuring business are the *nominal price figures* because they can describe the profitability of business process. Variables in the nominal price measurement are quality, quantities and distribution (prices). There are no excluded variables. Nominal price measures of value are suited for measuring profitability and its components as well as the value of reserves. Return and costs in the loss and profit statement are typical examples of a nominal price. In short-term reviews with only little



production income distribution taking place, nominal price values are well suited for estimates of fixed price values.

#### 4 COMPARISON OF THE PRODUCTIVITY MEASUREMENT MODELS

The principle of comparing productivity measurement models is to identify the characteristics that are present in the models and to understand their differences. This task is alleviated by the fact that such characteristics can unmistakably be identified by their measurement formula. Based on the model comparison, it is possible to identify the models that are suited for measuring productivity. A criterion of this solution is the production theory and the production function. It is essential that the model is able to describe the production function.

The principle of model comparison becomes evident in the following figure. There are two dimensions in the comparison. Horizontal model comparison refers to a comparison between business models. Vertical model comparison refers to a comparison between economic levels of activity or between the levels of business, industry and national economy.

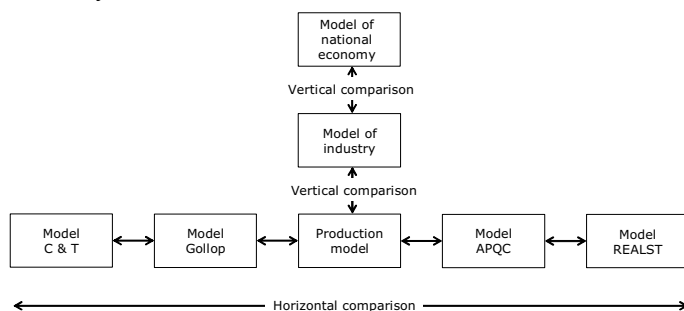


Figure 6. Dimensions of productivity model comparisons

The conclusion of the model comparison is interesting. At all three levels of economy, that is, that of business, industry and national economy, a uniform understanding prevails of the phenomenon of productivity and of how it should be modelled and measured. The comparison reveals some differences that can mainly be seen to result from differences in measuring accuracy. It has been possible to develop the productivity model of business so as to be more accurate than that of national economy for the simple reason that in business the measuring data are much more accurate. As soon as the development efforts related to the national economy model are carried out in practice, the logic of the model would be very close to that of the present business models.

##### 4.1 Business models

There are several different models available for measuring productivity. Comparing the models systematically has proved most problematic. In terms of pure mathematics it has not been possible to establish the different and similar characteristics of them so as to be able to understand each model as such and in relation to another model. This kind of comparison is possible using the production model

which is a model with adjustable characteristics. An adjustable model can be set with the characteristics of the model under review after which both differences and similarities are identifiable. A comprehensive comparison of productivity measurement models is presented in another publication [16].

A characteristic of productivity measurement models that surpasses all the others is the ability to describe the production function. If the model can describe the production function, it is applicable to total productivity measurements. On the other hand, if it cannot describe the production function or if it can do so only partly, the model is not suitable for its task. The production models based on the production function form rather a coherent entity in which differences in models are fairly small. The differences play an insignificant role, and the solutions that are optional can be recommended for good reasons. Productivity measurement models can differ in characteristics from another in six ways.

1. First, it is necessary to examine and clarify the *differences in the names* of the concepts. Model developers have given different names to the same concepts, causing a lot of confusion. It goes without saying that differences in names do not affect the logic of modelling. The name differences can be traced in the publication [16].

2. *Model variables* can differ; hence, the basic logic of the model is different. It is a question of the variables to be used for the measurement. The most important characteristic of a model is its ability to describe the production function. This requirement is fulfilled in case the model has the production function variables of productivity and volume. Only the models that meet this criterion are worth a closer comparison.

3. *Calculation order* of the variables can differ. Calculation is based on the principle of Ceteris paribus stating that when calculating the impacts of change in one variable all other variables are hold constant. The order of calculating the variables has some effect on the calculation results, yet, the difference is not significant.

4. *Theoretical framework* of the model can be either cost theory or production theory. In a model based on the production theory, the volume of activity is measured by input volume. In a model based on the cost theory, the volume of activity is measured by output volume.

5. *Accounting technique*, i.e., how measurement results are produced, can differ. In calculation, three techniques apply: ratio accounting, variance accounting and accounting form. Differences in the accounting technique do not imply differences in accounting results but differences in clarity and intelligibility. Variance accounting gives the user most possibilities for an analysis.

6. *Adjustability of the model*. There are two kinds of models, fixed and adjustable. On an adjustable model, characteristics can be changed, and therefore, they can examine the characteristics of other models. A fixed model can not be changed. It holds constant the characteristic that the de-

veloper has created in it.

Based on the variables used in the production measurement model suggested for measuring business, such models can be grouped into three categories as follows:

1. Productivity index models
2. PPPV models
3. PPPR models

In 1955, Davis published a book titled Productivity Accounting [4] in which he presented a productivity index model. Based on Davis' model several versions have been developed, yet, the basic solution is always the same [9], [7], [13], [20]. The only variable in the index model is productivity, which implies that the model can not be used for describing the production function. Therefore, the model is not introduced in more detail here.

PPPV is the abbreviation for the following variables, profitability being expressed as a function of them:

$$\text{Profitability} = f(\text{Productivity}, \text{Prices}, \text{Volume})$$

The model is linked to the profit and loss statement so that profitability is expressed as a function of productivity, volume and unit prices. Productivity and volume are the variables of a production function, and using them makes it is possible to describe the real process. A change in unit prices describes a change of production income distribution.

PPPR is the abbreviation for the following function:

$$\text{Profitability} = f(\text{Productivity}, \text{Price Recovery})$$

In this model, the variables of profitability are productivity and price recovery. Only the productivity is a variable of the production function. The model lacks the variable of volume, and for this reason, the model can not describe the production function. The American models of REALST [12], [14] and APQC [2], [5], [10], [14] belong to this category of models but since they do not apply to describing the production function they are not reviewed here more closely.

#### 4.2 Comparative summary of the PPPV models

PPPV models measure profitability as a function of productivity, volume and income distribution (unit prices). Such models are

- Japanese Kurosawa [11]
- French Courbois & Temple [3]
- Finnish Saari [15]-[19] in this paper called the production model
- American Gollop [6]

The following table presents the characteristics of the PPPV models. All four models use the same variables by which a change in profitability is written into formulas to be used for measurement. These variables are income distribution (prices), productivity and volume. A conclusion is that the basic logic of measurement is the same in all models. The method of implementing the measurements varies to a degree, depending on the fact that the models do not produce similar results from the same calculating material.

Even if the production function variables of profitability

and volume were in the model, in practice the calculation can also be carried out in compliance with the cost function. This is the case in models C & T as well as Gollop. Calculating methods differ in the use of either output volume or input volume for measuring the volume of activity. The former solution complies with the cost function and the latter with the production function. It is obvious that the calculation produces different results from the same material. A recommendation is to apply calculation in accordance with the production function. According to the definition of the production function used in the production model and that of Kurosawa, productivity means the quantity and quality of output per one unit of input.

The production model is the only model weighting quantity changes with new prices. The order of calculating the changes in the production model is as follows: 1) Prices, 2) Productivity and 3) Volume. The question is how the results of the real process should be valued. The solution is justified by the fact that the real process should be valued by the new prices because new prices are a spur guiding the activity. This choice is followed by the fact that the changes in income distribution are valued on the basis of the quantities of Period 1.

TABLE 5. SUMMARY OF THE PPPV MODEL CHARACTERISTICS

CHOICE	Saari	Kurosawa	Gollop	C & T
Variables used in the model	Distribution Productivity Volume	Distribution Productivity Volume	Distribution Productivity Volume	Distribution Productivity Volume
Theory, alternatives; 1. Production function 2. Cost function	Production function	Production function	Cost function	Cost function
Calculation order of variables	1. Distribution 2. Productivity 3. Volume	1. Volume 2. Productivity 3. Distribution	1. Volume 2. Productivity 3. Distribution	1. Volume 2. Productivity 3. Distribution
Accounting technique, alternatives; 1. Variance accounting 2. Ratio accounting 3. Accounting form	All changes; Variance accounting	All changes; Accounting form	Distribution; Variance acc. Productivity; Ratio acc. Volume; Account. form	All Changes Accounting; form
Adjustability, alternatives; 1. Adjustable 2. Fixed	Adjustable	Fixed	Fixed	Fixed

Models differ from one another significantly in their calculation techniques. Differences in the calculation technique do not cause differences in calculation results but it is rather a question of differences in clarity and intelligibility between the models. From the comparison it is evident that the models of Courbois & Temple and Kurosawa are purely based on calculation formulas. The calculation is based on the aggregates in the loss and profit account. Consequently, it does not suit to analysis. The production model is purely based on variance accounting known from the standard cost accounting. Variance accounting is applied to elementary variables, that is, to quantities and prices of different products and inputs. Variance accounting gives the user most possibilities for analysis. The model of Gollop is a mixed model by its calculation technique. Every variable is calculated using a different calculation technique.

The production model is the only model with alterable characteristics. Hence, it is an adjustable model. A comparison between other models has been feasible by exploiting this particular characteristic of the production model.

#### 4.3 Model of national economy

In order to measure productivity of a nation or an industry, it is necessary to operationalize the same concept of productivity as in business, yet, the object of modelling is substantially wider and the information more aggregate. The calculations of total productivity of a nation or an industry are based on the time series of the SNA, System of National Accounts, formulated and developed for half a century. National accounting is a system based on the recommendations of the UN (SNA 93) to measure total production and total income of a nation and how they are used.

Measurement of productivity is at its most accurate in business because of the availability of all elementary data of the quantities and prices of the inputs and the output in production. The more comprehensive the entity we want to analyse by measurements, the more data need to be aggregated. In productivity measurement, combining and aggregating the data always involves reduced measurement accuracy.

##### *Output measurement*

Conceptually speaking, the amount of total production means the same in the national economy and in business but for practical reasons modelling the concept differs, respectively. In national economy, the total production is measured as the sum of value added whereas in business it is measured by the total output value. When the output is calculated by the value added, all purchase inputs and their productivity impacts are excluded from the examination. Consequently, the production function of national economy is written as follows:

$$\text{Output} = f(\text{Capital}, \text{Labour})$$

In business, production is measured by the gross value of production, and in addition to the producer's own inputs (capital and labour) productivity analysis comprises all purchase inputs such as raw-materials, outsourcing services, supplies, components, etc. Accordingly, it is possible to measure the total productivity in business which implies absolute consideration of all inputs. It is clear that productivity measurement in business gives a more accurate result because it analyses all the inputs used in production.

The productivity measurement based on national accounting has been under development recently. The method is known as KLEMS, and it takes all production inputs into consideration. KLEMS is an abbreviation for K = capital, L = labour, E = energy, M = materials, and S = services. In principle, all inputs are treated the same way. As for the capital input in particular this means that it is measured by capital services, not by the capital stock [1].

##### *Combination or aggregation problem*

The problem of aggregating or combining the output and the inputs is purely measurement technical, and it is caused by the fixed grouping of the items. In national accounting, data need to be fed under fixed items resulting in large items of output and input which are not homogeneous as provided in the measurements but include qualitative changes. There is no fixed grouping of items in the business production model, neither for inputs nor for products, but both inputs and products are present in calculations by their own names representing the elementary price and quantity of the calculation material.

##### *Problem of the relative prices*

For productivity analyses, the value of total production of the national economy, GNP, is calculated with fixed prices. The fixed price calculation principle means that the prices by which quantities are evaluated are hold fixed or unchanged for a given period. In the calculation complying with national accounting, a fixed price GNP is obtained by applying the so-called basic year prices. Since the basic year is usually changed every 5th year, the evaluation of the output and input quantities remains unchanged for five years. When the new basic-year prices are introduced, relative prices will change in relation to the prices of the previous basic year, which has a certain impact on productivity.

It is clear that old basic-year prices entail inaccuracy in the production measurement. For reasons of market economy, relative values of output and inputs alter while the relative prices of the basic year do not react to these changes in any way. Structural changes like this will be wrongly evaluated. Short life-cycle products will not have any basis of evaluation because they are born and they die in between the two basic years. Obtaining good productivity by elasticity is ignored if old and long-term fixed prices are being used. In business models this problem does not exist because correct prices are available all the time.

#### 4.4 Conclusion of the model comparison

The business production model enables us to have a new point of view into growth research because by help of the production model it is possible to analyse growth at its sources or in the production and in the co-operative networks created by them, such as in the know-how concentrations or clusters. Until now, there has been very little, if any, research into economic growth at the production unit or cluster level despite the fact that there would be reliable initial data available.

The objectives of developing a productivity model for national economy are clear. In conclusion, we can say that in the business productivity model all the intended characteristics are working practices and indispensable principles; measuring the gross value-based output, considering all production inputs, measuring the capital input as a capital service flow, measuring the inputs (and the output) in as homogeneous groups as possible and the relative prices corresponding with the reality.

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# How to communicate target information in SMEs?

Juhani Ukko<sup>1</sup>; Jussi Karhu<sup>2</sup>; Hannu Rantanen<sup>3</sup>

<sup>1</sup> Project Manager, Lappeenranta University of Technology, Lahti Unit, [juhani.ukko@lut.fi](mailto:juhani.ukko@lut.fi)

<sup>2</sup> Researcher, Lappeenranta University of Technology, Lahti Unit, [jussi.karhu@lut.fi](mailto:jussi.karhu@lut.fi)

<sup>3</sup> Professor, Lappeenranta University of Technology, Lahti Unit, [hannu.rantanen@lut.fi](mailto:hannu.rantanen@lut.fi)

**Keywords**—target information, internal communication, performance measurement, SMEs.

## 1 INTRODUCTION

Companies have evaluated their performance with different measures and targets through decades. Since 1990s, a number of different frameworks for integrated and balanced performance measurement (PM) have been launched [1]–[5]. Nowadays, many companies apply performance measurement at the operative level. Therefore, understandable and accessible communication of the measures and targets can be seen as one of the major challenges for the management, whether using a formal or an informal performance measurement system (PMS).

The study of Lönnqvist [6] shows that communication of important targets is one of the main purposes of using PM for managers. Kaplan and Norton [7] state that communication and education should be emphasized when aligning the employees to the strategy. The employees must learn about and understand the strategy if they are to help implement it. The purpose of effective communication is to increase the understanding and knowledge of the employees. Ukko et al. [8] state that successful implementation and use of PM at operational level depends on the internal communication and information diffusion, as it increases the employees' understanding of the company's business and targets and thus their motivation. The role of communication is emphasized in the company's performance measurement and performing. The importance of communication has been highlighted in PM context, but how companies have put it into practice has not been studied so far. Thus, an interesting perspective is to study what channels the companies use for measurement information diffusion and communication and how successful the personnel see the current situation.

The objective of this research was to study the practices by which companies communicate about their targets and target realization at the moment. A second objective was to find out how the information diffusion and communication should be implemented in the future. Furthermore, the study focuses on e.g. the success of the information

diffusion and the characteristics and quality of the information. The study focuses on companies operating in manufacturing industry. Because the objective was to gather data from the whole personnel, not just a few representatives per company, the data was gathered with a structured survey. The participating companies were small and medium-sized and did not have any formal performance measurement systems. However, they measured their performance with single targets and measures.

## 2 INTERNAL COMMUNICATION AND PERFORMANCE MEASUREMENT IN SMES

### 2.1 Internal communication

Communication includes internal and external communication. The objective of communication is to deliver accurate and reliable information to the stakeholders of the company. External information covers the external stakeholders (e.g. customers, financiers, investors), whereas internal communication concerns the personnel of the company [9]. The present study focuses on the internal communication of measures and target information.

Åberg [10] divides internal communication to three groups: face-to-face communication, written communication and electronic communication. Later, he has designed a more sophisticated classification concerning the channels of internal communication [11]. He divides internal communication to direct communication based on face-to-face interaction (e.g. employee-foreman interaction, meetings, informative meetings) and indirect system communication based on written and electronic communication (e.g. noticeboard, handout, e-mail, and intranet). Åberg also divides the information channels to two groups, where the first group deals with a certain unit or individual and the other one concentrates on the whole work community. Based on the two different categorizations presented above we have outlined a framework suitable for this study. The framework is presented in figure 1.

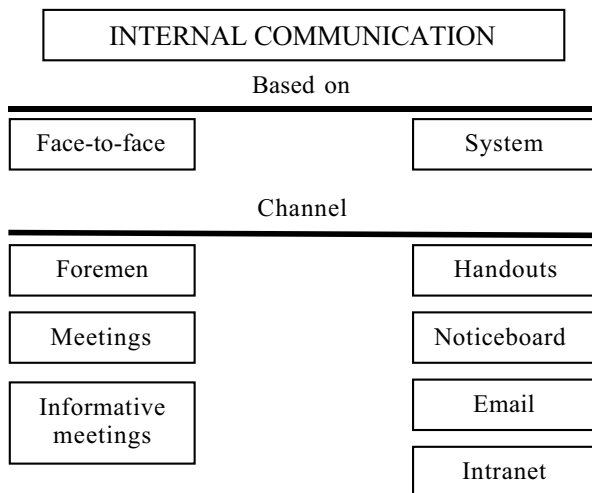


Figure 1. Framework of internal communication.

In this study the use of different communication channels is examined through face-to-face and system-based communication.

## 2.2 The role of communication in performance measurement

The importance of internal communication in the performance measurement context has been strongly emphasized by researchers [7], [8]. An interesting point of internal communication are the channels the companies use when they communicate the measures and targets through the whole organization. Traditionally, face-to-face communication has been the primary way to deliver information in organizations. Electronic communication, such as e-mail, internet, intranet and PowerPoint, provides lots of new possibilities for the presentation and communication of measure and target information in companies.

Bourne et al. [12] examined the differences of the use of a PMS in high-performing business units and average-performing business units in the same company. They conclude that in high-performing business units the managers used the PM information interactively and communicated about performance intensively, both in formal meetings and “at every opportunity”. So, according to this study, face-to-face communication around the performance measurement enhances in a way the performance of the company. Bititci et al. [13] studied the management implications of web-enabled performance measurement systems. They state that after implementing a fully integrated web-enabled, internet-based performance measurement system there was e.g. some improvement in the areas of business benefits and performance, proactive management style, behavior of operational staff, and significant improvement in the areas of confidence in managers’ decisions, behavior of the management, dissemination of knowledge and visibility of information. The accuracy, reliability and credibility were also improved significantly after launching the web-enabled PMS. Thus, it can be assumed that the use of the intranet should be a very

suitable way to communicate measurement information. Hewitt [14] examined the role of e-mail in internal communication and found it to be less influential in comparison to face-to-face communication. However, e-mail was found to influence positively and specifically the communication climate, shared objectives and goal alignment, and perceived external prestige.

According to Robson [15] the measurement systems have to provide graphical, relevant, local, and team level information to encourage a culture of high performance. The information should also be intelligible, available, presented in a familiar atmosphere and gathered cost-effectively [16].

As a summary of the previous studies it can be stated that internal communication in all its forms seems to have positive effects on companies’ businesses and performance. The small and medium-sized organization differs from larger ones in many ways. They usually do not have so sophisticated systems for information or measurement. Therefore it is interesting to study how they have organized their internal communication of target information, what channels are used at the moment and what channels should be emphasized in the future.

## 2.3 Performance measurement in SMEs

The performance measurement in SMEs differs a little from that of larger companies. According to Gunasekaran et al. [17] most SMEs operate with a poor forecasting and planning system. Barnes et al. [18] state that small and medium-sized enterprises are susceptible to business failure primarily due to poor risk management associated with inadequately informed decision-making. Typical characteristics of SMEs presented in literature are e.g. shortage of human and capital resources, retention of competent staff, fire-fighting mentality and lack of strategic planning [18]–[21]. Laitinen [22] brings out that a small firm is usually a simple system and therefore a very simple performance system will suffice. The same idea should be taken into consideration when designing internal communication of target information. It can be assumed that if SMEs operate with poor PMS they probably do not operate with very advanced information systems. Therefore, face-to-face communication may be emphasized in comparison to system information.

## 3 METHODOLOGY

The theme of the research questions emerged from the literature review presented above. The questions were formulated by three researchers, and two other researchers commented on them as well. The empirical data of this study was gathered from eight manufacturing companies with the help of a structured survey. In the survey, we used a 5-point Likert scale (1=strongly disagree... 5=strongly agree). To achieve a higher response rate, the questionnaires were delivered personally, not by mail. The total number of valid responses was 210 and the response rate was 69 %. The data was analyzed first with factor analysis. On the basis of the results of the factor analysis, we formulated

four sum measures for more efficient data analysis. Because the purpose of this study was to find out the practices by which companies communicate, and differences between companies, the means of the sum measures were compared with the analysis of variance, setting the company as an independent variable. Thus, methodologically this study is quantitative, applying statistical methods of data analysis.

## 4 FINDINGS

### 4.1 Data description

Table 1 presents the background information of the respondents. As can be seen, the respondents are quite equally divided into age groups. The larger number of male respondents is typical for the manufacturing industry. The education level of the respondents is well in line with the total Finnish workforce. Most of the respondents were blue-collar workers (61.4 %). 16.7 percent of the respondents were foremen.

TABLE 1  
BACKGROUND INFORMATION OF THE RESPONDENTS

		n	%
Age	-29	55	26.2
	30-39	47	22.4
	40-49	47	22.4
	50-	51	24.3
	not responded	10	4.8
Sex	male	125	59.5
	female	84	40.0
	not responded	1	0.5
Education	non-professional	49	23.3
	professional	100	47.6
	bachelor's degree or higher	58	27.6
	not responded	3	1.4
Organizational position	blue-collar worker	129	61.4
	white-collar worker	62	29.5
	manager	18	8.6
	not responded	1	0.5
Foreman	yes	35	16.7
	no	161	76.7
	not responded	14	6.7

The respondents represented eight companies, as table 2 shows.

TABLE 2  
RESPONDENTS PER COMPANY

Company	n	%
1	11	5
2	68	32
3	18	9
4	33	16
5	31	15
6	17	8
7	20	10
8	12	6
Total	210	100

The mean and the standard deviation for each research question (the numbering of the research questions is the same as in the questionnaire) concerning the present situation of communication are presented in table 3. As can be seen, the research question number 2 "Information of targets and target realization is communicated in meetings" reached the highest mean. The other two of the top three means were achieved by questions 1 and 3, also concerning face-to-face communication. The lowest mean was in question 6 "Information of targets and target realization is communicated via email". It can be stated that communication based on face-to-face interaction is the most trusted way to communicate target information, whereas electronic communication seems to be less used.

TABLE 3  
MEANS AND STANDARD DEVIATIONS OF THE RESEARCH QUESTIONS

Research question	Mean	Std. deviation
2. Information of targets and target realization is communicated in meetings	3.72	1.045
1. Information of targets and target realization is communicated by foremen	3.47	1.103
3. Information of targets and target realization is communicated in informative meetings	3.44	1.056
10. Information is reliable	3.40	1.090
11. Information is intelligible	3.34	1.000
12. Information is useful	3.26	0.959
14. Information is mainly verbal	3.22	0.941
13. Information is mainly numeric	3.05	1.061
9. Information is exact enough	3.04	1.096
5. Information of targets and target realization is communicated at noticeboards	2.92	1.312
15. Information is mainly graphics or pictures	2.92	1.083
8. I think that the internal communication of target information is successful	2.91	1.079
7. Information of targets and target realization is communicated via intranet	2.77	1.437
4. Information of targets and target realization is communicated by handouts	2.75	1.260
6. Information of targets and target realization is communicated via email	2.42	1.322

Table 4 presents the means and standard deviations of the research questions about the methods by which the communication should be done in the future according to the respondents. As can be seen, face-to-face

communication is the most desirable way in the future, and it was also the most common at the moment. Electronic communication did not receive much support.

TABLE 4  
MEANS AND STANDARD DEVIATIONS OF THE RESEARCH QUESTIONS ABOUT COMMUNICATION IN THE FUTURE

Research question	Mean	Std. deviation
17. Information of targets and target realization should be communicated in meetings	4.23	0.825
16. Information of targets and target realization should be communicated by foremen	4.21	0.885
18. Information of targets and target realization should be communicated in informative meetings	4.18	0.948
19. Information of targets and target realization should be communicated by handouts	3.72	1.162
20. Information of targets and target realization should be communicated at noticeboards	3.33	1.358
22. Information of targets and target realization should be communicated via intranet	3.30	1.421
21. Information of targets and target realization should be communicated via email	2.93	1.307

#### 4.2 Factor analysis

The questions about communication channels and quality of information at the moment were included in factor analysis. The principal component analysis produced four factors with an eigenvalue over 1.00. The factor model is presented in table 5. The model explains a total of 63.2

percent of the variance. The communalities of variables (questions) are relatively high, with the highest value in question 12 “Information is useful” and the lowest in question 7 “Information of targets and target realization is communicated by foremen”.

TABLE 5  
FACTOR ANALYSIS (LOADINGS ONLY OVER 0.4 PRESENTED)

Variable (question)	factor 1	factor 2	factor 3	factor 4	comm.
1. Information of targets and target realization is communicated by foremen	0.453		0.482		0.441
4. Information of targets and target realization is communicated by handouts	0.457	0.580			0.595
5. Information of targets and target realization is communicated at noticeboards	0.627				0.452
9. Information is exact enough	0.702				0.647
10. Information is reliable	0.778				0.705
11. Information is intelligible	0.841				0.734
12. Information is useful	0.841				0.766
6. Information of targets and target realization is communicated via email		0.806			0.708
7. Information of targets and target realization is communicated via intranet		0.754			0.657
2. Information of targets and target realization is communicated in meetings			0.813		0.720
3. Information of targets and target realization is communicated in informative meetings			0.743		0.671
13. Information is mainly numeric				0.804	0.716
14. Information is mainly verbal				-0.540	0.486
15. Information is mainly graphics or pictures				0.695	0.548
Eigenvalue	4.912	1.607	1.258	1.069	
% of variance explained	35.089	11.477	8.982	7.634	
Cumulative	35.089	46.566	55.548	63.182	
Principal component analysis – Varimax rotation					
KMO measure of sampling adequacy 0.839					



Factor 1: The first factor explains 35.1 percent of the variance and its eigenvalue is 4.912. This factor has seven main loadings. Questions number 11 “Information is intelligible” and number 12 “Information is useful” have the highest loadings. The other main loadings are in questions numbered 1, 4, 5, 9 and 10. The reliability of the factor was measured with Cronbach’s alpha. In this case, a higher value of alpha was achieved if questions 1, 4 and 5 (highlighted in *italics*) were deleted from the factor. Finally, the Cronbach’s alpha for this factor is 0.892. All the remaining questions represent certain quality of the communicated information. Therefore, this factor can be labeled as the *information quality* factor.

Factor 2: The second factor, with the eigenvalue of 1.607, captures 11.5 percent of the variance. This factor includes three main loadings. Question number six “Information of targets and target realization is communicated via email” has the highest loading. Also the questions about communication via intranet and by handout receive loadings. The Cronbach’s alpha of this factor is 0.683. The setting suggests that the factor is associated with a pattern characterized by some systematic

communication, and for this reason, the factor can be labeled as the *system communication* factor.

Factor 3: This factor accounts for 9.0 percent of the variance, with eigenvalue of 1.258, and with three main loadings. Question number 2 “Information of targets and target realization is communicated in meetings” has the highest loading. The other main loadings are received by questions 1 and 3. All of these represent internal communication based on face-to-face interaction. This factor can be labeled as the *face-to-face communication* factor. The Cronbach’s alpha of this factor is 0.670.

Factor 4: The fourth factor explains 7.6 percent of the variance and its eigenvalue is 1.069. This factor has three main loadings, and the highest one is in question 13 “Information is mainly numeric”. The other main loadings are in questions 14 and 15. In this factor higher reliability (higher Cronbach’s alpha) was achieved when question 14 (highlighted in *italics* in table 5) was deleted from the factor. The Cronbach’s alpha for this factor is 0.632. The setting suggests that the factor is associated with presenting information in quantitative form. Therefore, this factor can be labeled as the *quantitative information* factor.

TABLE 6  
COMPARISON OF THE MEANS OF SUM MEASURES

	Company								F-value
	1	2	3	4	5	6	7	8	
Information quality	3.30	3.18	3.29	3.24	3.78	2.84	3.28	3.04	2.152*
System communication	2.05	2.99	3.30	1.93	3.54	2.26	1.88	1.81	15.573***
Face-to-face communication	2.88	3.57	3.81	3.54	3.85	3.31	3.62	3.17	2.526*
Quantitative information	2.27	3.33	2.94	3.06	3.19	3.03	2.14	2.42	6.307***

sign. \*\*\*  $p \leq 0.001$ , \*\*  $0.001 < p \leq 0.01$ , \*  $0.01 < p \leq 0.05$

#### 4.3 Differences between companies

Based on the factor analysis, four sum measures were formulated. The differences between companies were analyzed with the analysis of variance. The results are presented in table 6. The analysis of variance shows whether there is a significant difference or not, but it does not reveal the companies between which the difference is. Thus, a Tukey’s post-hoc test was used to find out the companies between which the difference was significant.

Concerning information quality, a significant difference was detected between companies 5 and 6. Representatives of company 5 were more satisfied with the information quality than the representatives of company 6.

Concerning system communication, significant difference was found between two subsets. The first subset includes companies 1, 4, 6, 7 and 8, and the second subset includes companies 2, 3 and 5. So, according to the respondents, in companies of the second subset the internal communication of target information was more based on some system than in companies of the first subset.

One significant difference was found concerning face-to-face communication between company 1 and companies 3 and 5. Internal communication of target information was based on strongly face-to-face interaction in companies 3 and 5, whereas face-to-face communication was considered rather poor in company 1.

Significant differences were found in the quantitative form of information. Between companies 1 and 2 there was a significant difference, as well as between companies 2 and 8. There was one more significant difference. Companies 2, 4, 5 and 6 formed a subset. Between that subset and company 7 a significant difference was found. The target information is presented mainly in quantitative form in company 2, whereas in companies 1, 7 and 8 the information is less quantitative.

As a summary of the differences between the companies it can be stated that company 5 has the best organized internal communication of target information. Companies 2 and 3 have also succeeded quite well concerning communication of target information. System communication emphasizes in companies 2, 3 and 5 in comparison to other companies. Although face-to-face communication is the most common at the moment and the most desirable in the future, the successful communication of target information may need support from system communication. The answers to the question “I think that the internal communication of target information is successful” show the reality. The highest mean is the 3.50 of company 5. The mean of company 6 is the lowest (2.20). There was also a large difference between companies 5 and 6 concerning information quality. According to this, information quality has a major role in successful

communication of target information. Actually, company 5 is a part of a bigger corporation, and it has put effort in developing internal communication; this might be the reason for the best success. The reason for the poor situation of company 6 in internal communication is that there had not been much focus on internal communication before this study.

## 5 CONCLUSION

The study highlighted the importance of face-to-face methods in communication of target information. It can be argued that face-to-face communication is the lynchpin of internal communication of target information, and system-based communication can only support it. The channels that the companies use at the moment can be considered the right ones, because the same channels were at the top when it was asked how the information should be communicated in the future. When communicating face-to-face, an employee personifies the information to the person who communicates it. This can be considered as an advantage of face-to-face communication.

The quality of information has a strong influence on performance measurement through the success of communication of target information. According to the results, the highest mean of the sum measure of information quality led to the best success in communication of target information, and vice versa. It can be stated that companies should invest in the quality aspects of information, in its exactness, reliability, intelligibility, and usefulness. This can lead to better understanding of target and measure information.

In the future, the best success in communication of target information will be achieved, if the quality of information is good and it is communicated face-to-face and maybe supported by some system communication. It can be argued that in small manufacturing companies, where most of the employees do not work with a computer daily, electronic communication (email, intranet) is just waste of resources. In this case face-to-face communication can be supported by handouts and noticeboards.

For further study, it would be relevant to formulate a regression model for the success of internal communication of target information with the help of the sum measures presented above. Another interesting task would be comparing these results with the results from a similar study carried out in large companies.

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# Productivity development at construction branch after the last recession

**Terttu Vainio; Eero Nippala; Hannu Kauranen**

*Senior Research Scientist, VTT, terttu.vainio@vtt.fi*

*Research Teacher, TAMK, eero.nippala@tamk.fi*

*Teacher, TAMK, hannu.kauranen@tamk.fi*

***Productivity, construction, industrialisation, reorganisation***

## 1 INTRODUCTION

### 1.1 Background

The study on the productivity of the real estate and construction industry [1] was a joint project of the Finnish Asphalt Association, the Property Maintenance Association, the Confederation of Finnish Construction Industries RT, the Finnish Real Estate Federation, the Finnish Association of Earth Construction, and the Finnish Association of Building Owners and Construction Clients, which examined sector-level productivity. The parties became interested in this issue by the *Finland in the Global Economy* [2] report published in 2004 which questioned the improved productivity of the real estate and construction sector.

The research work was done 2005 - 2006 at VTT by research group Terttu Vainio, Eero Nippala and Hannu Kauranen.

### 1.2 Goals

The goals of the project were:

I. To increase project parties' understanding of the productivity concept, its components and impacts on both the national economy and sector renewal.

II. To assess how well official national economic productivity indicators (Statistics Finland Productivity Report [2]) describe productivity development in the real estate and construction sector by comparing statistics against real-world observations.

III. To suggest further measures for the sector in productivity improvement and monitoring of development.

IV. To clarify to interest groups the "real estate and construction" entity: the sector's main processes, end products and services and their role as a competitive factor of the national economy and enterprises as well as to describe the major changes that have occurred or are occurring in the sector, end products and services.

### 1.3 Implementation

Initially, material describing the real estate and

construction sector itself and productivity development was compiled from Statistic Finland's materials. It involved translating into plain language statistical concepts and the method of calculating productivity figures and related assumptions. The material consisted of:

- Time series of the productivity report and more detailed, sector-specific analyses that could be performed based on the same principles [3];
- Sector-specific building asset statistics [4];
- Sector-specific statistics and their analysis, e.g. the transfer of functions from one sector to another and changes in company structures;

The material was analysed and processed in workshops. Separate workshops were conducted on building construction, the real estate sector and the infra sector. In workshops experts attempted to identify the most significant changes in the production process or end products of sectors observable at the macro level that have contributed to each sector's productivity development. The impact of identified changes on productivity was verified by material collected from different sources. Finally, ideas about ways in which sector organisations and enterprises could further improve their productivity were developed.

## 2 THE FRAME

### 2.1 The facility and construction branch

The task of this sector is to provide the basic environment for business and industry, work, living and recreational activities. All buildings, constructions, traffic arteries and networks of society have been built to serve one of the above main tasks. Seventy per cent of Finland's national wealth (EUR 560 billion) is tied to that environment (Fig. 1). The largest amount of money is annually committed to housing whether measured by invested capital or the value of production or building maintenance. In 2005 the number of employed persons was about 2.3 million. Of them, 85 % work indoors. Of the remaining 15 % a significant portion work "on the road" providing logistical services or on construction sites.

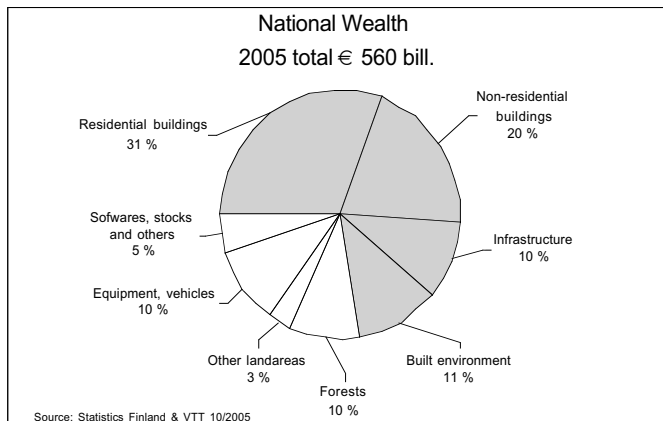


Fig. 1

About 6 % of the value of the built environment is spent annually on its maintenance, renovation and renewal. In 2005 a total of EUR 34 billion was invested in the built environment, of which 65 % went to the maintenance of existing buildings, constructions, arteries and networks (Fig. 2). The share of the cyclically sensitive new and replacement investments was 35 %. The stable and cyclically sensitive shares of the production of the real estate and construction sector vary according to the state of the national economy. In the construction products industry international business plays a major role. In 2005 the value of the international business of construction sector companies stood at EUR 15 billion.

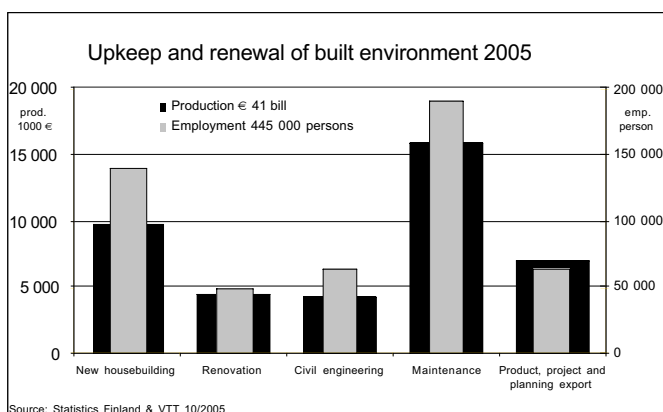


Fig. 2

Production and maintenance of the built environment account for a quarter of the GDP. The significance of the sector varies by segments of the national economy. The majority of the overall costs of housing are in some way related to the real estate and construction sector. Construction, repair and maintenance of spaces are a significant expense item also in education.

Production and maintenance of the built environment employ 450,000 people. The employed figure is remarkably high compared to total employment (2.3 million). Of those employed, 1/3 work in real estate, 1/3 on construction sites, and 1/3 in related industry and services. Of the investments in the sector, 25–30 % accrue to the public sector as direct or indirect taxes paid by enterprises and

employees and less than 10 % as social security and pension contributions..

## 2.2 Changes on a 15-year time scale

The economic recession of the early 1990s was an ordeal for capital-intensive sectors and sectors serving them, such as new building construction. The impact on civil engineering was smaller, and in renovation the backlog of work could be reduced with resources freed from new construction. The construction products industry entered international markets, and especially companies involved in the production of wood-products, building systems and metal products were successful. The 1990s may be characterised as a decade of unification, co-operation and internationalisation. National-level reorganisations of companies had already occurred in the sector, and the time of Nordic and, to some extent, European level reorganisations had arrived.

In the last few years construction has been driven strongly by the change in regional structure and internal migration, which concentrates population in appealing cities and surrounding municipalities. Altered and increased traffic flows required mass transport solutions and investments in arteries. Construction in built urban areas imposes constraints: the existing built environment must be considered and some construction has to be implemented underground.

Numerous new guidelines were drawn up for civil engineering and building construction in the last decade. For instance, the orders of national authorities and municipal planning regulations have increased dwelling prices by EUR 900/m<sup>2</sup> in the Greater Helsinki Area and other growth centres where the shortage of resources increases construction costs and construction is subject to more regulations.

The real estate and construction sector has also been affected by the strategic decisions of client sectors. As companies are focusing on their core competence, real estate assets and their management have been outsourced to specialists. The government has done the same with its real estate – ownership, asset management and real estate-related service functions have been transferred to a specialist organisation. The municipal sector has moved in the same direction by, for instance, incorporating its residential real estate. These measures have paved the way for the emergence of a new type of professional real estate business.

The real estate services sector has been a recipient of outsourced services, that offers intermediate products to other sectors, which is why its companies' job description has diversified. The most advanced real estate services could be characterised as presence services. The line of services may consist of typical construction services such as secretarial services, catering, maintenance, security, cleaning, reception services, etc.

Real estate services are produced locally; the target properties cannot normally be moved from one country to



another. Electronic alarm systems as well as monitoring and control of operations can, however, be remotely controlled, even from across the world. The sector has internationalised quickly as it has acquired new real estate and companies providing real estate services. Remember to check the spelling and have your paper proofread before submitting the camera-ready paper.

### 3 PRODUCTIVITY DEVELOPMENT

#### 3.1 Productivity of real process

The productivity of various types of work done in the construction sector has developed favourably during the last ten years. Work performances per unit of time have increased 20–50 % in many typical types of work. Productivity has been improved on a wide scale, and as a rule higher productivity has improved work ergonomics and safety.

Better work performances in civil engineering are based especially on machinery and equipment technologies. The efficiency of small, geographically dispersed projects has been improved by quick transfer of earth construction machinery between sites.

The site process of building construction has been streamlined and industrialised. Productivity development has been able to compensate the extra costs of new acts and decrees and the diversification of projects. In building construction, productivity has been increased through material and product technology, new construction machinery and measuring techniques, and process development.

The productivity of building construction means productivity at construction sites. Sites account for 40 % of the total costs, the products industry and imported products for 45 %, and construction services for 15 %. Determining the productivity of the overall building construction process requires considering also the productivity development in products industry and services in addition to site productivity.

Opposite development has also been observed. The most effective industrial production method cannot be used due to consumer demand which requires, for instance, building facades from internal skin elements delivered to the site to which thermal insulation and an external skin are then added. This requires investing in both machinery needed to install elements and scaffolding for on-site construction. On-site construction with blocks has been popular also in the case of one-family and row houses.

The volume of effectively implemented new construction is decreasing while that of infill and renovation work under difficult conditions is increasing. Work is increasingly being done in the built environment on the terms of the users of structures. Traffic disturbs transport infrastructure renovation and maintenance significantly more than e.g. in the 1980s. Similarly, the consideration of users in building renovation introduces certain special features and arrangements compared to new building projects.

#### 3.2 Productivity according to the statistics

Non-monetary indicators of real productivity changes show that productivity has developed favourably while official productivity statistics tell the opposite. This is due the special features of the productivity calculations in building construction. As a result of the predominance of small enterprises, the components of productivity calculations are not available from a single source dealing with business activity, but several sources must be used including production statistics, labour force surveys and companies' cost-structure statistics.

In deviation from other industries, construction productivity calculations have applied double deflation. Double deflation will be applied to other industries only from 2006 on. If the productivity of building construction had been calculated the same way as in other industries, productivity development in 1995–2004 would be + 23 % instead of the - 0.8 % showed by statistics (Fig. 3).

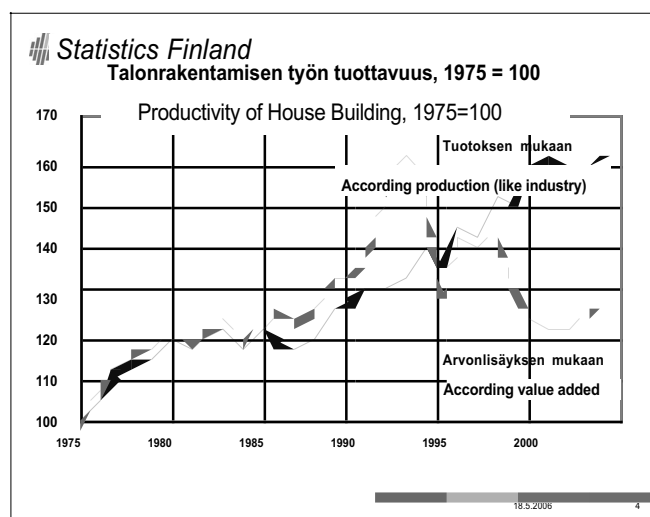


Fig. 3

A comparable figure cannot be calculated for civil engineering since only a cost index is available for that sector, not a price index that would be a more correct deflator.

### 4 CONCLUSIONS

Official productivity statistics give an erroneous picture of the productivity development and renewal of the real estate and construction sector. They are often used as justification for refusing to provide R&D funding on the national and, sometimes, also on the institute and enterprise level. Sector image is not the only thing that suffers from this state of affairs. The R&D people of enterprises are generally the youngest and most active sector professionals whose work input does not get the respect it deserves.

Productivity statistics are used to compare sectors ignoring the fact that the productivity figures of present statistics have been calculated based on different principles. There are differences in input data as well as in the conversion of monetary values. Industrial input data derive from a single source: enterprises' structural statistics. Construction input data are a compilation of calculated statistical data due to the dominance of small companies. Until recently, the change in the value of intermediate products was based directly on the change in the value of production (single deflation) in industrial calculations while construction has already for long applied double deflation. If sectors are compared to each other, the productivity figures should be calculated according to the same principles.

The EU KLEMS Project intended to improve comparability of productivity measures is under way. It is recommendable that the consistency of calculations is considered in this development work. By this I mean that since productivity statistics will be derived from other statistics also in the future, it should be ensured that statistics of the same type are used as input data.

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# Diffusion of new collaborative work environments, and impacts on society: Towards a system of policy indicators

Karsten Gareis<sup>1</sup>; Tobias Hüsing<sup>2</sup>

<sup>1</sup> Project manager, empirica Gesellschaft für Kommunikations- und Technologieforschung mbH,  
karsten.gareis@empirica.com

<sup>2</sup> Senior researcher, empirica Gesellschaft für Kommunikations- und Technologieforschung mbH,  
tobias.huesing@empirica.com

**Keywords**—collaboration, virtual teams, new forms of work organisation, policy indicators

## 1 INTRODUCTION

### 1.1 Background

Recent developments in business applications of technology have led to the assumption that New Collaborative Work Environments (NCWEs), based on mature broadband technologies and ubiquitous ("ambient") computing, will spread quickly throughout the economy of Europe in the years to come. Proponents believe that NCWEs will deliver sustainable growth in innovative activity, productivity and competitiveness for the companies and regions/countries who utilise them successfully. For doing so, they will have to positively impact on working processes at the individual, office, team, and (inter-) company level.

The European Commission has shown much interest in the potential which NCWEs have for contributing to the so-called Lisbon goals [7]. Its Directorate General "Information Society and Media" has a unit ("New Work Environments") dedicated specifically to the issue [31].

The key idea behind NCWEs is that the latest information and communication technologies (ICTs) enable access to digital work resources, communication tools and computing power at any place and at any time – thereby liberating work from many of the traditional constraints which bind it to specific locations and work schedules. This allows much easier real-time collaboration across the boundaries of individual firms, regions, countries, even continents. Improved collaboration has become a prime source of competitive advantage because of its role in globalised production and distribution systems [19], in supporting systemic innovation [37] and in making organisations more flexible and adaptive to the ever-more frequent changes in market environments [24].

In spite of the prominence of the topic in the policy debate, no evidence-based review of the change processes involved has been carried out yet, which also means that

there is insufficient insight in the type of indicators and measurement approaches which are needed for evaluating the impacts of such NCWEs in an economic, social as well as ecological sense.

### 1.2 Aims and structure of the paper

In order to contribute to a better understanding of the phenomenon of NCWEs, it appears necessary to exploit earlier approaches which have been developed, often in isolation from each other, for analysing phenomena such as tele-working/tele-commuting [20], mobile eWork [16], computer supported collaborative work (CSCW) [17], virtual teamwork [10][38], virtual organisations [25][26], and other ICT-based new patterns of how to organise labour in time and space. These approaches need then to be integrated in a holistic way.

This paper attempts to sketch a conceptual approach towards analysing real-world applications of NCWEs and their impacts on main stakeholder groups. It also make suggestions about the way forward for developing a measurement and benchmarking framework to be applied at regional or national level with the purpose of underpinning effective policy-making.

Section 2 defines NCWEs, using six dimensions extracted from the academic and practitioner literature. Section 3 briefly discusses indicators deemed necessary for measuring spread and impact of NCWEs, distinguishing between readiness, intensity and impact indicators. Section 4 gives an overview over the main existing sources of comparable, cross-country data on the subject. Section 5, finally, presents some suggestions about how the existing indicators and data collection mechanisms can be modified to take account of the importance of virtual collaboration and NCWEs for the competitiveness of the European economy.

## 2 WHAT ARE NCWEs?

Based on an extensive review of the literature [15], we can list the dimensions which are needed to define the subject of our analysis (NCWEs) by using six dimensions: collaboration, spanning of boundaries, team and project

organisation, ubiquitous access to resources, people focus and technology. Below we briefly discuss each of these dimensions and also show to what extent the defining features of NCWEs are related to earlier concepts of new forms of work organisation.

Collaboration occurs when two or more people interact and exchange knowledge in pursuit of a shared, collective, bounded goal. For empirical research, this definition may need to be operationalised. We suggest that one should speak of collaboration only when an explicit (e.g. written, but not necessarily legally binding) agreement about common aims has been made. It is important to distinguish collaborative work contexts from other forms of coordination [22]. In this context it appears useful to refer to the typology of coordination modes in the context of workflow processes [39]: These are, ranked according to increasing interdependency: pooled/additive, sequential, reciprocal and intensive interdependence arrangements. These types also relate to the extent to which co-workers carry out tasks in parallel, sequentially, or together. Depending to the extent to which tasks are designed as business processes, the two last types (reciprocal and intensive) are most likely to fit our understanding of “collaboration”. However, sequential coordination can also amount to collaboration if co-workers interact and exchange knowledge in pursuit of a shared, collective, bounded goal.

Boundary spanning: An important aspect in which NCWEs differ from traditional forms of collaboration is the extent to which it crosses boundaries of space, time, function, culture, and organisation [19]. In this sense, we use the term “virtual collaboration”, the initial rationale for which is to combine the skills and capabilities of a number of agents for the pursuit of a certain goal regardless of the traditional constraints of distance. Mobility – in all its meanings – plays a key role in this regard [33]. With regard to the geographical boundaries, NCWEs typically involve the transfer of work inputs and/or outputs via data telecommunications links across physical distance, typically defined as different sites/locations/ addresses.

Team and project organisation: Virtual collaboration is understood to take place in teams, i.e. in groups of persons who work together for a longer stretch of time. We define collaboration in virtual teams as a group of individuals who (or: some of whom) are located remotely from each other and who collaborate, and in which interaction takes place exclusively or almost exclusively via telemediation [38]. NCWEs also make extensive use of project organisation. A project is a temporary endeavour being undertaken to create a unique product or service.

Ubiquitous access to resources: NCWEs do not only provide advanced possibilities for interacting with remote collaborators, they also offer anytime, anywhere access to resources such as access to codified information in databases, and digital applications (often containing ambient intelligence) which effectively support the adaptation of the working environment (tools, etc.) to the requirements of the specific task on hand [22]. Ubiquitous

access to information resources is turning from science fiction into a realistic perspective with the advent of the Internet, and the gradual shift from stationary to mobile Internet access.

People focus: Depending on the complexity and nature of the tasks involved (see further below), NCWEs need to provide optimal working conditions for the worker if they are to support high levels of productivity – as research into high performance work organisation and related concepts has shown. Worker focus usually implies some or all of the following characteristics: a non-hierarchical organisational structure; flexibility in working methods; corporate cultures focussing on people orientation; continuous investments in learning & training; and innovative performance measurement and reward schemes [1][3]. In addition, people focus goes beyond catering for workers as it also implies that the focus of business processes should be on optimally serving the customer [24].

Technology: The type of collaboration outlined above is possible only with the support of advanced tools for, for example, computer supported collaborative work (CSCW), for mobile communication and for ambient intelligence. In essence, these tools enable easy access to knowledge resources and required communication channels at any place and any time, and are fully integrated in the working environment in order to support creative work as effectively as possible.

### 3 THE NEED FOR INDICATORS ON NCWEs

#### 3.1 *Types of indicators needed*

Following [18] and [35], three groups of indicators on ICT related innovations can be distinguished:

Readiness indicators, which measure the degree to which the basic infrastructural, organisational, regulatory and social preconditions for diffusion of an innovation are in place. As Figure 1 shows, this relates to the existence of drivers for change as well as obstacles and facilitators for change;

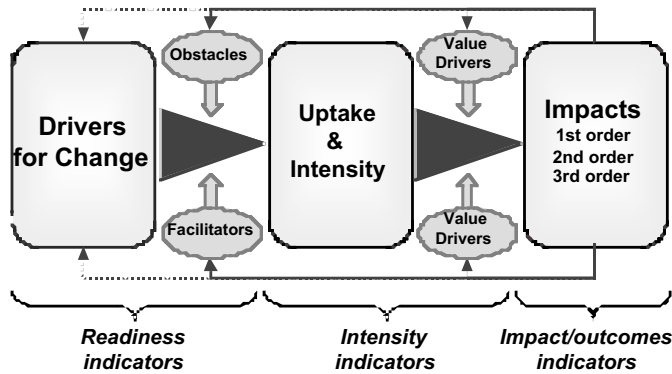
Intensity indicators, which measure actual uptake, focusing, in particular, on the purposes for which the innovation is used. In this context, value drivers are understood as the factors which impact on the degree of success of an ICT-related innovation;

Impact / outcomes indicators, which measure the effects which uptake of the innovation has at the level of the individual worker, the work team or unit, the organisation, and society at large.



FIGURE 1

FACTORS AFFECTING UPTAKE OF NWEs AND THEIR IMPACTS, AND TYPES OF INDICATOR NEEDS



Source: [14]

### 3.2 Readiness Indicators for NCWEs

The main factors of relevance in the area of readiness for NCWEs are (a) technological infrastructure; (b) work organisation at firm level (prevalence of co-operation, collaboration, teamwork, staff physical mobility); (c) worker skills; (d) attitudes among firms and workers; and (e) the extent to which firms make use of participation [14].

In general, the technological infrastructure requirements for uptake of NCWEs are very much related to the development of anywhere/anytime access to high quality (broadband) Internet connection. Because of the central role of mobility in the concept of NCWEs, indicators need to cover conditions for access at the main workplace(s); at other sites of the same organisation (if applicable); at home; at mobile locations. The latter may mean near-ubiquitous mobile broadband access e.g. through 3G networks, or punctual access through local WiFi networks or public Internet access points. The pace of techno-economic change requires indicators in this area to be carefully constructed to ensure that they stay relevant over an as long stretch of time as possible. Broadband, for example, should be defined dynamically rather than by using fixed bandwidth thresholds.

A second area of readiness indicators is concerned with work organisation at firm level. Organisations differ with regard to the need for collaboration and the potential effects thereof on performance and short and long term competitiveness. In general it seems fair to assume that organisations that operate in an area which is traditionally characterised by large degrees of co-operation and inter-firm networking are more likely than the rest to take up virtual collaboration and NCWEs [41]. They are also more likely to have acquired the necessary know-how and skills which are needed for managing intra-firm partnerships and collaboration. For these reasons, the overall degree of inter-firm co-operation and collaboration is a key readiness indicator for NCWEs. For these phenomena, organisation/firm-level indicators are required.

In addition, collaboration intensity need to be measured at the level of the individual worker/workplace, which is the level at which NCWEs are being implemented. Here, collaborative working inside of organisations is of as much

importance as collaboration across the boundaries of the firm. Involvement in team work and work organised in projects are indicators for the readiness of a worker to take up work in virtual teams and modes of virtual collaboration.

The complexity of collaboration is of vital interest, too, because experience in more complex types of working in teams and projects is likely to improve the skills needed for ICT-mediated collaboration. Collaboration complexity is the type and character of such relationships and their strategic role for the organisations involved. Factors of what in this context has also been called “people complexity” include team scope; team size; duration and team member turnover; cultural diversity; geographical distance; group cohesion; power balance; and personalities of team members [29].

A final factor to be mentioned here is physical worker mobility. Workers whose job requires them to be physically mobile typically make use of technology for staying in touch with co-workers and for accessing centralised resources. Latest generation ICTs open up completely new possibilities for supporting these activities. Firms which traditionally deploy physically mobile staff are therefore likely to be among the first to embrace NCWEs. This means that the degree and patterns of physical worker mobility are necessary statistical indicators for NCWE readiness.

The third category of readiness factors to be mentioned here are worker skills. NCWEs put high demands on the generic skills of workers. Felstead et al., through In-depth analysis of the UK Work Skills Surveys, identified ten categories of generic skills and how these can be operationalised [13]: literacy skills, physical skills, number skills, technical know-how, high-level communication, client communication, horizontal communication, planning, problem-solving, and checking skills. [14] explored the relevance of each of these for NCWEs. To summarise, four categories of skills appear of most importance: technical/digital skills, communication and collaboration skills, self-management skills and problem identification and solving skills.

In addition to indicators on current endowment with these skills, access to and take-up of continuous, lifelong learning and training are of prime relevance. This is because in collaboration-intensive fields of work, skills will become outdated faster than ever before. Constant renewal and updating of work-related skills are therefore becoming a core requirement. Indicator needs in this area have been defined in a number of policy documents [5]. For inclusion as readiness indicators in an indicator system for NCWEs, the total uptake and intensity of work-related lifelong learning are of most importance. In addition, provision and financing arrangements as well as total investments in training should be measured, since these indicate the degree to which firstly companies invest in lifelong learning of their staff, and secondly the extent to which workers themselves take responsibility for their own learning. In

addition to engagement in training measures (= structured, purposeful learning), recent years have seen some of the attention shift to incidental, experiential, non-structured training [9][12]. Incidental learning is very hard to measure in survey research, as experience from research in Canada shows [23]. It appears that the best way to do so is to avoid focussing on the learning process itself, as this is elusive and often taking place unconsciously. Rather, a measurement could focus on the (perceived) ability of the working environment to enable and induce learning: what might be called the extent to which a workplace is enabling experiential learning.

With regard to relevant attitudes among firms and workers, for the former awareness of the possible benefits of collaboration can be seen as a necessary condition for uptake of NCWEs. The same applies to awareness of the possible benefits of a work organisation stressing people focus (see above). In both cases, awareness of potential advantages to be achieved needs to be analysed against the context of a firm's strategic plans and the market area it operates in. Strategic goals which are likely to have a major effect on whether a firm can expect potential benefits to be obtained from NCWEs include: boosting the innovative capacity of an organisation; enabling more flexible configurations of human capital (task-specific, temporary combinations of core competencies); improving time-to-market and/or time-to-action; allowing R&D and/or production at global scale (economies of scale) while preserving/creating economies of scope; increasing responsiveness to client needs; obtaining access to labour markets which have been out of reach before; offering valued members of staff more attractive working conditions; enabling cooperation with remote high-qualified staff or sub-contractors. Readiness is also affected by the type and strength of obstacles perceived by decision-makers in firms.

At the level of individual labour force members, attitudes towards entrepreneurship (which does not necessarily have to imply self employment) are generally considered a good indicator of readiness for the willingness to work in a position which involves high self-responsibility and job autonomy.

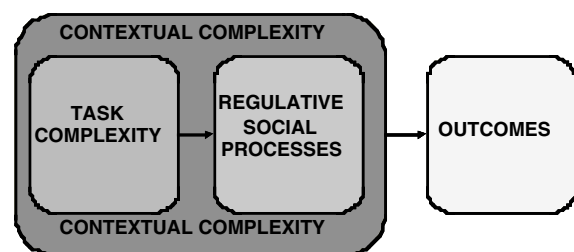
Last among categories of readiness indicators, Participative organisation, the extent to which firms make use of participation appears of key interest. Confusingly, many accounts of technology-related organisational change (implicitly) make the assumption that more participative, decentral forms of work organisation follow from implementation of technology. Most evidence, however, suggests that the causal relationship works the other way around: Technology has the most beneficial effect in organisations that have high levels of participation [28]. Having said that, it is important to distinguish between different types of participation, as they have distinctly different implications for the way in which decision making is executed in practice. Following the EPOC study [36] we can distinguish between: individual consultation (directly

or through a 'third party'), group consultation (involving 'temporary' groups who come together for a specific purpose and for a limited period of time, or 'permanent' groups who discuss various work-related topics on an ongoing basis); individual delegation (i.e. individual employees being granted extended rights and responsibilities to carry out their work without constant reference back to managers; often referred to as 'job enrichment'); and group delegation (i.e. rights and responsibilities are granted to groups of employees to carry out their common tasks without constant reference back to managers, as in the case of work in semi-autonomous groups).

### 3.3 Intensity Indicators for NCWEs

Vartiainen [41], based on the elements of Activity Theory [11], distinguishes between three basic features of collaborative work systems which need to be analysed in order to obtain proper understanding of all issues involved, and which together account for the outcomes of the work system in question, such as social and economic impacts: (a) the complexity of collective joint tasks (task or job complexity); (b) the complexity of context or space (physical, virtual, regulatory) where a team of collaborators is operating; (c) regulative social processes involving individual or collective subjects (e.g. inter-connectedness, trust, desires, common goals, etc.).

FIGURE 2  
NETWORKED WORK AS AN ACTIVITY SYSTEM



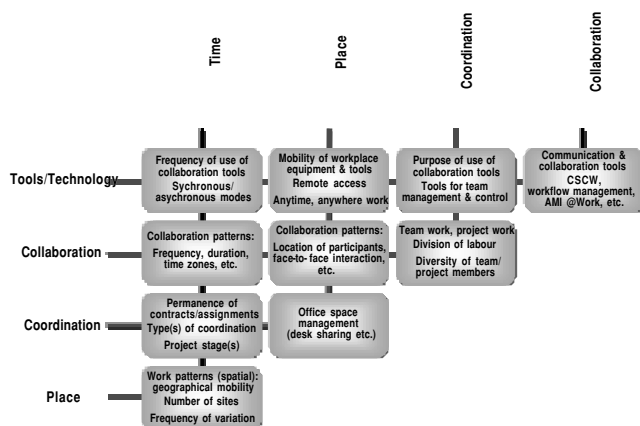
Source: [41]

The level of task complexity is relevant because high complexity is expected to make it more difficult to execute task interfaces via electronic communication channels – at least under the assumption that these are characterised by low media richness, such as in the case of e-mail. The main elements which need to be taken into account for assessing task complexity include the following: number and variety of tasks; variability of tasks; difficulty of tasks; nature of knowledge required (tacit vs. codified knowledge); verifiability of work; location-specificity of tasks; interdependencies between tasks [14].

Based on [41] we can identify five dimensions which determine the contextual complexity of a work system that includes collaboration: Time – the temporal dimension; Place – the geographical or spatial dimension; Coordination – the dimension of coordinating and managing work tasks and labour inputs in order to achieve the intended objectives; Collaboration – the dimension of people

interacting and exchanging knowledge in order to pursue a shared, collective, bounded goal; and Tools/technology – the dimension of work tools and technological infrastructure required by workers to carry out work tasks. Rather than separating these dimensions from each other, we suggest a matrix approach since there are multiple relations between each of the dimensions (see Figure 3). This approach allows us to single out the phenomena (and related indicators) at the interface between each of these five dimensions.

FIGURE 3  
MATRIX OF INDICATOR DIMENSIONS FOR DESCRIBING CONTEXTUAL  
COMPLEXITY OF NCWEs



Source: [14]

With regard to regulative social processes, the following are considered highly relevant for any process of NCWE implementation: fairness (workers' perception of the extent to which decisions are made in an unbiased way, based on accurate information, and involving all those who are likely to be affected); control (extent to which each team/project/unit member's work progress and performance is monitored); trust (extent to which persons believe that the motivations of co-workers etc. towards them are benevolent, "honest", truthful, reliable, considerate, amicable, dedicated, competent, careful); team spirit (extent to which team members have joint interests and values, and to which they consider that the team's success is their own success); leadership (workers' perception of the effectiveness and efficiency of team/unit leadership); goals and motivation (extent to which goals and objectives are properly defined, planned and communicated within the team/project/unit, and to which these are shared by all team/project/unit members); cooperative behaviour (willingness to invest in helping co-workers without the formal obligation to do so).

### 3.4 Impact Indicators

Following common practice in research on impacts of ICT system implementation in organisations [40], among impacts a distinction can be made between first order impacts, i.e. effects on the main indicators of business performance including productivity and efficiency of business processes, but also consumer orientation, levels of

innovative activity, etc. – first order impacts mainly relate to the viewpoint of the organisation; second order impacts, i.e. effects on the social structure of the organisations involved (e.g. working culture, roles, trust) and on the workers as individuals (psycho-social impacts such as job satisfaction, work-life balance, health) – second order impacts mainly relate to labour as stakeholder. In the longer term, though, worker well-being is generally assumed to be in the economic interest of the employer as well; and third order impacts, which are externalities, i.e. effects on parameters that are external to the organisation and do not directly affect its main forward and backward linkages, but which concern the wider labour market and the society at large, the environment, etc. Stakeholder here is the community / society.

First order impacts are, first of all, the effects of NCWEs on traditional performance measures including labour productivity at workplace, team or firm level, total factor productivity, gross rates of return and Tobin's q at firm level, throughput times at individual or team level, and time-to-action or time-to-market at team or firm level, to name the most established. Newer concepts which try to take account of the nature of modern business processes and industry structures include value chain productivity. The level of pay/remuneration (which needs to be put in relation to total working hours) should also be considered as outcome indicator.

Quality measures play an increasingly important role not only as secondary, but as core performance indicators. Output quality can be measured in a number of ways – more or less adequately – depending on the type of product at hand. In heavily customer focused market segments, customer satisfaction can be a first order outcome indicator, as well.

For organisation which are heavily relying on innovation to maintain competitiveness, the level of innovative activity is a further first level outcome indicator, as is capacity to change, which denotes the ability of an organisation (or part thereof) to adapt flexibly to changing market conditions (in the widest sense).

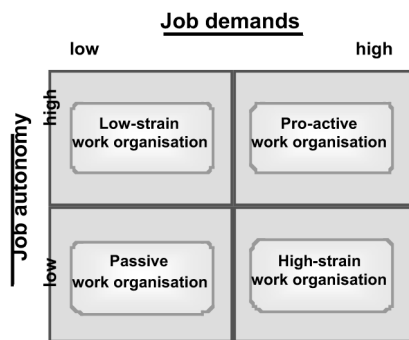
The exact choice of performance indicators depends, of course, on the type of product and sectoral environment the organisation is operating in [2].

Second order outcomes concern, in particular, effects on the quality of work from the viewpoint of workers. Established outcomes indicators for job quality include, apart from levels of pay/remuneration, job satisfaction and the existence of negative impacts on worker health [4].

The extent to which staff has a say in decisions which affect their work (participation) has been identified by recent research as having a direct influence on job satisfaction. The same applies to job autonomy. It is necessary, though, to put job autonomy (task discretion) in relation to job demands (workload, work strain): Recent research [1] has shown that the relation of both decides about job satisfaction, and economic sustainability (see Figure 4).



FIGURE 4  
THE “TIME CONSTRAINTS / JOB DEMANDS” MODEL



Source: Adapted from [8], [21]

Combinations of high (albeit not excessive) job demands with high job autonomy are referred to as pro-active work organisation. They are typically associated with high work motivation which has proven to be a core factor in any attempt to permanently increase labour productivity in high-qualified knowledge-based occupations.

High-strain work organisation is usually associated with stress, which is defined as an event which a person perceives as important with respect to his/her goals, but which at the same time exceeds his/her capabilities [30]. Low-strain and passive work organisation, on the other hand, are often associated with workers being/feeling overqualified for the job they do. This is not only a waste of resources from the society's point of view, but also negatively impacts on job satisfaction. A good match between jobs characteristics and worker characteristics must be regarded as a key goal of labour market policies.

Perceptions of job security is another, often used indicator for job quality. Against the background of labour market paradigms gradually shifting from “life-time employment” towards “life-time employability”, job security appears to be of decreasing relevance for gauging quality of work at the aggregate level. For this reason, an indicator on perceived employability, i.e. perceived individual labour market opportunities appears to provide better value.

The recent emphasis in the public debate on the issue of work/life balance means that more attention is being paid today to the effect of working conditions on life satisfaction or, more generally, happiness (subjective well-being). Indicators for work/life balance are hard to define without resorting to notions of what is (or should be) important in life (such as family, children, civic participation etc.). Such indicators may make sense from society's point of view (see following section) but should be avoided when analysing personal outcomes of work. A more non-judgmental indicator would have to focus on the extent to which work limits individuals to use their spare time for the things which are most important to them.

At the level of the team/group/unit level, secondary outcome indicators need to include measures of social capital, such as the degree to which (different types of) trust are being perceived among team members. The notion of

social capital also includes team and goal cohesion, perceptions of effective leadership and co-operative behaviour. Care needs to be taken, since these factors can be preconditions as well as outcomes of the implementation of NCWEs. Here, they are featured under the subsection “Regulative social processes” (see above).

At the firm level, secondary outcomes which have been identified in the literature include impacts on an organisation's ability to manage its knowledge [15]. This applies, in particular, to configurations of human capital which are short-term, temporary and at-arms-length all at the same time. In these cases, knowledge management can be expected to be negatively affected unless innovative solutions are implemented to counteract such tendencies. Further firm-level outcome indicators need to cover changes to a firm's (longer term) innovative capacity. Both indicators are extremely difficult to translate into policy indicators. More research in this area will be necessary.

Apart from these, additional firm-level outcome indicators can be seen as aggregates of the individual and team-level aspects discussed above. For example, total rates of absenteeism are directly related to health effects at the workplace level, albeit also influenced by external factors such as job insecurity and intrinsic motivation.

Among third order impacts we can distinguish between the following broad spheres which are likely to be affected by the implementation of NCWEs: the labour market and employment structures; the systems of skills acquisition including the formal and informal education systems; economic growth (wealth generation); and public welfare, social cohesion and sustainability.

With regard to labour market related indicators, total rates of employment as well as unemployment rates are of prime importance as structural indicators for the health of European economies. Because of the well-established fact that women and older citizens are the population groups whose participation in the labour market needs to be strengthened more than anything else [6], specific indicators should be deployed to measure the effects of NCWE related developments on the employment rates of older people and of women. In this context, there is much talk of work/life balance as a challenge which needs to be tackled in order to attract more people into the labour market. An interesting country-level indicator on work/life balance could be the employment impact of parenthood, since it can be used to measure the effectiveness of political initiatives to decouple labour force participation from parenthood for both women and men.

The value of indicators on job tenures appears to be mixed: Evidence collected by the OECD suggests that aggregate numbers tend to overshadow often dramatic change at sectoral and or regional level, and it is anyway much up to debate whether shorter or longer job tenures are more favourable for long-term economic and labour market development [27]. In its place, we suggest to use an aggregate indicator on perceived individual labour market opportunities (see above).



With regard to skill needs and the appropriateness of the structures of skill acquisition (i.e. the systems of formal, non-formal and informal education), more comparable, consistent and relevant indicators on the skill requirements of companies are much in demand. Skill requirements indicators need to detach themselves from existing taxonomies of occupations/ qualifications in order to be more flexible in reflecting shifting demand for skills. This applies, naturally, especially to generic and “soft” skills – the relevance of which for recruiting companies seems to have increased considerably in recent years.

With regard to economic growth, a number of well established indicators are readily available to be used in econometric analysis to single out the effect of NCWEs – once better data is available on uptake and intensity of usage. Examples include total factor productivity growth and GDP growth.

With regard to public welfare and social cohesion, established social inclusion indicators could be applied [42]. Because of the special relevance which NCWEs can have for regional development [33], innovative indicators may be required to reflect the degree to which their virtual collaboration is being utilised by the centre on the one hand, and by the periphery and rural hinterland on the other hand.

Insofar as environmental impacts of NCWEs are concerned, indicators on travel volumes and patterns (such as total miles of work-related travel) and the relation between wealth production and resources consumed for transport may be required. It will, however, prove extremely hard to disentangle the effect of NCWEs on such parameters from other influence factors, as all of these tend to be heavily interrelated.

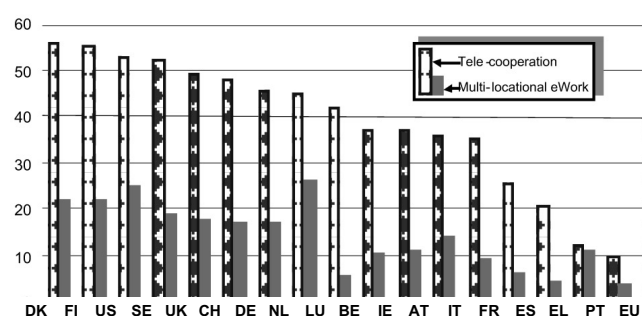
#### 4 CURRENT DATA AVAILABILITY

At EU level, the data sources which are used for mapping issues related to firstly use of ICT at and for work, and secondly working conditions and work organisation, are currently separated from each other. This makes it very difficult to analyse ICT-related changes in work organisation. In addition, collaboration using ICTs is a subject which has scarcely found any attention in existing surveys. This may be understandable given the elusiveness of the phenomenon, which makes it hard to measure using survey research. It does, however, seem very problematic in the face of evidence which suggests that collaboration across firms and other organisations is a prime determinant of competitiveness in the knowledge economy. It is clear that for Europe to develop its economic competitiveness while preserving current standards of wealth, social stability and equality, European companies have to make best use of virtual collaboration.

Among existing data sources, the most valuable for the purpose appear to be [14]: (a) for workers as reporting and observation units: the European Survey on Working Conditions, the ICT Usage Household Survey and the upcoming EU Adult Education Survey; (b) for

organisations as reporting and observation units: The Community Innovation Survey and the ICT Usage Enterprise Survey. Because of the scarcity of official data on some of the core features of NCWEs, one-off surveys play an important role for filling gaps. Of particular interest is the SIBIS survey conducted 2002/2003 which collected data on use of tele-cooperation at the workplace [34], see Figure 5.

FIGURE 5  
MULTILOCAATIONAL EWORK AND TELE-COOPERATION IN EU25  
Base: Total employment



Source: [14]

#### 5 CONCLUSIONS AND RECOMMENDATIONS

There is a need to provide better, more suitable and relevant statistical indicators for informing policy making at the EU, national and regional level in Europe on the drivers, uptake and impacts of NCWEs. Because of the costs of data collection for producing statistics, any attempt to provide new indicators must put much focus on finding the most cost-effective means to collect the required data.

Against this background, we suggest some ways how NCWE related issues can be better covered by EU statistics, and which of the existing data collection instruments may be best placed to carry the suggested new and modified variables.

First of all, there is a case for developing the European Survey on Working Conditions (ESWC) into a fully-fledged element of the European Statistical System. Comparable, timely data on working conditions and NCWE related issues must be a top priority in order to tailor the European Employment Strategy to the individual situation in each Member State.

The survey is currently under the responsibility of the European Foundation for the Improvement of Living and Working Conditions, and has been conducted every five years since 1990. It is not yet integrated in any way with the more established instruments of Eurostat and the National Statistical Institutes (such as e.g. the Community Labour Force Survey). At the same time, the ESWC is partly a duplication of effort since similar surveys are being carried out at the national level by many of Europe’s NSIs.

We suggest to put the ESWC on a more formal basis by giving Eurostat overall responsibility for survey execution, with the medium-term goal of replacing the existing

national surveys on work organisation by a joint Community Survey on Working Conditions (following the example of similar frameworks such as the Community Surveys on ICT Usage in households and enterprises). This would also provide the basis to conduct the survey more frequently, such as once every two or three years. The upgraded survey should then fully cover issues related to collaboration through ICTs and traditional means.

It is important to note that the function of the Community Survey on Working Conditions would be less to “rank” countries by their success in implementing “modern” forms of work organisation, but rather to supply EU and national policy making with the required comparative data to gauge the room for common policy making as well as to identify the necessity for policies which are specifically tailored to the situation in a given country.

Secondly, the emphasis in data collection in the area of ICT utilisation at the workplace needs to shift away from “fashionable” phenomena such as home-based telework towards the really important elements of change, such as multi-locational working and virtual collaboration using ICTs. It appears that the focus on modern-day utopias such as, for example, the “electronic cottage” is harming the decision-making ability of policy makers since it tends to mask underlying, much more relevant changes in the way work is organised across people, time and space. Collaboration in general, and virtual collaboration in particular, are hardly covered at all by statistical indicators at the national level, to say nothing of cross-country data. This situation needs to be remedied. The adequate instrument for such indicators, as far as they are to be collected from workers as observation/reporting units, would be the Community Survey on Working Conditions. The Community Survey on ICT Usage in Households is not well suited for the purpose as it primarily targets the household as a user category of ICTs.

The third point to be made is that Europe lacks a data source for assessing the extent to which workers are equipped with the necessary generic (as well as specialist) skills for working in the knowledge economy. There is plentiful evidence which suggests that to be successful in working in an NCWE-based job – or, more generally, in what has been termed the pro-active workplace – workers need to have advanced levels of communication, collaboration, team working and self-management skills, as well as up-to-date digital literacy. Because of the important role of the public sector – and EU funding – in providing further training and education opportunities to EU citizens, a data source for comparable indicators on generic skills should be developed. It appears that the European Adult Education Survey which is currently being prepared would provide a good vehicle for this purpose. It should be ensured that the decisions about which variables to include in the survey will not be taken by core education policy-makers alone.

Finally there is the need to ensure that all indicator data discussed in this document become available to policy-

makers more timely than it is currently the case. Eurostat has shown in the case of the Community Surveys on ICT Usage that timely publication of data collected by Member States’ NSIs (following a common data collection approach) can be achieved if the will is in place. The intention should be to achieve this timeliness for all Eurostat-managed data sources, including for instance the European Community Household Panel.

#### ACKNOWLEDGEMENT

This paper is based on research carried out in the context of the network4value study (1/2005–3/2006) funded by the European Commission, DG Information Society & Media, Unit New Work Environments.

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# The meaning of results oriented pay and its effects on individual performance

Anu Hakonen<sup>1</sup>; Kiisa Hulkko<sup>1</sup>; Johanna Maaniemi<sup>1</sup>

<sup>1</sup>Researcher, Helsinki University of Technology, [firtsname.lastname@tkk.fi](mailto:firtsname.lastname@tkk.fi)

**Keywords**—results oriented pay, reflection theory of pay, pay meaning, performance.

## 1 INTRODUCTION

In recent decade, there has been an increasing trend for organizations to implement new pay systems such as systems based on job and performance evaluation. In addition, results oriented pay systems have been actively developed. The future plans include these same elements. [1] According to the Confederation of Finnish Industries [2], 52% of the employees in private sector were in a results oriented pay scheme. Results oriented pay is a bonus system with predetermined goals for either individuals or groups. The amount of money involved in usually quite small, about 5 % of annual salary [3].

Financial incentives or pay systems are presumed to affect employee motivation and performance. This is a common thought both in theoretical and practical discussion. Research suggests that financial incentives are related to improved employee performance [4] - [10]. Yet there is also studies indicating that effects of pay systems varies [4] and costs and benefits have been evaluated too narrowly [11].

Still very little research is done to study the importance of pay systems to individuals. As Robert Heneman [12] stated, there is a need for new theoretical knowledge regarding pay systems. The reflection theory of pay [13], [14] was designed to clarify which meanings pay may have to an individual and how pay affects an individuals' behavior at work. The reflection theory of pay has been developed by Henk Thierry [13], [14]. The basic idea of the theory is that pay may be meaningful for an individual if it communicates about issues important to that individual. Pay may have four types of meaning. Firstly, it may have instrumental value in achievement of an important objective. Secondly, via pay a person may get feedback on his or her performance compared to objectives or coworkers. Thirdly, pay may reflect a person's power position at workplace. Fourthly, pay may support material well-being. In addition, the theory suggests that the meaning of pay mediates the relationship between a pay system and individual motivation and performance.

The model of reflection theory of pay has been empirically tested only in few studies that have mainly

focused on pay satisfaction, not on performance. Thierry [13], [14] stresses the temporary nature of reflection theory. This paper aims at investigating the relationships between the meaning of results oriented pay and its effects on individual performance and testing the theoretical assumptions of reflection theory of pay in connection to results oriented pay.

### 1.1 Reflection theory of pay

The reflection theory of pay [13], [14] is based on the proposition that pay is meaningful to individuals because it reflects information from important domains other than pay. Pay is perceived as important when it conveys information about domains that are relevant to the individual. In addition, the reflection theory assumes that pay system affects the performance and pay satisfaction of employees through its perceived meaning. That is, the meaning of pay mediates the relationship between pay system and its outcomes.

Thierry [13], [14] has adopted ideas of several theories in order to construct a way to understand individual perceptions and behavior in context of rewarding. Expectancy theory [15] and Lawler's [16] ideas of importance of pay form the key ideas of the theory. In addition, equity theory [17], goal-setting theory [18], theory of cognitive evaluation [19] plus several other theories have influenced the development of reflection theory.

Thierry [13], [14], [20] - [22] suggests that pay can be meaningful for individuals in four different ways.

1. *Motivational properties.* Pay can be meaningful if a person considers pay as a mean of achieving important goals. In other words, motivational properties refers to the instrumentality of pay. This category is based on propositions of expectancy theory [15] and Lawler's [16] ideas of importance of pay. In addition, Thierry has adopted ideas from reinforcement theory to state that human behavior is not necessarily conscious, but can be guided by its outcomes.
2. *Relative position* stresses two feedback characteristics. An individual can perceive a pay systems as meaningful if it gives her feedback of how successful she has been in relation to her co-workers or in relation to her goals. Several theories relate to this category of pay meaning [14]. Equity theory [17] relates to the idea of getting feedback of persons effectiveness in relation to others in workplace. Goal-



setting theory [18] stresses the role of feedback in increased performance.

3. *Control* dimension refers to power. Pay can be meaningful if it reflects the persons' position in the organizational hierarchy. It stresses the degree to which the individual has influenced other employees performance. A pay system can be perceived as meaningful if it signals the importance of a person to the organization. One theory behind this dimension is theory of cognitive evaluation [19]. Based on this, pay can be meaningful if it supports individual's feeling of competence and self-determination.
4. *Spending*. Pay denotes the goods and services purchased. In this sense pay can be meaningful if it affects persons capability to acquire goods and services. This is especially important if there are no other means available for the person to acquire these goods. This spending dimension is partly based on expectancy theory.

Reflection theory holds the proposition that pay that is not perceived as meaningful, has no effects on performance. On the other hand, the more significant the reward system is the more effects it has. Thierry [13], [14] has created a model of the factors that may affect the pay meaning, performance and satisfaction of the employees. Besides individual factors like personality and demographic factors at least the knowledge of pay is presumed to be a clear predictor to the pay meaning. Structure or type of the pay system, its fit with organization's strategy and participative planning are matters that are according to the core model supposed to be in connection with the perceived meaning of pay [13].

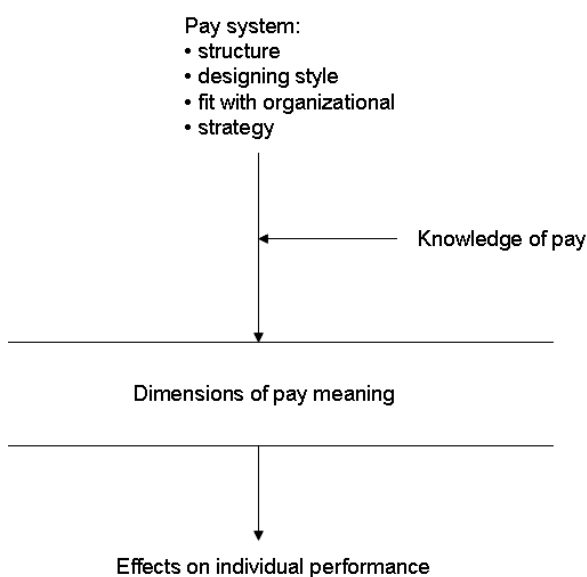


FIGURE 1  
THE MODEL OF REFLECTION THEORY IN THIS STUDY

*Structure or type of the pay system* is supposed to affect on the perceived meaning. Thierry [13], [20] states that different kinds of pay systems may be meaningful in different ways. He argues that relevant questions are whether

the pay system is based on performance or not and is it on individual, group or business unit level.

*Participative planning*. The model [13] is also based on the presumption that when pay systems are developed in participation with employees, the employees will be more satisfied to the final result and it has more effects on behavior. In goal-setting theory [18] it is presumed that goal-setting leads to better performance when individuals are committed to the goal. Participation has been found to be effective mean to enhance goal commitment [19]. In decisions regarding rewarding, participation can be taking part in designing pay system plans or indicators for measuring results. In general, participation has been considered to increase productivity and job satisfaction [24]. Participation or representativeness as in Leventhal's [25] classic justice rules, has been an important argument in justice research. It is suggested that individuals are more committed to final results, if they have been involved in the process [26], [27].

*Fit with organizations strategy*. According to Thierry [13] an important aspect is the extent to which the pay policy is integrated into the strategic company policy. From the organizations's point of view pay has been thought to be most effective when it supports organizational strategy [28], [29]. According to Lawler [28], to be effective organization's strategy, structure, processes, pay systems and personnel should be in line with each other. Also Thierry [13], [30] argues that as well as pay systems, also other human resource practices should be in line with each other and integrated into the strategic policy.

*Knowledge of pay* is one of the most important antecedents of both meaning of pay and effects on individual performance. The basic proposition is that a pay system that is not known by the employees can not affect their behavior. This same proposition is also hold by the motivation theories behind reflection theory. According expectancy theory [15] a pay can motivate only if it is known by the individuals. Also goal-setting theory [18] has the proposition that high performance is related to specific and known goals. In addition, in theory of reasoned action knowledge is a prerequisite for predicting human behavior [31].

According to studies of Shaw and Jenkins [32] and Salimäki [33], [34] knowledge was related to meaning of pay. The better the pay system was known by the respondents, the more meaning it had. In some other studies using the reflection theory perspective knowledge has not been significantly related to pay meaning [13], [14].

The relationships between knowledge of pay and pay satisfaction has been studied. Most research suggests that the better the employees know their pay system the more satisfied they are with it [35] – [37]. Similar finding has been reported in studies using the model of reflection theory [32] – [34]. Yet some studies are suggesting that knowledge can also lead to lower satisfaction, especially if persons are informed about having lower pay than others in the company [38] – [39].

The reflection theory suggests that the *meaning of pay mediates* the relationship between a pay system and individual motivation and performance [13], [14]. This means that pay affects individual performance through its meaning.

The model has previously been used in explaining pay satisfaction. Miedema [40] studied in her doctoral thesis the relationship between meaning of pay and pay satisfaction. Based on her results both relative and control meaning was related to pay satisfaction. The more meaning the pay system had the more satisfied the respondents were on their pay. According to Thierry [13], [14] the relative dimension of pay meaning has been related to pay satisfaction in several studies, but other dimensions of pay meaning have been in connection to pay satisfaction only in some of the studies.

In one study all the dimensions of pay meaning had positive correlations with pay satisfaction. [32]. In two studies in Finland relative meaning was found to be positively related to pay satisfaction [33], [34] and perceived effects of pay [33].

The aim of this study is to examine how the theoretical frame of this study, that is, the reflection theory of pay works in context of results oriented pay. The more detailed questions are: 1) are the structure of the results oriented pay, pay systems fit with organizational strategy, participative planning and knowledge of pay related to perceived meaning of pay, 2) what are the relationships between the meaning of results oriented pay and its effects on individual performance 3) is meaning of pay mediating the relationship between a pay system and individual performance.

## 2 METHODS

### 2.1 Sample

The data for this study was gathered with a questionnaire during the years 2003-2005 from 11 organizations in Finland. In three companies two different results oriented pay systems were used, so the respondents represented altogether 14 different pay systems. The organizations were participating in evaluation of functionality of their results oriented pay system. During the evaluation process also facts of the pay systems were collected.

Altogether 858 employees filled the questionnaire. The respondents were predominantly female (59.3 %) and most respondents (61%) were 35-55 years old.

### 2.2 Measures

We used both some facts of the pay systems and the questionnaire data in the analyses. The facts were structure of the pay system (individual or group measures, pay amount), participative planning (is the system designed in co-operation with the personnel) and researchers' estimate whether the pay system is in line with the organizations strategy (fit). The measures in the questionnaire were knowledge of pay, meaning of pay and effects on individual performance.

*Structure of the pay system.* The respondents were classified into four different groups based on the *structure of the pay system*. As a basis of the grouping, we used the level of measures and the amount of reward. First group consisted of respondents who had measures in personal level and the maximum amount of reward was 20 % or more of annual salary. In the second group were respondents with measures in personal level and the maximum amount of the reward was 12-16 % of annual salary. Third group consisted of subjects with measures in unit or company level. The maximum amount of reward was 7-12 % of annual salary. Finally, in the fourth group were respondents with measures in unit or company level and the maximum amount of the reward was 5-6 % of annual salary. The groups were coded and used in the analyses as three dummy variables.

*Participative planning or designing.* The respondents were classified in two groups on basis of designing style. Less than half of the respondents (45 %) had a pay system that was designed in co-operation with the personnel (at least an employee representative was attending the group responsible for the designing). Later on in this paper this is called participative planning.

*Fit between the pay system and organizational strategy.* Estimate whether the pay system is in line with the organizations strategy. This was evaluated by the researcher evaluating the pay system based on the extent to which the pay system is integrated into organization's strategy. Most respondents (79%) were in scheme of a system with clear link with strategy.

*Knowledge of pay.* The seven item measure developed by Mulvey, LeBlanc, Heneman and McInerney [36] was used to assess the knowledge of pay (e.g. "I know the measures used to determine my reward"). The response scale ranged from strongly disagree (1) to strongly agree (5). The measure reached good reliability ( $\alpha = .77$ ).

*Meaning of pay.* The meaning of pay was measured with the MOP-scale developed by Thierry and Miedema. We used three items from relative, control and spending dimensions. In addition, we added three questions of respect based on interview study of the meaning of results oriented pay [41]. The items were answered on a five-point scale ranging from strongly disagree (1) to strongly agree (5).

To test the empirical distinctiveness of the meaning of pay dimensions a principal-components analysis (PCA) with oblimin rotation was conducted. PCA yielded two components (Eigenvalue of component 1 = 6.80; component 2 = 6.80; variance explained by component 1 = 56.6%; component 2 = 12.6%) which accounted for 69.2% of the total variance. All the spending dimension items loaded on the first component (later in this paper called financial meaning) and all relative, control and respect items on the second component (later in this paper called feedback meaning). The Cronbach's alpha for the financial meaning measure was .84 and for the feedback meaning .94.

*Perceived effects the pay system on individual performance.* The perceived effects of the pay system to individual performance was measured with four item scale. The scale included following items: "Because of the results oriented pay system I put more effort on reaching the goals", "the goals of the pay system are affecting my work", "the pay system does not influence the way I am working" and "the pay system influences the priorities in my work". The measure reached good reliability ( $\alpha = .82$ ).

TABLE 1  
CORRELATIONS

	1	2	3	4	5
1 Participative planning					
2 Fit with organizational strategy	-.105**				
3 Knowledge of pay	-.091**	.009			
4 Financial meaning	.124***	.109**	.240***		
5 Feedback meaning	.173***	.162***	.281***	.503***	
6 Effects on individual performance	-.011	.144***	.353***	.455***	.482***

\*p < .05, \*\*p < .01, \*\*\*p < .001

To test the effects of independent variables to meaning of pay we regressed the independent variables on both dimensions of meaning of pay. The results are shown in Table 2. As expected, all the independent variables were positively related to the dimensions of pay meaning. They explained 12% of the variance of financial meaning and 16% of the feedback meaning.

TABLE 2  
THE RELATIONSHIPS BETWEEN INDEPENDENT VARIABLES AND PAY MEANING DIMENSIONS

Independent variables	Financial meaning	Feedback meaning
Structure of the pay system	***	*
Participative planning	.19***	.24***
Fit with organizational strategy	.12**	.18***
Knowledge of pay	.23***	.28***
R <sup>2</sup>	.12***	.16***

\*p < .05, \*\*p < .01, \*\*\*p < .001

Also the structure of the pay system was significantly related to both dimensions of pay meaning. As the structure of the system was coded as dummy variables, we tested the differences with analysis of variance. Pay system was financially most meaningful ( $M = 3.48$ ) for the respondents with measures on personal level and high rewards. Their responses differed significantly from other groups ( $M_{g1} = 3.48$  vs.  $M_{g2} = 3.04$ ,  $p < .01$ ;  $M_{g1} = 3.48$  vs.  $M_{g3} = 2.96$ ,  $p < .001$ ;  $M_{g1} = 3.48$  vs.  $M_{g4} = 2.95$ ,  $p < .001$ )<sup>2</sup>. Accordingly pay conveyed significantly more feedback meaning ( $M = 3.14$ ) for respondents with measures on personal level and high rewards than for others ( $M_{g1} = 3.14$  vs.  $M_{g2} = 2.93$ ,  $p = ns.$ ;  $M_{g1} = 3.14$  vs.  $M_{g3} = 2.72$ ,  $p < .001$ ;  $M_{g1} = 3.14$  vs.  $M_{g4} = 2.86$ ,  $p < .01$ ).

<sup>2</sup> Structure of the pay system: g1 = measures on personal level and high rewards, g2 = measures on personal level and intermediate rewards, g3 = measures on unit or company level and intermediate rewards, g4 = measures on unit or organization level and small rewards

### 3 RESULTS

The correlations between our variables are presented in Table 1. As can be seen all the independent variables had a significant correlation with both dimensions of pay meaning. Besides participative planning, other independent variables also were significantly correlated with the perceived effects of the pay system. Interestingly, both dimensions of meaning of pay had a significant correlation with the perceived effects of the pay system.

As shown in table 3 both the financial meaning and feedback meaning of pay were significantly related to the perceived effects on individual performance.

TABLE 3  
THE RELATIONSHIPS BETWEEN MEANING OF RESULTS ORIENTED PAY AND EFFECTS ON INDIVIDUAL PERFORMANCE

Independent variables	Effects on individual performance
Financial meaning	.28***
Feedback meaning	.34***
R <sup>2</sup>	.29***

\*p < .05, \*\*p < .01, \*\*\*p < .001

We used hierarchical regression to test the presumption of mediation. In the first step we entered the facts (pay system structure, participative planning, fit with strategy) and knowledge of pay into the equation. As can be seen from the Table 4, step 1, all independent variables except participative planning, had significant relationships with the perceived effects.

The effects of pay system structure were analyzed in detail with Anova and t-tests. The effects on individual performance were largest among those who had individual measures with large rewards ( $M_{g1} = 3.35$  vs.  $M_{g2} = 3.07$ ,  $p < .05$ ;  $M_{g1} = 3.35$  vs.  $M_{g3} = 2.68$ ,  $p < .001$ ;  $M_{g1} = 3.35$  vs.  $M_{g4} = 2.86$ ,  $p < .001$ ).

TABLE 4  
HIERARCHICAL REGRESSIONS PREDICTING EFFECTS ON INDIVIDUAL PERFORMANCE

Independent variables	Effects on individual performance	
	Step 1:	Step 2:
Structure of the pay system	***	*
Participative planning	.06	-.06
Fit with organizational strategy	.11**	.03
Knowledge of pay	.32***	.19***
Financial meaning		.25***
Feedback meaning		.29***
R <sup>2</sup>	.17***	.35***
R <sup>2</sup> change		.18***

\*p < .05, \*\*p < .01, \*\*\*p < .001

In the second step, to test the mediation, both dimensions of pay meaning (the potential mediators) were entered into the regression model. When the meaning of pay was entered to the regression in the second step fit with strategy lost its statistical significance (step 1:  $\beta = .11, p < .01$ ; step 2:  $\beta = .03, p = \text{ns.}$ ) and the coefficient of knowledge of pay became remarkably smaller (step 1:  $\beta = .32, p < .001$ ; step 2:  $\beta = .19, p < .001$ ). Also the significance of the relationship with the structure of the pay system and perceived effects was lower. Instead, as predicted, both financial meaning ( $\beta = .25, p < .001$ ) and feedback meaning ( $\beta = .29, p < .001$ ) had strong relationships with the perceived effects. When pay meaning dimensions were added to the equation the amount of variance explained increased significantly from 17.3% to 35.4%.

Considering the results (Table 2) according to which these three variables (structure, fit with strategy, knowledge) also have a main effect on the mediators the traditional requirements of mediation suggested by Baron and Kenny [42] were fulfilled: The meaning of pay mediated fully the relationship between fit with strategy and performance and partially the relationship between structure of pay system and knowledge of pay and performance.

Since the participative planning had no main effect on individual performance the beta coefficient did not change significantly after the entry of the expected mediator (meaning of pay). This pattern violates the classic third rule of the four-step mediation testing strategy, that is, the independent variables should be related to the dependent variable [42]. However, several subsequent authors [43], [44] have suggested that the relationship between independent variables and dependent variable is not a necessary condition for the mediation. The essential criteria for establishing full mediation were here met [43] since participative planning was related to pay meaning (mediator; see Table 2) and pay meaning dimensions were related to individual performance (dependent variable; see Table 3).

#### 4 DISCUSSION

Our results show that the more meaningful a pay system is for individuals the more it affects their performance. It was also found that pay systems have more meaning to individuals and affects more to individual behavior at work if the system is designed in co-operation with the personnel, the system is in line with the organizational strategy and it is known by the employees.

Our results indicate that results oriented pay has most meaning for persons who have measures on personal level and large rewards. Moreover, the results oriented pay affects most to the performance of these persons. These results are in line with findings of a Kauhanen and Piekkola [45] that the respondents considered results oriented pay as most motivating when the measures were at personal or team based level and the amount of reward was high enough.

Our results also show that the results oriented pay has more meaning and more effects on individual performance when the pay system is clearly connected to the strategy of the organization. Studies of pay system fit with organization's strategy are highlighting organizational effectiveness. In this study the focus was different and the novelty is in finding that employees are considering pay system as more meaningful if it is in line with organization's goals.

According to our results a pay system has more meaning for employees and affects their performance more when the employees have participated in the pay system development. Participative planning has no main effect on individual performance, the meaning of pay mediated fully the relationship between participative planning and performance. Also these results are supported by Kauhanen and Piekkola [45]. Their study suggested that when the employees participated in the design of pay system, the system was perceived more motivating. Also other studies suggest similar findings. Participation in pay plan development had according to Lawler & Hackman [46] a positive effect in employee attendance and according to Jenkins and Lawler [47] in pay satisfaction and understanding the plan.

Our results suggest that results oriented pay has more meaning and more effects on performance the better the employees know the pay system. Some of the studies using reflection theory of pay are in line with this finding. In those studies knowledge of pay has been positively related to pay meaning dimensions and pay satisfaction [32] – [34] and perceived effects [33]. Yet Thierry [13], [14] states that the role of knowledge has been less clear than expected.

Our findings about importance of knowledge of pay are also supported by Kauhanen and Piekkola [45]. According to their results the pay system was perceived as more motivating when the employees knew their performance measures. Also several other studies suggest that employees are more satisfied with their pay when they know the system well [35] – [37].

This study provides clear support for the propositions of the reflection theory of pay. The results suggest that the meaning of pay partially mediates the relationships between pay system structure and knowledge of the pay system, and performance. The meaning mediated fully the relationships between the way of pay system was developed, its fit with organizational strategy, and performance. In previous studies the meaning of pay has been shown to mediate the relationship between managerial actions and pay satisfaction [33] – [34].

*In conclusion*, these results provide further evidence for the reflection theory of pay.

The structure of the pay, participation of the personnel in design of the pay system, pay system's fit with organization's strategy and knowledge of pay were all significantly connected to the meaning of pay. The meaning of pay was found to be a mediator between the independent variables and perceived performance.



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# The effects of job and competence evaluation based pay systems on the gender pay gap in the Finnish public sector

Sini Jämsén<sup>1</sup>

<sup>1</sup>Researcher, Helsinki University of Technology, [sini.jamsen@tkk.fi](mailto:sini.jamsen@tkk.fi)

**Keywords**—gender pay gap, pay systems, job evaluation, performance and competence evaluation, public sector

2 THE GENDER PAY GAP AND EVALUATION BASED PAY SYSTEMS IN FINLAND

## 1 INTRODUCTION

Pay systems based on job and performance or competence<sup>2</sup> evaluation have recently become very popular in Finland. One reason behind the popularity of these systems is assumption that job evaluation can promote the principle “equal pay for work of equal value” and diminish the groundless pay differences between men and women.

In this paper I examine, how the new pay systems based on the job and performance evaluation have affected to the pay gap between men and women in the Finnish central and local government sector. The study is based on case studies<sup>3</sup> from both central and local government sector and statistical analysis of national wage data on the two sectors.

I find that the introduction of the evaluation based pay systems has reduced the wage gap in the case organizations in the central government sector and small diminishing of the gender wage gap can be seen in the level of whole central government sector as well. In the local government sector, there were no case organizations where the pay gap was clearly diminished because of the implementation of the new pay system. The gender pay gap in the local government sector is notably wider in the whole sector than within separate agreements. I propose that differences between local and central public sector can at least partly be explained through corporatism: profession-based agreements (segregated by gender) have inhibited convergence of pay between men and women.

In the European Union the estimated pay gap between the average gross hourly earnings of men and women were 15 % in the year 2004. In Finland, the gender pay gap was sixth widest in the EU, about 20 % [1]. According to research by Vartiainen [2], [3], about half of this wage gap can be explained by individual characteristics, industry, and occupation. In the public sector, even larger part of gender wage gap can be explained.

### 2.1 Why Is There a Gender Pay Gap?

There are several reasons, why the gender pay gap exists. For example, the differences in the human capital - education and experience - have been used when explaining the gap. It is true that earlier the wage gap may partly have derived from the lower level of education females had in comparison to males. However, at present in younger age groups, female already have even higher education level than male in Finland [4]. Another reason for the gender wage gap may be that having children affect women's careers more than men's. For example, women work part time more often than men. Budig and England [5] have studied “the wage penalty for motherhood” and its causes. In their data, women who were mothers received not only lower wages than men, but also lower wages than women without children.

In Finland, as in the most economies, labor markets are segregated by gender. One of the most important reasons for the gender pay gap is that female dominated jobs are usually paid less than do those predominantly male jobs. Under these circumstances, an extensive wage gap can exist even though male and female workers would be equally rewarded by all individual employers.

It is a partly unsettled question, whether the gender pay gap derives from acceptable procedures and whether it can be called discrimination. The wage differences between men and women may occur from several processes. First, the pay differences can arise from systematic differences in the pay of men and women performing the same job for the same employer. Petersen and Morgan [6] call this process

<sup>2</sup> There are different conventions whether the use term competence or performance evaluation.

<sup>3</sup> Case study results presented in this paper are from two research projects, which were executed in Helsinki University of Technology, BIT Research Centre. The research project which studied the central government sector was funded by Ministry of Finance: the Office for the Government as Employer, The Occupational Safety and Health Fund of the state sector and the case organizations. The project about local government sector and private industrial companies was funded by Ministry of Social Affairs and Health, European Social Fund, labor market organizations and the case organizations.

“within-job discrimination”. Second, there might be cases in which, in given organization, there are a tendency for women to be concentrated in lower-paying jobs. It is often unclear, how much this arise from possible discrimination and how much from employees personal choices. This process may involve discrimination through different access to occupations and establishments, for example, through the processes of hiring and promoting. And third, there might be a tendency for women to work for lower paying employers, occupations and establishments with lower average wage levels. There might be cases, where occupations held primarily by women are paid lower wages than those held primarily by men, although skill requirements and other wage-relevant factors are the same [6], [7].

## *2.2 Concept of Equal Pay and Pay Systems Based on Job and Performance Evaluation*

The principle of equal pay from equal work has been presented in many laws and international agreements. According to the United Nation’s Universal Declaration of Human Rights, “everyone, without any discrimination has the right to equal pay for equal work” [8]. Also EU directives, Finnish national legislation and International Labour Organization ILO’s Equal Remuneration Convention include regulations and guidelines of equal pay. For example, in the European Council Directive 75/117/EEC, the principle of equal pay has been expanded to relate not only equal work but also work with equal value [9]. Principle of equal pay concerns jobs with the same employer.

The doctrine of comparable worth is based on an assumption that each job possesses an inherent worth independent of the market forces of supply and demand. The comparable worth policies addresses to the inequities, which are not necessarily associated to a low absolute wage for a given worker, but result from a wage consider too low relative to a wage paid for another job. The notion that jobs are segregated by gender and jobs dominated by women pay systematically less than jobs dominated by men provides the rationale for the comparable worth systems [7].

The basic idea of job evaluation based pay systems is that employers should set wages on job requirements without regard to the demographic characteristics of job’s typical holder [10]. The job’s worth depends on the characteristics of the job, not those of the workers who hold the job [7]. Every job in the organization should be evaluated, and jobs found comparable in worth are expected to be paid equally. There are different kinds of methods to do the evaluation. These methods are usually divided to quantitative and qualitative methods [11].

The personal pay component based on performance/competence evaluation is usually defined by the evaluation made by manager using some kind of point scale and on the grounds of this evaluation the personal wage component is defined. Evaluation should always

happen prorata to the task. Regarding the equality between men and women, the essential thing is that the evaluations treat men and women equally.

Pay systems based on job and performance and/or competence evaluation are becoming increasingly popular in all sectors of Finnish working life. In the central government sector the transition to evaluation based pay systems began in 1990’s. In the summer 2006 95.7 % workers in the central government sector were under new pay systems based on job and performance evaluation [12]. Also in the local public sector the job and performance evaluation based pay systems are in extensive use, excluding only teachers and hourly-paid employees. Pay systems based on job and performance evaluation are very popular also in private sector in Finland, and now even The Evangelical Lutheran Church of Finland is planning to begin to use these systems. One motive behind the popularity of the pay systems based on job evaluation is the assumption that the job evaluation based systems can be the tool to define which jobs have equal value and by this, reduce wage gap between men and women. This is based on a thought that the standards of female-dominated jobs can often be underestimated [13], [14]. In Finland, the working group set by central labor market organizations assessed job evaluation systems and ended up to recommend them as a central method to determine work of equal value and to promote equal pay between men and women [15].

Groshen [16] professes that any enacted or proposed policy to reduce the wage gap between men and women are addressed to specific components of the gap. The job evaluation based pay systems target mainly inequality based on wage differences between occupations and job-cells (occupation within employer). According to Vartiainen [3], in the public sector in Finland the principle of equal pay for equal work is fulfilled quite well. However, Vartiainen do not estimate how pay equality works in work of equal value.

Regardless of high expectations, pay systems based on job and performance evaluation are not an easy and automatic way to reduce the gender wage gap. The good implementation of the pay system is also extremely important [17], [18]. Ideally, the old wages should not direct the evaluation. England and Dunn [19] forewarn possible problems in the job evaluation. First, the gender bias may intrude if women’s jobs are described as less demanding than they really are. Second, the gender bias in the job evaluation may enter if women’s jobs are not given as many points they merit. Third, the gender bias may also appear, whether weights for compensable factors are determined a priori or through policy-capturing. In a priori methods the greater weight may be given to factors more prevalent in male jobs and this will disadvantage women. In policy-capturing approaches the weights governing wage setting have been influenced by considerations of the gender of people doing the work.



### *2.3 Collective Labor Agreements and Central and Local Government Sector as Employers in Finland*

The work agreement system in Finland is very centralized. 70 % of Finland's employed persons are members of a trade union. In the government sector the union density is even greater [20]. Also the majority of employers are members of an employer organization. Incomes policy agreements concluded between employee and employer confederations and the government have been the key instrument by which the level of pay rise has been determined in the past few decades. These agreements have been used to define a framework for pay rise for collective agreement negotiations. Agreements have been reached also e.g. on social benefits and income tax [20]. These abovementioned union agreements can be seen as institutional constraints in the labor markets [21].

In 2005, the central government employed 124,000 employees. The terms and conditions of employment relationship for civil servants and employees under contract are agreed at central level on the Collective Agreement for State Civil Servants and Employees under Contract and at agency level in separate collective agreements. The pay systems currently used in the central government sector are agency-specific, but share some general principles. The salary is composed of a basic salary based on a job evaluation and a personal component based on the evaluation of performance. Some of the government organizations use also some separate result-based rewards [21].

There are 432 municipalities and 217 joint municipal authorities in Finland. These local authorities provide the majority of public services. Local authorities employ a fifth of Finland's employed labor force, nearly 430,000 employees. All local and joint authorities and local government employees and officeholders fall within the scope of the municipal collective agreement system. The principal negotiating organizations and the Commission for Local Authority Employers compose national collective agreements on civil service and contracted employment, which cover issues such as pay. However, local government sector can also make local agreements, which are concluded between local or joint authorities and sub-organization of the principal negotiating organization for the employees [20].

There are five major collective agreements in the local government sector. About 70 % of the personnel are covered by the General Collective Agreement. Technical personnel, teachers, physicians and hourly-paid employees each have their own agreements [20]. In this paper I study female-dominated General Collective Agreement and male-dominated technical personnel agreement.

## 3 DATA AND METHOD

To analyze the development of the gender pay gap, I utilize national statistics from central and local government

sector along with case studies. I collected wage data from three sources. The wage data covering whole sectors is collected from the statistics of Statistics Finland [22]-[41].

The agreement specific wage data from municipal sector was delivered from municipal person register from Commission for Local Authority Employers. All wage figures presented in this paper concern employees that work full-time and receive monthly salary. This improves the solidity of comparisons between sexes, because the groups of men and women are as similar as possible. Finland began to use Euro as an official currency 1.1.2002. All amounts that were in the Finnish marks in the statistics or data have been changed to euros by using the official exchange rate: 1 Euro is 5.94573 FIM.

The case studies consist of six central government sector organizations and five municipalities. From three municipalities I studied five General Collective Agreement cases and four technical personnel agreement cases. Local government sector cases were units from different municipalities, while in the central public sector we studied whole organizations. The central government sector organizations studied here are Finnish Meteorological Institute, Geological Survey of Finland, Ministry of Foreign Affairs of Finland, Population Register Centre, Safety Technology Authority and The Administrative Office of the Academy of Finland. Municipalities are Helsinki, Järvenpää, Lohja, Pori and Turku. From these municipalities we studied different kinds of units.

Organizations delivered the case-specific wage data themselves. Thus, the data can be expected to be highly accurate. Organizations were asked to deliver not only wage data before and after the pay reform, but also many kinds of personal data of employees: age, education, job experience etc. Unfortunately, all requested information was not available from all the case organizations.

The case specific analyses included the comparison of average wages of men and women and different kinds of regression analyses. The comparison of average wages of men and women was also done to identical data, including only those people, who were in the data in all considered years. I utilized regression analyses to examine effects of gender on pay. The dependent variable was the logarithm of monthly wage. The model with a logarithmic variable provided a better fit compared to the linear wage variable and made possible to study the relative changes of wages. Independent variables in the regression analysis were individual characteristics as gender, age, education level and work experience. Case specific analyses are not presented in this paper, but results are introduced briefly and used for background for discussion. More about these analyses can be read from final reports of projects [17], [18].

We also collected many other kinds of data during the two research projects: survey data, interviews and written material from organizations. This data is not analyzed here, but the data is contributing in the background in the conclusion and discussion section.

## 4 RESULTS

First, I review the development of gender wage gap in the sector wide perspective. In the Figure 1 are women's earnings for regular working hours of men's earnings in percent in both the central and local government sector and separate from General Collective Agreement and technical personnel agreement in the local government sector. In the Figure 2 there is same information of total wages. In both sector the wage gap seems to be decreased a little from the year 1995 to year 2004. In the local public sector the wage gap is generally a little wider in this data. When the wage gaps are examined within particular agreement, the gap is remarkable smaller. Within the technical personnel agreement can be seen the clearest diminishing of wage gap. This agreement was the first to use the pay system based on job and performance evaluation in the Finnish public sector. In the grounds of only the study of average wages can not be argued that the change is caused particularly the pay reform, but it can be one reason for the change.

In the central government sector the implementation of the new pay systems carried out different years in different organizations. In the local government sector the implementation of new pay systems were more centralized and the implementation of pay systems happened almost same time in the all municipalities. Technical personnel agreement started to use job evaluation and personal pay component based on deliberation already in the year 1995. Job evaluation was included in the General Collective Agreement in 2001 and personal pay component 2004.

In the Figure 3 there are average wages of General Collective Agreement of average wages of technical personnel agreement in percent. Both the average earning for regular working hours and average total wages of technical personnel agreement are in every year bigger than in General Collective Agreement. The difference between average wages of these two contracts is larger when looked the total wages than wages for regular working hours. The wage gap seems to enlarge from year 1995 to year 2001 and then diminish again. This is the same period when the job evaluation is in use only in the technical personnel agreement.

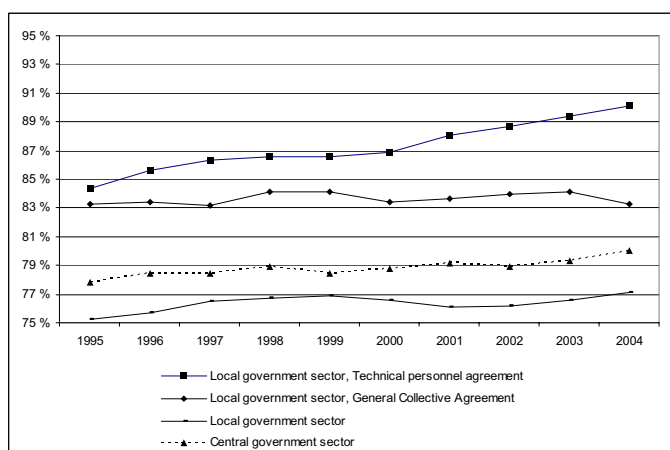


Figure 2  
Women's average total earnings of men's average total earnings (%).

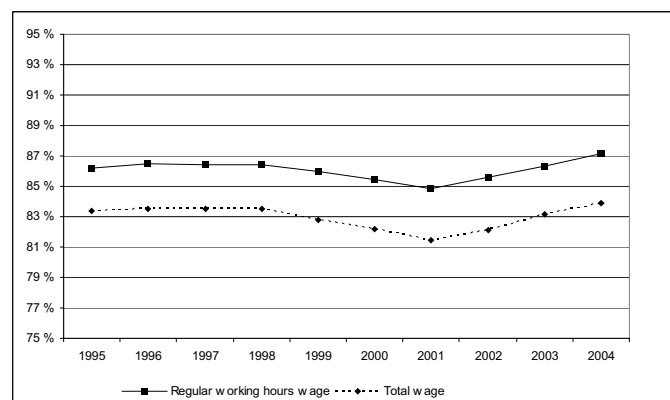


Figure 3  
Average wages of General Collective Agreement of average wages of technical personnel agreement (%).

Next, I introduce the case analyses. In the Tables 1 and 2 all cases are introduced briefly and the main results of case specific data-analyses are reported. The gender wage gap diminished in the central government sector in all cases following the implementation of the new pay system. However, alternative analysis which included only identical data (only people that were in data all years) did not show diminishing the gap in two cases (C & F). These two cases were also these ones, where the effect of gender in the wages in the regression models, where other independent variables were education and age, was bigger after the pay reform than before. In other central government sector cases the regression models supported the hypothesis that gender wage gap had been diminished because of the new pay system.

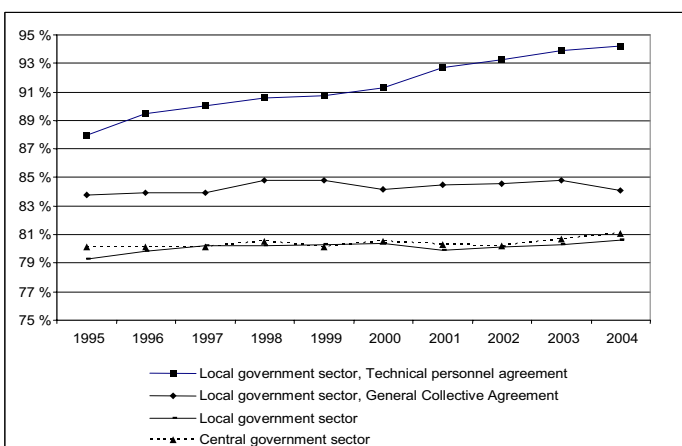


Figure 1  
Women's average earnings for regular working hours of men's average earnings for regular working hours (%).

TABLE 1  
THE CASE ORGANIZATIONS IN THE CENTRAL GOVERNMENT SECTOR.

### Case A

The year of the pay reform: 2003

The wage gap between average wages of men and women diminished little from the first review point (2000) to the last after the pay reform both in the whole data and in an identical data. However, the development of wage gap was not completely straightforward. There existed a small wage gap after the pay reform even within the same job evaluation level.

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**Case B**

The year of the pay reform: 1998

The gender pay gap shrank notable from the time before the pay reform to the year 2005. In the whole data in the year 1997 the total wage of women's was only 71.8 % of men's average wage when in the year 2005 it was 84.6 %. Also in the examination of the identical data, the wage gap had narrowed. The meaning of the gender as the explanatory term in the regression models, where there were also other explanatory terms, also diminished.

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**Case C**

The year of the pay reform: 1997

The wage gap between average wages between men and women shrank a few percents in the whole data, but not among those who were in the wage data all the time. On the grounds of the regression analyses it did not seem that the new pay system had reduced the gender effect to the wages.

---

**Case D**

The year of the pay reform: 1998

The wage gap diminished both in the whole data and in identical data. However, the development is not straightforward all the time. After the pay reform the new pay system seems to treat men and women quite equally. There were no unexplained gender wage gaps in the regression analyses, when personal data like education and age had been taken to a consideration.

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**Case E**

The year of the pay reform: 2003

The gender wage gap diminished little from the first review point to the last after the pay reform both in the whole data and among those people who were in the wage data all the time. The remaining wage gap after the pay reform was explained by men's and women's differences in personal data and there was no wage gap left unexplained. Also, gender did not have statistical significance effect on the size of percentage wage component based on performance evaluation or to the level of the job evaluation.

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**Case F**

The year of the pay reform: 1999

The wage gap between average wages of men and women shrank a few percents in the whole data, but not among those who were in the wage data all the time. On the grounds of the regression analyses it did not seem that the new pay system had reduced the gender effect to the wages.

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In the local government sector there were no cases, in which the wage analyses suggested the new pay system to have an effect on the wage gap (Table 2). In some case units, there was even no statistically significant wage gap within particular agreement and unit even at the beginning. Also a couple of municipal units were so segregated by gender that there were not enough men or women to conduct proper statistical analyses.

TABLE 2

THE CASE UNITS IN THE LOCAL GOVERNMENT SECTOR.

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**General Collective Agreement**

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**Case G**

There were no statistical significant pay differences in any examination and therefore also not remarkable differences before and after the pay reform.

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**Case H**

There was no clear direction in the development of gender wage gap in time period under examination. The wage gap even enlarged little from the first examination point to the last.

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**Case I**

The gender wage gap first decreased a little from the time before the beginning of use the job analysis but later the wage gap grew

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**Case J**

The unit was so segregated by gender that there were not enough men to do reliable analysis. When average wages were compared to the personnel within technical personnel agreement in the same organization, the wage gap between these two agreements, and also between genders in this whole data, diminished a little.

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**Case K**

The gender wage gap in this organization was for the advantage of women. This derived mainly because the women had better education than men in this organization and worked in the jobs that required more professional skills. There was no clear direction in the development of gender wage gap in time period under examination.

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**Technical personnel agreement**

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**Case L**

There were no statistical significant pay differences in any examination and therefore also not remarkable differences before and after the pay reform.

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**Case M**

There was no clear direction in the development of gender wage gap in time period under examination. The differences between years were very little.

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**Case N**

The unit was so segregated by gender that there were not enough men to do reliable analysis. When average wages were compared to the personnel within General Collective Agreement in the same organization, the wage gap between these two agreements and therefore also between genders in this whole data diminished a little.

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**Case O**

There was no clear direction in the development of gender wage gap in time period under examination. The size of the gender wage gap varied up and down between years.

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## 5 CONCLUSION AND DISCUSSION

A one major motive driving the implementation of the new pay systems based on job and performance evaluation is an attempt to promote the principle equal pay for work of equal value and influence the pay differences between genders. In the central government sector there were cases, when the new pay system based on job and performance evaluation had clearly diminished the gender wage gap. In the local government sector the situation is more complicated, because the wage differences exist mainly between different collective labor agreements than within agreement. The average wages in the male-dominated technical personnel agreement are bigger than in the female-dominated General Collective agreement. Under such conditions, the new pay systems that are in the municipal sector organized within each agreement have more limited possibilities to reduce the gender wage gap.

In the local government sector there were no cases where the gender wage gap has diminished after the pay reform, but this does not obviously mean, that this kind of cases could not exist in municipal sector. It is also possible that in these cases there were no groundless pay differences to start with. However, the comparison of women's and men's

average earnings within the technical personnel agreement shows that the gender wage gap has diminished from the year 1995 to year 2004. Technical personnel agreement of municipal sector was the first to use evaluation based pay systems in the public sector. Because the pay systems based on evaluations were introduced in 1995, it is possible that the new pay systems have had relevance to the reduction of the wage gap. Still, it could be seen that the gender wage gap is notably wider in the municipal sector in total that it is when each agreement is considered separately. Technical personnel agreement covers fewer than ten percent of workforce in the municipal sector in Finland and the agreement is clearly male-dominated. So the influence of pay system does not reach very wide in the municipal sector. The use of different agreements seems to have impact on the realization of equal pay from work of equal value in the sense that these agreements prevent the evaluation and comparison of jobs and performance beyond agreements and groups of tasks.

Based on case studies in the research projects, the wage changing effects of the new pay system were not on the average as big in the local government sector as in the central government sector. In the General Collective Agreement the job evaluation happens within the specific wage groups, so even all jobs inside this one agreement are not compared with each other. This partly decreases the real influence that job evaluation has on wages and maintains the old wage structure. Also, for example, the personal wage component might be titularly in use in some municipal organizations, but actual performance evaluation was not made. Besides, when the new pay system was brought to the organization in the central government sector, it happened completely at once. In contrast, in municipalities General Collective Agreement first adopted the job evaluation and then the performance evaluation. Also within the General Collective Agreement, the total wage includes the wage component based on work experience still after the pay reform.

It seems that the structures related to determination of wages in the Finnish public sector, as the agreement system, have impact on effect that job evaluation based pay systems have and can have to gender wage gap. Therefore, traditional explanations of the gender wage gap based on example differences in human capital between genders should be supplemented with consideration of institutional factors. The institutional approach emphasizes the meaning of such factors as for example the arrangement of jobs by employer and unionization in determination of wages [21]. These institutions have a great effect to the possibilities in which width the job evaluation can be used and this way also to the possibilities that job evaluation has to promote the gender equality.

On the grounds that pay differences have not been reduced in case organizations in the local public sector and in couple organizations in central public sector can not be made a conclusion that the job evaluation is not working correctly in these organizations. It must be remembered that

there are no unambiguous way to determine the fair order or wage of jobs. The process of choose the compensable factors and relative weights on them in the job evaluation, is inherently judgmental [21]. The fact that gender wage gap has not diminished during the process of pay reform, can be caused by that job evaluation has not have real effect on order that jobs are valued or jobs have been in proper order (according to job evaluation) in the first place. The job evaluation method used can also have its own impact. Anyway, in the local public sector the fact that job evaluation is done only within agreements, and even within specific worker or wage groups, limits the possibilities that job evaluation system has to effect on wages. In the future, when job evaluation systems are introduced, it should be considered carefully, whether to use one or multiple systems in an organization.

A few limitations remain in this study. The case analyses do not allow generalization concerning the whole sectors. Multiple factors affect the gender wage gap in the level of whole sector, and comparison of the average wages is only one way to measure the pay systems. Also it must be remembered that the effects of pay reforms do not appear entirely immediately. Therefore, it is very interesting to regard the gender wage gap in Finland also in the future. Only the future will tell if there are going to be significant changes. However, based on this study it seems probable that the several agreements in the same sector and same organization inhibit radical change in the wage gap across professional groups.

#### ACKNOWLEDGEMENTS

I would like to thank my former and present researcher colleagues Carita Lahti, Saara Tarumo, Mari Huuhtanen, Sanna Juvonen, Virpi Karppinen, and Johanna Maaniemi, who have worked with me studying the complicated questions of equal pay and pay systems.

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# Total rewards from an employee perspective

An Verbruggen; Xavier Baeten

*Researcher, Vlerick Leuven Gent Management School, an.verbruggen@vlerick.be*

*Manager, Vlerick Leuven Gent Management School, xavier.baeten@vlerick.be*

**Keywords** — total rewards, compensation, pay-for-performance, employee satisfaction, employee motivation, employee preferences

## 1 INTRODUCTION

In this paper, the results of a broad-based employee total rewards research will be reported. This research took place in 2005 as a joint initiative of the Strategic Rewards Research Centre (SRRC) of Vlerick Leuven Gent Management School<sup>2</sup> and Jobat, a job advertising newspaper.

The Employee Rewards Research has some specific features, both looking at content and at the employee groups that have been studied: the survey did not only question managerial, but also operational employees, blue collars and public servants. With regard to the content of the research, a first important element is that it was not limited to financial rewards, but also asked for information on total rewards, being according to Antony et al. all types of direct and indirect, short and long term financial returns employees obtain as part of their employee relationship [1]. Within the context of financial rewards, the survey also focused on bonus systems and their functioning in the employees' eyes. Second, motivation, retention, satisfaction and preferences were studied as well as the links between these dimensions. A third interesting feature content-wise, lies in linking reward satisfaction and preferences on the one hand, and the respondents' performance on the other hand. This will enable answering questions with regard to to what extent high performers' reward preferences differ from average and low performers.

This paper is intended to be descriptive, reporting employee satisfaction with and preferences for the different components of the reward package, and the employees' total rewards experience.

## 2 RESEARCH QUESTIONS AND METHODOLOGY

### 2.1 Background

In June 2005, SRRC launched a large-scale Employee Rewards Research, asking employees from public and private sector about their motivation in general, and their

rewards satisfaction, preferences and perceptions more specifically. The research took place in Belgium, and thus gives an idea of the practices and experiences on rewarding in a European context.

This research was set up in order to update SRRC's rewards satisfaction research that was carried out in 2002. That survey assessed 3000 employees' satisfaction with financial and non-financial rewards. The current research builds further on and updates the findings of the 2002-research. In 2005, we could restrict to the large rewarding dimensions which we were able to deduct from the previous survey, where we questioned 52 reward components. Moreover, the current research also measures some other dimensions (like preferences and perceptions) that have not or rarely been studied in research on reward policies and systems.

Another reason for setting up this research was that, through day-to-day contact with companies and on the basis of own research results, it was observed that organisations are not paying enough attention to and are not fully aware of preferences and needs of employees, thus neglecting these important stakeholders.

The questionnaire was built on the following dimensions: total rewards, cash, employee benefits, bonus schemes. Furthermore, some questions were asked on socio-demographic characteristics in order to be able to make further refinements.

### 2.2 Research questions

The study aimed at providing an answer to 3 important questions: how satisfied are employees with the different elements of their rewards package, leading to the most important strengths and weaknesses of organisations' reward policies; how motivated are employees and to what extent are total rewards elements drivers for motivation; and what are the employees' preferences with regard to the total rewards elements in their package and specifically with regard to cash.

### 2.3 Methodology

The survey was only available as web-based application through the website of media partner Jobat. An element of critique could be that this way, the study only focused on people in search of a new job, thus only targeting a specific group of respondents. This criticism can be countered by the results of a specific question in the study, concerning the respondents' willingness to change jobs.

<sup>2</sup> Vlerick Leuven Gent Management School is the Autonomous Management School of Ghent University and Katholieke Universiteit Leuven. Research centres like the Strategic Rewards Research Centre provide a laboratory context to develop, detect, validate and diffuse new management concepts and theories. Interaction between the partner-companies of such a centre is of vital importance.

TABLE 1  
WILLINGNESS TO CHANGE JOBS

	Blue collars	Clerical workers	Middle Mgt	Senior Mgt
Don't want to change	29%	27%	31%	42%
Consult job ads, but not planning change	38%	44%	48%	42%
Actively looking for a new job	32%	30%	22%	16%

Percentages in table 1 indicate the number of respondents that agree with the statement. The results clearly prove that only a minority of the respondents is actively looking for another job. In addition, it should be mentioned that the members of the Strategic Rewards Research Centre played an active role in promoting the research to their employees as well, thus broadening the scope too.

#### 2.4 Processing

The total number of respondents was more than 13000. However, extensive data cleaning has been performed in order to ensure the quality and reliability of the results. All incomplete questionnaires were deleted and questionnaires with aberrant answers were fully discarded as well. After this cleaning, company size and company sector were added on the basis of data found in the Trends Top 100000 ([www.top100000.be](http://www.top100000.be)) and Belfirst, providing financial reports and statistics on Belgian and Luxemburg companies.

This brought us to the final 10902 respondents: 7286 private sector employees, 3600 public sector employees and 16 'unknown'. The remainder of this paper will focus on the results for the 7286 private sector employees.

For the processing of the data, the statistical programme SPSS was used. An appeal was also made to Innexys, in order to help creating good graphical output. Innexys develops internet software for data analysis and graphical reporting on an ASP platform and provides data analysis models.

In order to be able to analyse and report in a consistent and clear way, it was decided to take some of the reward dimensions together in more embracing categories. This resulted in the overview in Figure 1.

#### 2.5 The Sample

The total sample consists of 10902 responses, of which 33% from public sector employees and 67% from private sector employees.

The respondents' median age was 34 years, with a balanced representation of different age groups.

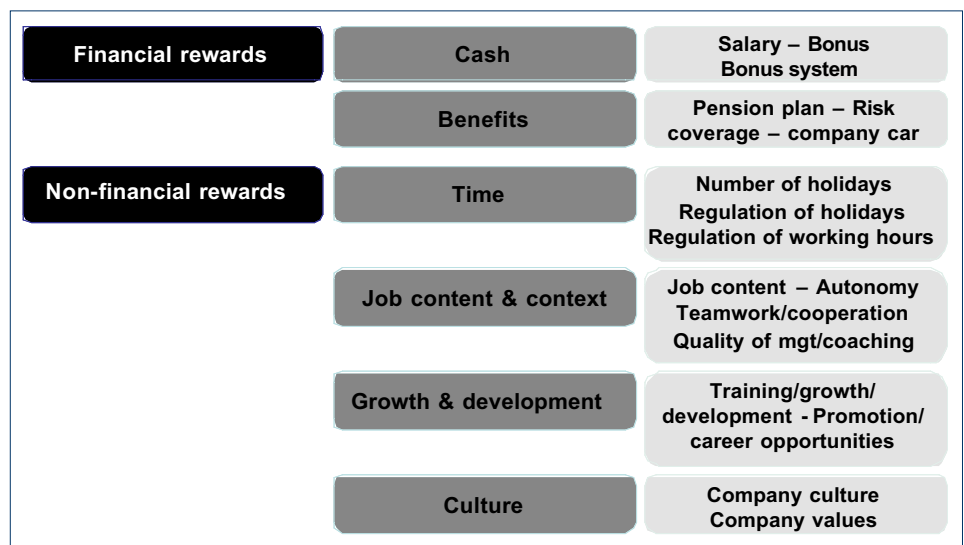
The main focus lies on white collar employees: 62% clerical workers (4497 respondents), 25% middle management (1808 respondents) and 5% senior management (374 respondents). Although only 8% of the

respondents were blue collar workers, it is meaningful to point out that 528 blue collar employees participated.

32% of the respondents were female, unequally distributed over management (18%), clerical workers (43%) and blue collars (22%). Most respondents are active in the services sector (54%) and industry (32%). Other sectors are commerce and non-profit.

Through some analyses on questions where respondents were asked to score their own professional functioning on 7 dimensions and where they had to indicate how their line management would/had evaluated their performance, we were able to make a distinction between weak, average and top performers.

Figure 1: Overview of financial and non-financial rewards



### 3 RESULTS

#### 3.1 Total rewards satisfaction

##### 3.1.1 General satisfaction scores

Respondents had to indicate their satisfaction on a seven-point Likert scale.

Table 2 provides an overview of the satisfaction scores for the different reward dimensions that were taken into account. The percentages indicate the number of respondents that were (very) satisfied. The scores are ranked on the basis of the results for clerical employees.

When looking at the satisfaction of all employee categories, the main strengths are teamwork and cooperation, autonomy, regulation of working hours and holidays, job content, pension plan and company car (for those employees who are entitled to these benefits). Managers (both middle and senior management) are clearly more satisfied with the total reward package, compared with blue collars and clerical workers. The difference mainly lies in higher satisfaction scores for financial rewards (cash and benefits) and time (holidays and work regulations). However, it could be discussed whether the difference in satisfaction between blue collars (38%) and management (57% and 71%) is actually justified.

The main general weaknesses are to be found in non-financial rewards: promotion and career opportunities, education, growth and development, leadership and coaching and company culture. Also some financial rewards, mainly the bonus level and bonus system, have a rather low score. This is a very important finding in an era of short-term incentive schemes. The discontentment might be explained by the inferiority of the systems of performance management, by line management lacking the potential to evaluate people properly, by the use of wrong performance measures and by people overestimating their own performance.

Blue collar workers seem to be very dissatisfied with their benefits package as compared to other organisations. For white collar workers (clerical and middle management), the quality of leadership and coaching are points of attention. For senior management, the main weaknesses are leadership, coaching, and the bonus system.

Looking at these satisfaction scores, it can also be concluded that among others, company culture has to be taken into account more seriously, because of its rather low satisfaction scores, especially for management. Although this should be subject to further research, it might be a consequence of the M&As and downsizing streams that have taken place over the last few years. A recent study by SRRC on the reward management profession, showed that nonfinancial rewards are the least important element in the

time occupation of reward managers. Only 12% of the respondents stated they spend (quite) a lot of time on this issue, whereas more than 60% of the respondents indicated they spend a lot of time on job evaluation, data management, budgeting and external benchmarking [2].

### 3.1.2 *Does the salary level drive satisfaction with total rewards?*

There is a clear link between salary level on the one hand, and total rewards satisfaction on the other hand. People earning less than 2500 euro (gross monthly wage) are clearly less satisfied whereas people earning more than 3500 euro are clearly more satisfied. This supports Heneman's statement that the consistency of the relationship between pay level and pay satisfaction is the most forceful finding when looking for the causes of pay satisfaction [3]. However, this is a general finding which has not only to do with financial rewards.

People earning more seem to be more satisfied with the total package. Satisfaction with benefits clearly rises at wage levels above 2500 euro. Maybe, people earning less are not entitled to these benefits, or they are clearly less important.

### 3.1.3 *Differences related to company size*

When taking into account company size and company sector, some important differences show up. Bigger companies (more than 1000 employees) have a more motivated, but also a more satisfied workforce. The main differences lie in benefits and time. Respondents from companies with 10 to 50 and 100 to 199 employees, are less satisfied with cash. Satisfaction with benefits is clearly higher in companies with more than 500 employees.

There is no clear link between company size and satisfaction with non-financial rewards, except for the previously mentioned satisfaction with time, which might be related to practical organisation issues. Job content has a slightly lower score in companies with 10 to 50 employees. Satisfaction with growth and development is not good on the whole, but slightly better in companies with more than 1000 employees. The same pattern was found with regard to company culture.

### 3.1.4 *Differences related to company sector*

Utilities, industry and financial services have the most satisfied employees, as opposed to hotels and restaurants and public office. Employees in the chemical sector are definitely more satisfied with salary and number of holidays, as are employees from the financial services sector. IT has a good satisfaction score for the benefits package. Consultancy received rather average scores, except for the number of holidays, being a weakness. The non-profit sector's strong points are job content & context as well as company culture.

Public office, hotels, restaurants, real estate and construction score less good with regard to satisfaction with cash. Satisfaction with benefits scores very well in the

TABLE 2:  
SATISFACTION WITH TOTAL REWARD ELEMENTS

	Blue Collars	Clerical workers	Middle Mgt	Top Mgt
Company Car	n.a.	74%	80%	88%
Holiday regulation	51%	65%	77%	82%
Autonomy	50%	65%	76%	83%
Working hours	52%	64%	74%	84%
Teamwork & cooperation	58%	63%	64%	73%
Job content	53%	59%	70%	83%
Risk covers & pension plan	44%	57%	69%	74%
Number of holidays	45%	50%	67%	68%
Company culture & values	31%	39%	42%	67%
Salary	36%	38%	56%	71%
Education/development	31%	34%	42%	62%
Leadership & coaching	34%	34%	35%	50%
Last bonus	27%	30%	40%	59%
Benefits package <sup>3</sup>	16%	30%	52%	66%
Bonus system	28%	25%	35%	59%
Promotion & career	20%	22%	38%	63%
<b>Average Satisfaction</b>	<b>38%</b>	<b>47%</b>	<b>57%</b>	<b>71%</b>

<sup>3</sup> We asked for satisfaction with the benefits package compared to other companies



visibly less good. Satisfaction with time receives better scores in the electricity and financial sectors, and worse scores in the sector of hotels, restaurants and health care. Company culture scores better in electricity and non-profit, and bad in hotels, restaurants and public office.

### 3.1.5 Differences related to work regime

Part-time workers are clearly more satisfied with holidays and regulation of working hours, but are also clearly less satisfied with their job content. This might mean that these employees have fewer responsibilities and/or less attractive projects/tasks. Part-timers tend to be less satisfied with benefits as well. For management (middle and senior), it is striking that part-timers are more satisfied with the regulation of working hours, but show less satisfaction with job content.

### 3.1.6 Differences related to gender

There is quite some difference between the general satisfaction of men (53%) and women (47%).

Focusing on salary, the differences even seem to be bigger: 47% of men are (very) satisfied, while only 39% of women claim to be (very) satisfied. This seems to be in line with other findings that have proven that in many countries, there is salary discrimination between men and women. When focusing on the different employee categories (only for white collars and middle management), we see figures that lie a bit closer to each other (Table 3). Women however, in general tend to be less satisfied with pension, number of holidays, regulation of working hours and autonomy.

TABLE 3  
SATISFACTION WITH SALARY

	Men	Women
Clerical workers	39%	36%
Middle Management	57%	54%

### 3.1.7 Differences related to time in the job/company

There is a positive relationship between satisfaction with benefits and time, and seniority. Satisfaction with growth and development decreases after two years in the company, and increases again after 15 years. Satisfaction with company culture also clearly decreases after two years.

When looking at time in a specific job, newcomers are most satisfied with all total reward elements. Employees having been in the same job for more than ten years are least satisfied, especially with regard to benefits. Furthermore, promotions (coming together with a salary raise) only have a temporary effect: already the second year after the promotion, there is a clear drop in salary satisfaction. More in general, satisfaction levels are clearly higher in the first 2 years in a company/first year in a job. This is a very important finding which could be explained by the fact that employees tend to be more positive about rather unknown working environments. HR professionals should pay specific attention to the expectations they raise and to the 'moment of truth' once people have already been working in the company for some time.

### 3.1.8 Differences related to the presence of a bonus (scheme)

We have found an interesting relationship between the presence of a bonus and satisfaction with salary for both clerical workers and management. Without the presence of a bonus, satisfaction with salary is 34% for clerical workers and 51% for management. When a bonus is present, these satisfaction scores rise respectively to 45% and 64%. As a consequence, being eligible for a bonus is positively correlated with total rewards satisfaction.

Apparently, the size of the bonus is also strongly correlated with the satisfaction with the bonus system. If the bonus is less than a half month's wage, satisfaction with the system is 11%. If the bonus lies between a half and a monthly wage, satisfaction with the system rises to 35%. When the bonus exceeds a monthly wage, satisfaction with the system rises to almost 50%.

There is, unfortunately, quite some ignorance at the clerical workers level with regard to bonuses: more than 9% admit not to know the size of their bonus. This is clearly more than is the case with middle (3%) and senior management (1%). Moreover, respondents with a bonus have better (internal and external) equity feelings.

Although it should not be forgotten that satisfaction with bonus levels and systems clearly is a very important point of attention, bonus schemes also seem to have positive effects mainly with regard to the satisfaction with total cash.

### 3.1.9 Transparency

Companies should take into account that employees talk about their wages and look for information on the internet. More than 60% of white collars admit to look for salary information on websites.

There is a clear negative relationship between salary satisfaction on the one hand, and openness on pay on the other hand. This might mean that the more people are informed about or seek information on pay, the less they are satisfied with it, or that employees who are less satisfied or motivated, are looking for information on salaries more often. This might mean that openness on rewarding does not always have positive consequences.

### 3.1.10 Top performers

By making analyses on specific questions about employee performance and employee evaluation, three performance categories were identified: top performers, average performers and weak performers. Top performers comprise 11% of all respondents, average performers 74% and weak performers 15%.

Table 4 gives an overview of the performance distribution over the different employee categories.

TABLE 4  
PERFORMANCE DISTRIBUTION

	Weak	Average	Top	Total
Blue collars	28%	65%	7%	100%
Clerical workers	16%	75%	9%	100%
Management	11%	74%	15%	100%

Table 5 shows the satisfaction results of managerial top performers compared to those of average and weak performers. Top performers are overall more satisfied, and specifically with the level of autonomy they have, with the regulation of working hours, their job content, the number of holidays, teamwork, salary, education, growth, development, promotion and career opportunities, their last bonus and the bonus system. Although these elements have relatively higher satisfaction scores, satisfaction with bonus and bonus system are still low in absolute value. This might mean that employers are still not able to differentiate enough with regard to variable pay.

### 3.2 Motivation

Herzberg claimed that intrinsic sources of motivation such as job design, are far more important than extrinsic motivators (like pay) as sources for employee motivation. He called this respectively motivators and hygiene factors. Scott on the other hand, is convinced that intrinsic and extrinsic sources of motivation are just as important and add up to total motivation. Even more, when extrinsic motivation is lower, total motivation will be reduced, even when the intrinsic motivation is high. Kohn felt that extrinsic motivators do not work at all, because of their discontinuity, and finally, Deci states that extrinsic motivators undermine the motivational capacities of intrinsic motivators. Their research, and that of a lot of

others, has come to one common conclusion: both intrinsic and extrinsic motivators can provoke very intense and counterproductive emotionally loaded responses from both employers and employees [4]. Therefore, we found it very interesting to have a look at what Belgian employees experience as motivating forces.

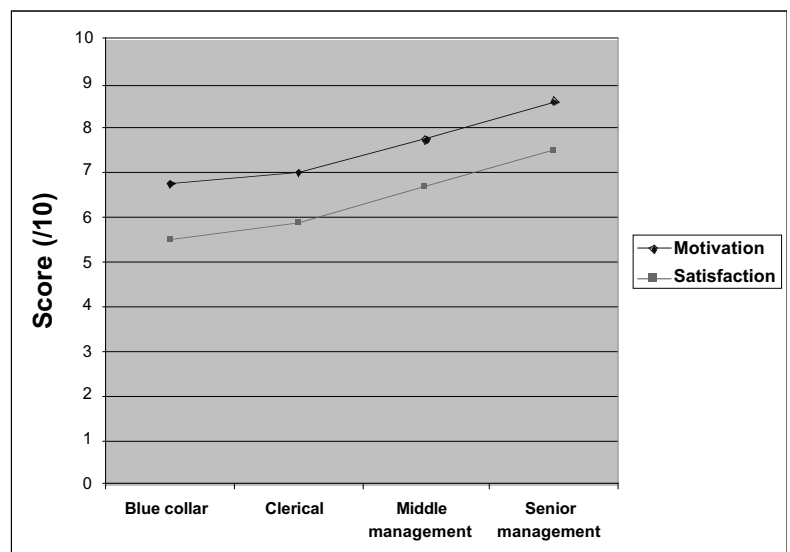


Figure 2: Total satisfaction and motivation per employee category

TABLE 5

REWARD ELEMENTS' SATISFACTION FOR MANAGERIAL TOP PERFORMERS

	Top performers	Average & weak performers
Autonomy	83%	75%
Company Car	82%	82%
Holiday regulation	81%	78%
Working hours	80%	75%
Job content	79%	70%
Number of holidays	73%	67%
Risk covers & pension plan	70%	70%
Teamwork & cooperation	70%	65%
Salary	61%	57%
Benefits package	55%	56%
Education, growth, development	49%	43%
Company culture & values	48%	46%
Promotion & career	48%	40%
Last bonus	46%	41%
Bonus system	45%	36%
Leadership & coaching	41%	37%
<b>Average Satisfaction</b>	<b>63%</b>	<b>59%</b>

### 3.2.1 General motivation

Respondents were asked to give their general feeling of motivation on a seven-point Likert scale.

14% of the respondents feel (absolutely/rather) not motivated. 23% states to feel neutral or rather motivated, while only 6 out of 10 employees (63%) fully agree to be (very) motivated. This means that a (small) majority of the Belgian workforce is motivated. Still, 4 out of 10 employees seem not to be motivated enough. From our research results, we concluded that the higher the hierarchical level, the more motivated employees are. An interesting phenomenon is that employees over all categories generally score higher on their motivation than they do for satisfaction with their reward package (Figure 2).

Another interesting result is that, like satisfaction, motivation is positively linked with employee category. The motivation of top performers is 71%, and thus, not surprisingly, slightly higher than that of the rest of the employees.

### 3.2.2 Differences with regard to company size

Companies with 1 to 9 employees and companies with 1000 employees and more seem to have more motivated workers. Taking into account that small companies pay less, cash might not have a very strong influence on motivation. However, also other (intervening) variables might play a role.

### 3.2.3 Differences with regard to gender and employee regime

Men display a higher motivation score (65% indicate to be (very) motivated) than women, where only 59% declare to be motivated. These differences become, however, negligible when the employee category is taken into account (table 6).

Furthermore, motivation is clearly higher in case of full-time employment (63% as opposed to 58%).

### 3.2.4 Differences with regard to seniority and time in the job/company

Motivation seems to be higher in the groups that have worked between 0 and 2 years in the company, and especially in the group that has more than 15 years of seniority in the company. Motivation is the highest during the first year in a job (69% as opposed to 63% in general). This is in line with other research results. Sirota goes even further and states that six months after being hired, employee morale declines in 9 out of 10 companies [5].

Employees having worked for at least 4 organisations, are less motivated. No differences could be found when looking at employees that have been working in 1 to 3 companies. Job hoppers seem to be not that motivated.

### 3.2.5 Motivation and performance management

An interesting link could be found between the presence of a performance management system and the number of motivated employees in a company. When there is no performance management system, 57% of employees claim to be motivated, whereas in the presence of a performance management system, this percentage rises to 67%. This could mean that, both thanks to the development and identification of objectives and to the measuring of results, employees become more motivated.

However, specific attention should be paid to (the outcomes of) performance-based reward systems. Employees might become somewhat frustrated because they seem to be too positive about their own performance. SRRC's research in 2002 found that 65% of employees (fully) agree with the statement 'From a professional perspective, I am an excellent performer' [6]. This will have an influence on equity feelings, which seem to be one of the major shortcomings, both from an internal and an external point of view. It is of no surprise that overall, good performers are more in favour of performance-related pay.

TABLE 6  
GENERAL MOTIVATION FOR MEN AND WOMEN

	Men	Women
Blue collars	53%	51%
Clerical workers	60%	57%
Middle management	72%	70%
Senior management	86%	86%

### 3.2.6 So... is cash a motivation or a hygiene factor? The motivating power of reward components

By means of regression analysis, we were able to

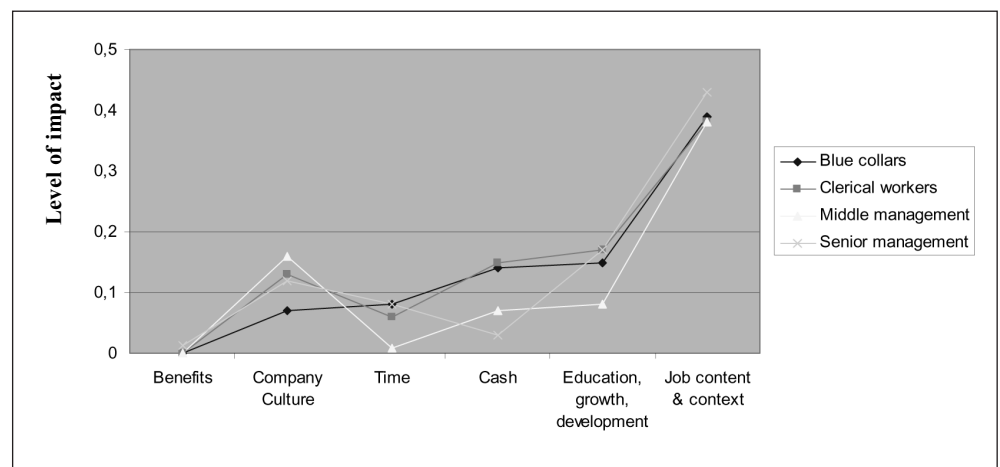


Figure 3: Motivational impact of Total Rewards Elements

examine the relative motivational impact of the different total reward elements (Figure 3).

This showed that job content and job context are obviously the most important drivers of motivation. As explained above, this dimension groups job content, autonomy, coaching, teamwork and colleagues. As shown, employees are quite satisfied with these elements. On the second place, education, growth and development can be found. Company culture and cash have a medium to high impact on motivation. The satisfaction scores for both reward dimensions were quite low. This proves that cash indeed is an important motivator, but not the most important one. Employee motivation seems to be driven mainly by job content, as implicates the theory of Herzberg: the most successful method for motivating is to build challenge and opportunity for achievement in the job itself [4].

Job content is, however, a difficult concept to offer by a company, since what people find (un)attractive about the content of a job is very personal.

Less important drivers are pension and risk covers, company car, and number of holidays. When we link both satisfaction and importance, then education, growth and development of white collars seems to be the most urgent topics to work on, followed by company culture and cash.

### 3.3 Total Rewards Preferences

#### 3.3.1 General preferences

When people are directly asked for their reward preferences, we see that a salary increase of 2,5% is the biggest motivating driver (40%). Extra holidays come on the second place (36%) followed by a bonus for individual performance (28%) and a contribution in a pension plan (24%). A bonus for team performance (12%) and a company car of a higher level (16%) have less motivational impact.

Top performers' preference differs a bit from average and weak performers: top performers' top preference is a bonus for individual performance (42%), followed by a salary increase (38%) and extra holidays (32%). Whereas average and weak performers show a 25% preference for a good coach, top performers are less interested (19%), and the same goes for earlier retirement (19% and 14%). Weak and average performers are also more in favour of a good coach (25% and 19%)

#### 3.3.2 Differences according to employee category

Mainly blue collar and clerical workers prefer base pay increases. This seems to be in line with Maslow's needs hierarchy. Time (additional holidays or earlier retirement) comes in second and even shares a joint first place for managers. For management, there is a more balanced view in general. They are also more in favour of bonuses dependent on individual performance.

#### 3.3.3 Differences according to gender and work regime

There are some interesting differences when looking at the different preferences of men and women for both clerical (Table 7) and managerial employees (Table 8).

With regard to clerical workers, women far stronger prefer a raise in fixed pay and extra holidays, and are less than men in favour of variable pay elements. Men are significantly more in favour of a bigger car and a contribution in a pension plan. This is not in line with research by Jurgensen in 1978, who found that men and women attribute the same importance to pay. Also Lacy et al. did not find any difference in pay preferences in 1983. Bretz and Judge, however, were able to find out that in a group of job seekers, there was a subgroup, predominantly male, strongly influenced by salary levels [3]. For management, we see practically the same differences but more pronounced.

TABLE 7  
PREFERENCES OF CLERICAL WORKERS

	Men	Women
Fixed pay raise of 2,5%	41%	50%
5 extra holidays	38%	44%
Bonus for individual performance	30%	26%
A contribution in a pension plan	25%	20%
3500 euro education	22%	19%
A company car of a higher level	21%	9%
A good coach	20%	24%
Retire 3 years earlier	17%	17%
A bonus for team performance	13%	10%
Other colleagues	7%	10%

TABLE 8  
PREFERENCES FOR MANAGEMENT

	Men	Women
Bonus for individual performance	31%	25%
A contribution in a pension plan	31%	26%
5 extra holidays	27%	39%
Fixed pay raise of 2,5%	25%	34%
A good coach	23%	28%
Retire 3 years earlier	22%	21%
3500 euro education	16%	20%
A company car of a higher level	16%	8%
A bonus for team performance	16%	11%
Other colleagues	7%	9%

What is also interesting here, is that a salary raise comes on the fourth place for men, preceded by a bonus for individual performance, a contribution in a pension plan and extra holidays.

Part-time workers prefer increases in fixed pay and a pension contribution more than full-time workers, but are less interested in receiving a company car of a higher level and variable pay.

#### 3.3.4 How should older employees be kept active?

Figure 4 and Figure 5 give an overview of reward preferences according to different age categories. Older employees are clearly more in favour of a contribution in a pension plan. They are relatively less in favour of a raise in fixed pay and a bigger company car. Cash is clearly more important for the youngest employees.



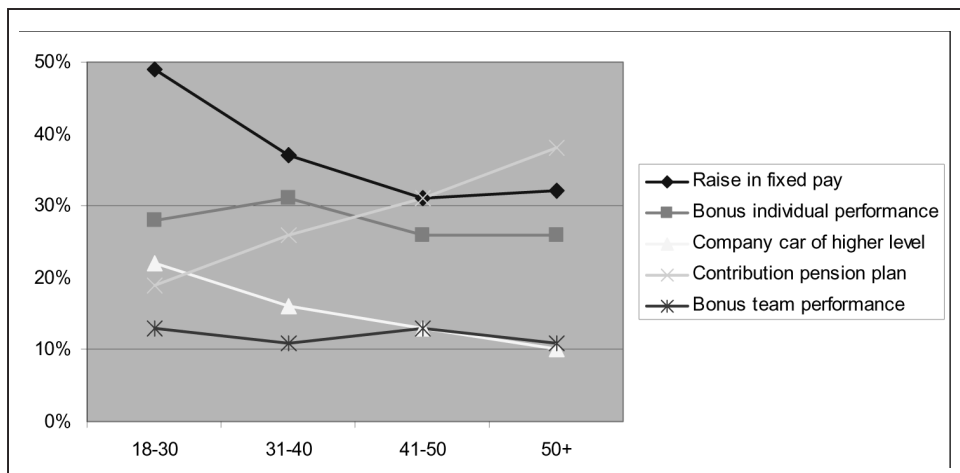


Figure 4: Reward preferences per age category (1)

### 3.3.5 Preferences for the composition of cash rewards

The respondents were also asked how they would like to see their wage composed. Age and seniority should play the least important role. For blue collars (26%) and clerical workers (23%), however, age and seniority are relatively more important compared to middle management (16%) and senior management (14%). Only 19% of clerical employees don't want age to play a role in determining the wage. More than 80% of white collar workers prefer performance to play a major (more than 15%) role in rewarding.

No clear differences can be found between men and women. Almost all employees however, seem to find that performance should play a role.

Employees eligible for a bonus, don't have different preferences.

Interestingly, there are no big differences taking into account the functional domain, except that medical functions are more in favour of seniority and less in favour of performance as a criterion for determining the wage.

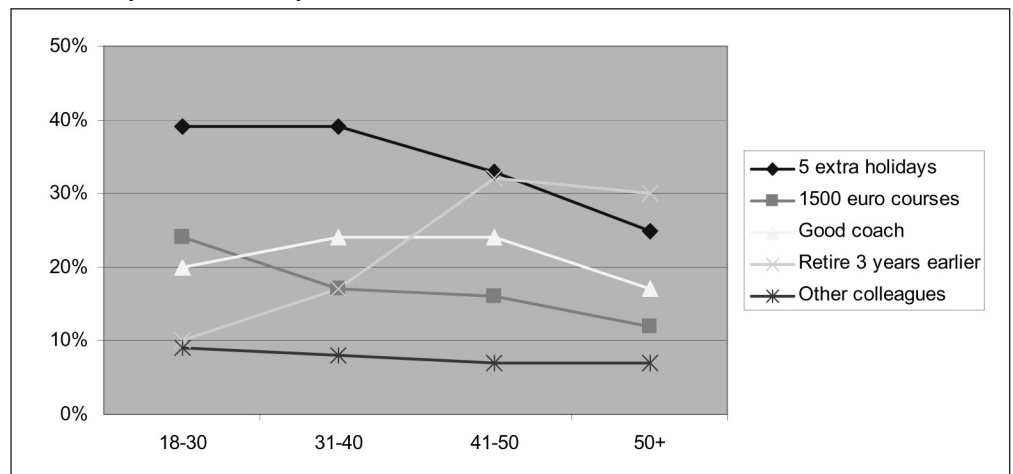
The most important conclusion to draw here is that even for blue collars, seniority and age should not play that big a role in determining their wages. Far more important are responsibilities, competences and performance. This supports the statement of Heneman, saying that pay for performance is not only desirable, but even a necessity for most organisations [4].

Going more into depth on employees' preferences regarding pay-for-performance, individual performance seems to be the most popular criterion to determine performance-related pay. Once again, some important differences come up which are related to the employees' hierarchical level. Senior management is clearly more in favour of company results to determine rewarding. All employee categories express approximately the same degree

of preference for team bonuses. Sirota even recommends to base variable pay on group performance instead of individual performance. The reasons he gives are that group performance is easier to measure, and that performance most often does not depend on individual capabilities and effort alone, but also on teamwork [5]. A study by Le Blanc & Mulvey in 1998 the US, however, found that US workers wanted rewards

focused on the individual and not on the team, group or company. Moreover, they wanted increases to their pay included in base pay, and not in the form of one-time payments [3].

Figure 5: Employee preferences per age category (2)



#### 3.3.5.1 Top performers

Top performers do not show any relevant deviations as opposed to the other employee categories, except for the fact that they are slightly more in favour of (individual) pay-for-performance.

#### 3.3.5.2 Preferences with regard to fixed and variable pay

Blue collars and clerical workers show the largest amount of people that do not like to have any part of their pay being variable (31% and 26%). These numbers however, show also that for both categories, 7 out of 10 employees do want to have a variable part in their pay, even if this would lead to a lower fixed part. For management, this number rises to 9 out of 10.

For the latter category, employees already being eligible for a bonus are more in favour of variable pay: 17% of employees not being eligible for a bonus prefer no variable part compared to only 8% that do have a bonus. 29% of the employees having no bonus choose to receive an important variable part, as opposed to 41% of employees that do have

a bonus. Once again, this is a positive message for bonus schemes.

Women have a stronger preference for fixed pay, which might mean that they are more risk-averse. They are less in favour of a bonus for individual performance and have a higher preference for more holidays.

The higher the wage, the more people are in favour of a strong variabilisation. This again proves Maslow.

Top performers largely follow the distribution we found for middle management (Figure 6).

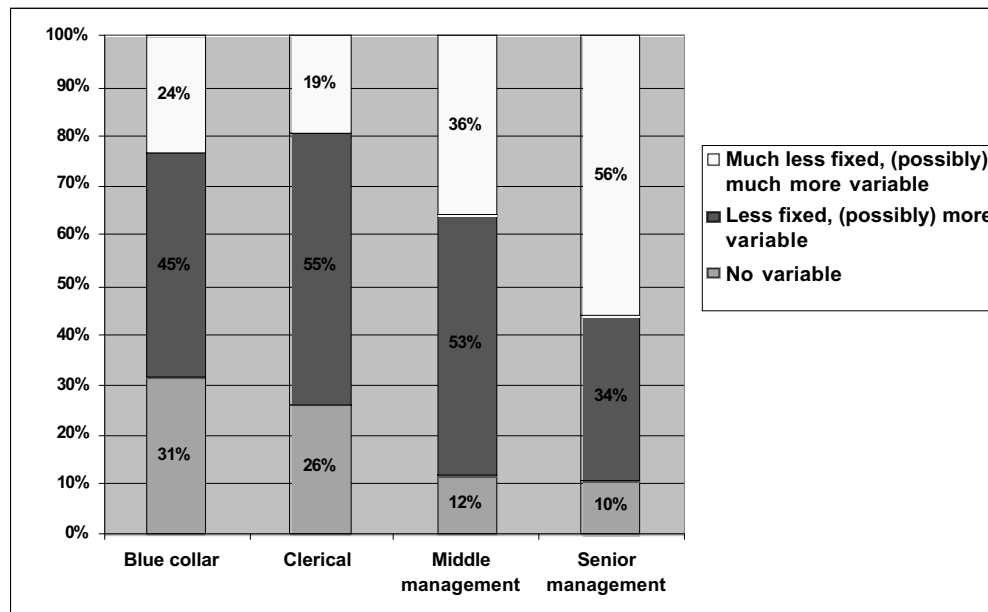


Figure 6: Fixed/Variable Pay Preferences

when taking into account people's preferences, they seem to be really in favour of performance-related and variable pay linked to the results of the individual, the team and the organisation. This means that people are really in favour of bonus schemes, but also that, once they are implemented, they lead to a lot of dissatisfaction. The research has also proven that seniority-related pay is not that popular any more, as far as the employees' preferences are concerned. Employees seem to be more in favour of responsibilities, performance and competencies in order to determine their salary.

As far as the other reward elements are concerned, employees are not satisfied with promotion and career opportunities, which are indirectly related with cash, leadership, education and corporate culture.

Taking into account employees' opinions, there clearly is no 'one size fits all'. Age, gender, employee category,... all have a moderating impact on satisfaction, motivation and preferences. Apparently, flexible rewarding and cafeteria plans need to be considered by

reward practitioners.

### 3.3.5.3 Distribution of team bonus

For clerical and blue collar workers, only one criterion counts: an equal distribution (same for everybody). For management, we see a more balanced approach in preferences between an equal distribution, decision taken by the supervisor and allocation on the basis of responsibilities.

Top performers clearly prefer the bonus to be equally distributed (38%), or to be distributed according to fixed pay earnings (25%) or responsibilities (24%).

## 4 CONCLUSION

The motivational impact of pay is an issue that has been studied by psychologists for almost 30 years. Research results are not unanimous and there are different schools of thought. Some of them are of the opinion that pay is an important motivator, whereas others do not see any motivational impact at all. Our research has broadened the scope by taking the total rewards approach, including both financial and nonfinancial reward elements. Cash is a relatively important motivator, but job content is much more important. Interestingly, cash and organisational culture seem to have the same motivational impact.

Going further into detail on the cash dimension of total rewards, it was found that both the level of the bonus and the underlying system lead to dissatisfaction. However,

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# Informal communication conversations as a form of organizational communication

Minna Nylander

*Research assistant*

*Helsinki University of Technology*

*Firstname.lastname@tkk.fi*

**Keywords—** Organizational communication, informal communication, change communication.

**Abstract.** The objective of this paper is to think over the informal communication conversations as a form of organizational communication. The starting point was the implementation of the new salary system and the change situation in Helsinki University of Technology in spring 2005.

The implementation of a new salary system is, as any other state of change, complicated for organizations. The impact of change communication is usually extensive – one way or other. Usually change spawns confusion, anger and skepticism. There is a plethora of data and studies discussing the role of informal communication in effective collaboration. Informal communication builds relationships among employees and employers, and face-to-face interaction is the primary way people communicate informally.

This paper is based on same data as a report “Opportunities and challenges of the new salary system at Helsinki University of Technology. Personnel’s perceptions and opinions about the preparation of the new salary system in spring 2005”.

The study covered a sample of different employee groups from Helsinki University of Technology. Open-ended questions in a survey were analyzed by creating “theme groups” and naming them. In this paper we take a closer look to the so called coffee table conversations-group. Coffee table-group includes three types of thinking. The first type is “my opinion”, the second type is “other people’s opinions” and the third type is “our shared opinion”.

## 1 INTRODUCTION

Helsinki University of Technology is preparing to transfer to a new salary system during the current year. The new salary system is based on the requirements of the job and the performance of the employee whereas the old system was based on salary grades and increments. Helsinki University of Technology is not alone in this reform; all Finnish universities are preparing for this change.

This paper describes some reasons (and questions) for why the respondents had such inconsistent feelings about organizational communication, cultural change and the new salary system. In this paper the main purpose is to analyze the perception of knowledge on the organizational change situation.

## 2 ORGANIZATIONAL COMMUNICATION IN ORGANIZATIONAL CHANGE

The New salary system and the state of change in Helsinki University of Technology arise basically from the Finnish society and the public sector’s needs for change. So, thus there is more extensive background for salary system change than

just organization personal needs the basic elements are quite same as in the basic textbooks about organizational communication. In this chapter I discuss about organization, communication and change.

The implementation of a new salary system is, as any other state of change, complicated for organizations. Literature usually talks about change communication. The impact of change communication is usually extensive – one way or other. Usually change spawns confusion, anger and skepticism, argues D’Aprix [1] and continues that it requires a powerful rationale to help people understand why they must embrace the change. Basically in change situations the supervisors are in key position and it doesn’t matter how well all the professional communicators do their jobs, if the employer and supervisors won’t commit to the organizational change.

### 2.1 Organizational communication.

The definitions about the organizational communication have changed many times during history. Two primary communication systems are internal and external organizational communication channels, argues Kreps [2]. A primary organizational function of internal communication is to enable formal task development, coordination, and accomplishment. According to Kreps, external organizational communication must be communication among organizations to bring about interorganizational coordination. External communication channels are used to enable organization members to interact with individuals outside the organization. Those channels carry messages between the organization and the organization’s relevant environment. Messages are both sent to and received from the organization’s relevant environment [2].

**Communication is an umbrella<sup>2</sup>** for everything that happens in organization and in the past decade this thought has come more and more prevalent over the field of study says Åberg [3]. However, in the daily life ways of thinking about communication is still a bit mechanistic and only a concrete part of the organization. It is still confusing for people to understand the totality of communication. Umbrella-thinking is not obvious. Lehtonen [4] argues at, while the technology advances, people may have forgotten to work for decent organizational communication. New technology enabled fast and multiform communication for everyone with fair investments. Lehtonen [4] is concerned that employees would consider that just a mechanical communication via email or internet is “real” communication and with this new technology the professional communicators won’t be necessary any more. However, at the same time Lehtonen [4] argues that organizations need much more professionals to take care of the huge flood of information. As Choo [5] notices, organizations are inundated with information, but find it difficult to interpret and act on the flood of information. Organizations are information-rich but interpretation-poor

systems awash with raw information which must be channelled and converted into organizational intelligence.

Åberg [3] has clarified the idea of organizational communication and made a simple list of the five most important functions of communication. Åberg argues that work community can effect directly four of those functions. Only the last one, social interaction -function is not directly under the organization's control. Those functions are:

### 1. Communication is an anchor for the organization's basic operations.

This is the most important way of communicating in the organization. If the operational communication won't work, even a good internal communication or pr won't replace it. Juholin [6] has argued that this first function is not far away from management, but the point of view is just different.

### 2. Work community profiling.

Communication is a necessary function for long-span development. Organization needs communication to create hoped-for reputation.

The second function, profiling is more and more important for organizations. Taking care of the brands and reputations are nowadays part of the strategies.

### 3. Engagement

Communication is a basic element for employees for at have a clear expectations from/ of organization and for at commit to the work.

The third function is a difficult idea. Basically we read that function as an expectation for a decent work environment with a fair criteria for working and for fair relationships between employees and employer.

### 4. Information.

Mechanical or technical, "neutral" information is highly important for and between employees, employers and partners.

The fourth function means fair and neutral communication for partners and for work environment.

### 5. Social interaction.

We just need each other in daily life. We have our basic social needs and a work community is one of the most important places to have those connections. The fifth function includes so many different kinds of aspects that I should discuss it in the next chapter. This function includes for example the idea of the coffee table conversations.

<sup>2</sup>Our definition is bit different from Elisa Juholin's [6] definition. She argues that neutral term; information is umbrella for internal and external organizational communication.

<sup>3</sup>The idea of engagement is of course much more than just committing to the work, but here and now, let's keep it simple.

## *2.2 Under the umbrella; informal communication in organization*

There is a plethora of data and studies discussing the role of informal communication in effective collaboration. Informal communication builds relationships among employees and employers, and face-to-face interaction is the primary way people communicate informally argues Narni et al. [7].

Informal communication has a big role in organizational communication. Informal communication is one part of the Åberg's fifth function which means that it's a part of the social interaction-function. This function is also the only function which is not precisely under the organization's straight control.

Juholin [8] argues, that informal communication (e.g. coffee table conversations and gossiping on the hallway) have quite negative reputation in organizations. On the other hand everybody knows how important way of communicating that phenomenon is. It's important because it develops common understanding and meaning of knowledge. Juholin reminds us that workmates are in big role what comes to new information and change communication.

Sometimes the critics are right about the ineffectiveness of the informal communication, but we have to also remember, that usually the information in that informal forum is basically correct, but it just doesn't come from a formal source (or formal style of speaking). In past few years the researchers in communication studies have had started to realize the good power of informal communication [6].

## *2.3 The change communication*

The change communication is basically part of a normal organizational communication, thus, nowadays people usually perceive it as an independent part of the communication studies and practices. The thoroughgoing difference between daily communication and change communication arises from comparing change communication the daily organizational communication.

Change communication's most important role is at the same time both to explain and to direct the change. It's also important to realize the difference in communication when comparing crisis situations and change situations. They are not the same [8]. Compared to crisis communication, change communication aims to explain and create knowledge of a new or a confusing situation. One important part when explaining the change is to figure out how the personnel in organization relate to change. For example, do they have a slant on this subject? Or what kind of information workers are expecting from the managers? Is the change basically a problem or is it for the good of the workplace?

According to Juholin, usually the reactions in a change situation depend of the organization's culture. She discusses that a very abiding organization culture is more unwilling to change, than an organization which is in continuous change. Schein [9] (1999) lets us assume that all adult learning starts with "disconfirmation" and that "disconfirmation" creates the challenges also for the change communication.

## *2.4 D'Aprix model of change*

D'Aprix [1] argues that there are various stages in employees' responds to change. First stage is shock and disbelief, and according to D'Aprix; there are three questions in the mind of the employees at that point: How serious are the threats to our organization? How did this happen? Who is to blame? D'Aprix's point is that this is an initial step in the process of communicating change, because people are trying to understand the personal implications of what has happened.



The second stage follows the first one also in a hierarchical order. In the second stage employees have adapted to the change, but often the main question on the minds of the employees is: do we have a plan of action? And if so, what is it? According to D'Aprix, the most frightening suspicion for any employee group is that there is no "battle strategy", that the "war" will be only a series of firefights in which people will be picked off one by one as the generals try to concoct a strategy on the spot [1].

The third stage is, according to D'Aprix, characterized by the natural human desire to want to solve the problem. Its hallmarks are the questions about what do you want me to do? And how can I help? According to D'Aprix, when people reach stage three, it's necessary that someone's able to answer their question or they are likely to be demoralized by their helplessness [1].

Today most of the researchers also recognize the connection between for example a job satisfaction and communication satisfaction [6]. A well-functioning organizational communication system contributes to job satisfaction and satisfied employees are usually satisfied also with the organizational communication.

According to Juuti [10], there are at least three dimensions which interact with job satisfaction. First are the job's contents and opportunities, second deals with pay satisfaction and finally, the third covers the implications of the work environment.

Juuti [10] believes, that job satisfaction is made of sincere, "open-door" organizational culture, confidential (not a cagey one!) and respectful atmosphere with a comfortable and peaceful work environment. He also accentuates, that the roles of the supervisors and managers are important in many ways, for example they should follow the idea of open communication.

### *2.5 Earlier research on the subject.*

This paper based on same data as a report "Opportunities and challenges of the new salary system at Helsinki University of Technology. Personnel's perceptions and opinions about the preparation of the new salary system in spring 2005" [11].

In the report; the respondents evaluated their superiors positively when opinions about the old system were asked for. However, the old system was not considered to correspond to the employees' skills and competences. So far, the most important experiences from the preceding spring were the performance reviews with the superiors. This is because job descriptions and priorities were discussed and clarified.

Employees felt that there was not enough information available about the new salary system.

The job evaluation criteria were well-known. To the contrary, the criteria for the evaluation of the work achievements or the employees' expertise were not yet perceived as well defined. As a result, the next step would be to set specific and common terms and to prepare evaluation tools for the performance reviews.

Some of the respondents considered that one of the greatest challenges with the new salary system is to find the balance between the common norms and the use of the system as a management tool by superiors of the units and groups.

The new salary system was considered more flexible. It was seen to support results-oriented management and also better to reward successful work performance compared to the old system. However, the respondents considered the new salary system neither more competitive nor better supporting the strategy and goals of the University than the old system. The respondents also believed that the new salary system is too complicated and will cause conflicts among the employees.

The schedule for the preparation during spring 2005 was experienced as too tight. According to the respondents, the opinions of the different parties were not paid enough attention to. In addition, different concerns about the future of the Helsinki University of Technology were reflected in the responses.

Summa summarum. The objective of this paper is to think over the informal communication conversations as a form of organizational communication. The starting point was the implementation of the new salary system and the change situation in Helsinki University of Technology in spring 2005.

## 3 METHOD

The study covered a sample of different employee groups from Helsinki University of Technology. We invited 267 employees around Helsinki University of Technology to participate in the survey. A survey was sent via email in the summer of 2005. Invitations briefly explained the study's purpose, guaranteed anonymity and confidentiality, and included a hyper-text link to the survey. Survey took approximately 20 to 30 minutes to complete. Survey was created with Surveyor -program and the data analysis made with SPSS for Windows 12 -program and qualitative method. The reply rate was finally nearly 40 % (103 respondents). Survey includes nearly 20 pages of claims (like Pay Satisfaction Questionnaires from Heneman and Schwab or Distributive Justice Index -questions from Price and Mueller). In this paper it's needless to open the questionnaire sheet more than this.

Questionnaire sheet includes four open-ended questions, which were analyzed. The focus of this paper is to figure out the respondent's ways to talk about the new salary system in spring 2005.

### *3.1 Open-ended questions in survey*

The respondents' lettered answers were analyzed by creating theme groups and naming them. In this paper I will describe and analyze one of the theme groups.

The lettered answers to the question "what kind of surprising, funny or even annoying debates about the new salary system have you had?" were analyzed for this paper. I named that group as a coffee table -group. There were 46 answers to that question.

According to Silverman [12]; there are four major methods used by qualitative researchers: observation, analyzing texts and documents, interviews and recording and transcribing. Our survey lends from qualitative research to quantitative research so called "open-ended questions" [12].

So, the analyzing method (in "open-ended question") was borrowed from the qualitative side. This made sense, because the idea of open-ended questions was to analyze respondents' answers as open-mindedly as possible. Of course this method is quite arbitrary, but the point of this kind of research method is to read through the answers several times with open mind and then sort those answers with her/his conscience. Critical thinkers might say that the results are just one construction about the truth, and of course it is so, but like Eskola, Suoranta [13] and Vallin [14] remind us, qualitative research is always tied to the culture of the researcher and it's always just a one side of the truth.

As I mentioned, there were 46 answers for the paper's main question (all data N= 103), but only 31 of those 46 answers were available for statistical analysis. To illustrate more the respondent's feelings, I also used statistical analysis alongside the qualitative analysis and that's why the number of respondents change in pictures 1 and 2.

#### 4 RESULTS- COFFEE TABLE-GROUP AND THE FEELINGS OF CHANGE

The reason why the answers were so interesting in the first place was the finding that respondents didn't really answer straight to the question "what kind of surprising, funny or even annoying debates about the new salary system have you had?"

Normally this could be a huge problem, e.g. if the respondents answer incorrectly or "wrongly" to the question in questionnaire form, but at this time it was just a good "misunderstanding" between the question and respondents. That question made a really interesting data.

So the respondents didn't answer to the question, on the contrary, they rewrote the question and wrote about how they assume that other people think/feel about new salary system and the change situation and how that fictional "public opinion" fits with their own state of mind. They basically created their own version about the other workmates' opinions in the change situation. Well, there's nothing new about that, people do it all the time, but it is an interesting phenomenon. Basically the data includes three different types of thoughts on the subject. Henceforth, I will call those three types as a coffee table-group.

Coffee table-group includes three types of thinking. The first type is "my opinion", the second type is "other people's opinions" and the third type is "our shared opinion". The classification shows us which kind of respondents dare to say they opinion about the new salary system, work in the organization and other important things, and why they dare. And why other won't. However, as I mentioned earlier, from now on we have to remember that the data wasn't large, so the divisions into the three types are not statistically comparable and generalization is not recommended.

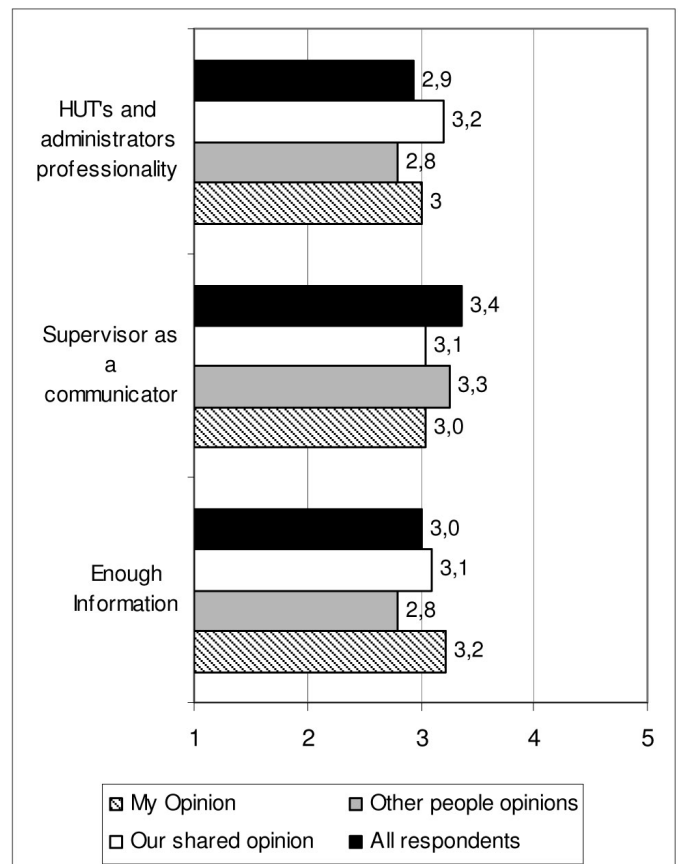
The types inside the coffee table-group spread out very uniformly. The "my opinion"-type includes 11 identified respondents, the "other people's opinions"-type had 10 respondents and finally the last one, "our shared opinion"-type had 10 respondents.

The "my opinion"-type includes respondents who knew what they wanted and how they could get it. "My opinion"-respondents were quite sure that they had correct information and knowledge about new salary system. They told their opinion as their own and without any hesitation. The point in this type was the respondent self-awareness. Even when the respondent's writing was as a question, the question was some kind of own thinking and/or written with sarcasm, like this example: "The funniest thing is that when the administrative department (of the Helsinki University of Technology) advanced the new salary system, they froze all other employees' bonus, except their own." The second example continues with the same sarcastic way as the first ones: "the main point of the new salary system is to assign even more paperwork for the Universities bureaucrats?"

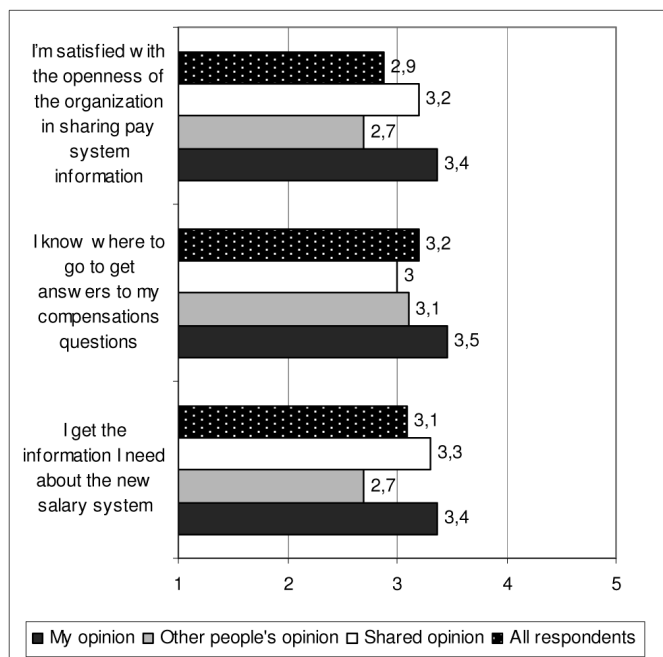
The "other people's opinion"-type consist of the respondents who felt more hesitant about their own opinions on the new salary system and the professional skills of the administration during the spring than the other two types. "Other people's opinion"-respondents usually wrote more often assumptions about people's ways to think. They didn't write "as themselves" as often as the two other types did. Like this respondent wrote: "I have heard that in some department, the supervisors had said to an employee in the middle of the performance review that his job is totally useless and won't need brains at al. Motivation can't be good after that."

The "our shared opinion"-type. In this type of the coffee table-group the respondents didn't really speak of they own. Instead, they had had conversations with other workmates, so the dominating opinion accumulated from their own and their workmates' beliefs. Like this respondent wrote: "Mainly discussions about how unfair the new salary system is for old employees, new employees be allowed to the same salary as the old on, but old employees had collected that salary during many years."

Coffee table-group and believes about the managers' and employer's professional skills in change situation and about change communication. Picture 1 shows that "my opinion"-type and "our shared opinion"-type appreciated professional skills of administration more than "other people's opinion"-type. "Other people's opinion"-type respected more their supervisors as professional communicators than the other two types. "My opinion"-type and "our shared opinion"-types believe more than "other people opinion"-type, when told that they had enough information about the new salary system and the change situation. The finding made sense, assumed the people who have had some kind of coffee table and hallway conversations with workmates, have also mused over the new salary system, probably more actively than other. "All respondents" feel in "professional question" almost same (2,9) as "other people opinion"-type (2,8), they also trusted most the supervisors as communicators, but were neutral about the sufficiency of information.



Picture 1. Coffee table-group's (N=31) and all respondents (N=103) beliefs about professional skills of the (Helsinki University of Technology) administrators in the change situation, how supervisors managed in their role as a communicators and thoughts about whether there was enough information during springtime 2005. (1=very unsatisfied, 3=neutral, 5=very satisfied, N= 31.)



Picture 2. Coffee table-group's (N=31) and all respondents (N=103) beliefs about information and how to get it. (1=very unsatisfied, 3=neutral, 5= very satisfied, N= 31 and 103).

As we can see in picture 2, there are differences between the three types in the coffee table group. In the picture 2 you will find two questions behind the "enough information" -sum (picture 1). Those questions are the second and the third claims in the picture 2. As we find, the "other people's opinion" -type was less satisfied with the organizations openness than other types, and you can find the same phenomena also from the last claim (I get the information I need). "I know where to go to get answers to my compensation questions" -claim shows that "my opinion" -type knows better than any other types where to ask for extra information about the new salary system.

## 5 CONCLUSION

In this paper I have introduced the so called coffee table -types. The idea of categorization was based on informal communication. As I mentioned earlier, informal communication is one part of the Åberg's fifth function which means that it's a part of the social interaction-function. This function is also the only function which is not precisely under the organization's straight control.

Coffee table -categorization was made by using qualitative analysis. The original data was a survey study as a questionnaire, but it included also written answers. The problem of the coffee table conversation's analysis was the quite small amount of data. As I wrote earlier in this paper, the divisions into the three types are not statistically comparable and generalization is not recommended (in statistical sense). Although it cannot be unequivocally stated in this paper that informal communication (like hallway conversations or lunch break speculation) made (statistical) difference in the common knowledge of the new salary system, it still gives us something to think about in qualitative way. Also the earlier studies and theories have described and thought about the same questions.

The coffee table group includes three types of respondent's answers. There was the "my opinion" -type, which included respondents who wrote their answers as themselves. Those respondents were pretty sure about their knowledge of the new salary system. Of course the knowledge wasn't necessarily

"right information" from organization's formal communication point of view, but it was meaningful for the people and created common understanding about the new salary system and the change situation.

The second type was "other people's opinion"-type, were respondents commented on informal communication and the hallway conversations with words like "I have heard that..."

In the "other people's opinion"-type the respondents didn't really speak of they own, but they had had conversations with other workmates, so the dominating opinion accumulates from their own and their workmates' beliefs. I think those respondents had split at least to two different kinds of respondent type; there were those who had enough information, but wouldn't/couldn't really show it. Then there were that respondent who really didn't have enough information about the new salary system and that's why they didn't comment on themselves. Of course there are a number of reasons why people react like they react and this is just my interpretation of the answers.

The last division, the "our shared opinion" -type was, in my view, also the most interesting type. It might be speculated that "our shared opinion"-respondents showed that the informal conversations might have helped people to get the picture of the change situation. This might be so because they wondered together what was going on in the organization and they created a common or "shared" opinion about the change and the new salary system. In my view, that kind of groups were active and also curious.

I think that the main result of coffee table conversations is that informal communication, conversations in hallways or at lunch break created the knowledge. So gossiping might be for good!

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# Change management in pay systems implementation

Carita Lahti<sup>1</sup>

<sup>1</sup> Project manager, BIT Research Centre, carita.lahti@tkk.fi

**Keywords – change management, pay system, job evaluation, personal performance**

how could the change process relating to pay systems be improved, i.e. what could have been done differently.

## 1 INTRODUCTION

In an organizational change things are organized in a way that differs from the organization's previous practices. "Change means things being different than before" [1]. According to French and Bell, (1999) the need for change can come from many directions, from within or outside the organization (see also [2], [3]). Outside factors include e.g. authorities, Labor Market or competitors, whereas internal factors may include the production of new services or products, a new strategic direction or a continually differentiating workforce. Change is needed, when the operational and working methods no longer correspond to the requirements inside the organization or in relation to the surrounding environment and competitors. How organizations manage to react to these changes in their surroundings determines how well they survive the challenges of the coming years. In most organizations adjusting to changes in the surroundings and actively exploiting and forecasting them requires wide-reaching and profound internal changes. Well-managed continuous development becomes one of the most central conditions for the survival of an organization.

An organization's relationship to its operating environment is in a state of constant change, and its functionality and development are dependent on many factors. Based on systems thinking, Lawrence and Lorsch (1967) assumed already in the 1960's that the actions of the members of an organization are as much affected by the official organization as by the unwritten rules and rewards controlling its behavior [4], [5]. According to contingency theory, the effective functioning of an organization is dependent on the compatibility of its structures and functions with its tasks, environment and members [6]. When the operational environments of organizations change, so do the work itself and the ways to organize the work, and it is then often necessary to think whether forms of payment should change. The change in forms of payment has usually been depicted as a change from administrative pay systems towards strategic payment [7] - [10].

In this paper organizational change processes are examined in which the grounds for pay determination change. Special attention is paid to the change management relating to the development and implementation of pay systems. The object of the change is the pay system, which is based on the collective agreement and the conditions agreed upon by the social partners in the labor market. In addition the change process is evaluated through the experiences of those who took part in its development and factors that are felt to be critical to the change are underlined. In this paper focus is laid especially on the following questions: what success factors promoted or hindered the success of change in the target organizations and

## 2 THEORETICAL BACKGROUND

### 2.1 Success factors enabling change

We can consider change through the factors making successful change possible. The most important thing in defining change is not to place the different phases of the change on certain levels, but rather to define those factors that are more crucial than others when we strive for successful change. Stage models of development are in practice always based on some critical success factors and models of critical success factors are presented in a way that corresponds to a stage model (see e.g. [11], [12]). In the literature on change management the focus has been on defining factors enabling change and on offering methods for attaining them [13]. According to Carnall (1990), change management shows that continuous learning about business and organizations is an absolutely crucial part of making changes permanent. Making the changes permanent in a way that does not encourage learning may lead to frustration and negative attitudes towards the changes and attempts to change. Carnall (1990) suggests five factors as central in change management: setting the values, supporting in problem situations, planning the system to support the activities, focusing on administration and developing people's skills [14]. Cummings and Worley (1993) for their part claim that all important practical instructions and guidelines for change management can be divided into five classes: motivating for change, creating a vision, building up political support, administering the change and making the change happen. In conclusion it can be said that it is very difficult to pick out and name the most important differences between the different models when we consider practicality and usability in a "real life context".

When considering change and change management it must also be taken into account that changes are often carried out as projects. In this paper a project is defined as a one-time event with temporal limits, goals, a budget and an organization founded for the project (e.g. [15] - [18]). The critical factors of an internal project and hence the skills required from the project manager differ somewhat from those of traditional, external project activities. Although traditional project leadership and its methods are needed in development projects, there are many factors related to them that require special skills and new inputs, such as resource, cost and risk management [19]. Failures in organizational change have often been attributed to human factors rather than problems with techniques (see more [20] - [22]). In the study this paper reports on nine possible critical factors in change management have been chosen based on amongst other sources the literature presented: planning, goals, participation, support of the management, management, informing and training, culture and cooperation, follow-up and feedback. Taking or failing to take these factors into account will be examined in the empirical part of the study.

## 2.2 Bases of pay and types of payment

According to work contract laws a pay is one of the identifying aspects of a contractual relationship. When the work performed is measured and evaluated as contributions, the pay is determined based on how much time and what kinds of knowledge and skills the employee hands over for the use of the employer. Pay is then a replacement for the work done. The work performed can also be measured and evaluated according to how well and efficiently the employee uses and exploits her knowledge and skills. The work performed can also be defined by evaluating the results of the work. Thus the pay may be based on 1) the contribution the employee makes in her work; 2) the method in which the employee uses these contributions in her work; or 3) the achievements of the employee.

The job and its demands, the qualities and performance of the person and the results can be used as bases for pay. When the pay is determined by the job, the person or group and by the results, there are three bases for pay, while there are numerous pay systems. Pay systems consist of these bases for pay and pay methods and instructions supplementing them. This paper is focusing only on job and personal based pay. In the job specific pay component the job is evaluated without paying attention to the person performing the task. The job evaluation system is a total package including, evaluation method, instructions supplementing the method, training for the staff and the actual evaluation work in the organization. The individual or group pay component reacts to an individual person or group performance. Personal performance consists of the skills, knowledge, experience and behaviors' that an individual needs to perform a job effectively. To conclude in based pay components attention is paid to accomplishment, outputs and results. (see e.g. [23] - [25].)

## 3 RESEARCH APPROACH

The study this paper reports on was a qualitative case study of three cases, focusing on the change management of pay systems reforms in industrial organizations. The object of my study was the development of pay systems for official employees in three Finnish chemical industry organizations. The study this paper reports on was limited to cover the development processes of pay systems for just official employees. The study material for this paper consists of thematic interviews and documents of the target organizations. The study material was from The European Social Fund project "Towards Equal Wages Through Pay Systems Reform" that was done by the BIT Research Centre of the Helsinki University of Technology and funded mainly by the Ministry of Social Affairs and Health. The material was collected between April and November 2003. The primary data in this paper consists of 69 interviews, 34 managers interviews and 35 official employees interviews were conducted (Table 1).

TABLE 1 STUDY PARTICIPANTS BY ORGANISATION

	Official employees		Managers	
	Male	Female	Male	Female
Case A	3	7	11	2
Case B	1	15	6	5
Case C	3	6	9	1
Total	7	28	26	8

The interview material from three target organizations was combined and by analyzing this material a picture was formed

of the development process of pay systems. Documents produced by the organizations were used as background information for depicting the research object. The critical factors selected from the field of change management have stayed in the background while collecting the study material, planning the interview structures and analyzing the interview material.

The material was analyzed in a so-called material-based manner [26]. The analysis was conducted not only by answering the study questions, but also by starting off with the material itself and trying to find circumstances relevant to the phenomenon studied. The starting point for analyzing the study material corresponded to the starting points of the so-called realistic reading style [27]. All the interviews conducted for this study were transcribed. After the transcription the reading and coding phase of the material followed. Classifying the material was in the first place directed by the order of the thematic areas of the interview structure. When the classification into coded classes according to themes was complete, each coded class was handled separately interpreting the contents of comments and at the same time classifying them inside the different coded classes. The connections between the codes started to look clearer and clearer as the analysis progressed. During the analysis the number of the coded classes also increased to sixteen from the original nine critical factors.

## 4 FINDINGS

### 4.1 The starting point in the organizations

Pay systems reforms began in the target organizations in the 1990's. The targets of the development for the part of job evaluation had been agreed upon in the collective agreement, and for the part of personal performance models and ideas had been presented on how the issue should be taken into account in the pay systems of the organizations. Motivation and flexibility and as well as fairness and objectivity had been set as goals for the pay systems based on job evaluation and personal performance in the target organizations. The development work was in all organizations organized as a project, where a representative of the human resources administration acted as its leader. The staff was represented in the development project group by union representatives. There were management level steering groups overseeing the activities and results of the project groups. The time the development work had been going on in the organizations varied between 6 - 10 years, already partly including redevelopment work and small interventions as time passed and the requirements of the organization changed. As pay is a part of human resources management and active leadership, its development should indeed continue as a process, but there were differences in how far the implementation of the new pay system had advanced in the organizations. In the early phases of the development work the personal pay component was taken into account in all organizations and the need for developing it was recognized, since the first personal performance based pay system constructed was not actively used in the organizations.

With the second wave of development work in organizations after the official labor unions joined together in year 2001, a simplified model was reached in the development of a personal performance based pay system, a model that is currently in the implementation phase or has been in use for the last years in the organizations. How the staff was included in the development project in the organizations varied, from them being mainly involved in creating the task descriptions to only taking part through a representative. The development projects had not

made plans on how to share information or train staff, but instead people were informed at the start of the development work and then in the implementation phase the results were made known. Regarding training, both in the development and implementation phases the labor market organizations and their representatives played a large role, as the staff training organized by the organization was mainly focused on the implementation phase, when the evaluation system was checked up together with the managers and official employees. Information about the target of the development, job evaluation and performance appraisal, piled up on those actively involved in the development activities. Lacks in change management became evident during the process of developing the pay system, when combining the pay system and further developing the two pay components started. The lack of planning was evidenced by delays in development work and in overlapping inputs, when pay components were developed separate from each other or when pay systems were developed inside the organization as separate development projects. The time limit when the new pay system should be in use and the organizational budget for change effects act as guidelines for finishing the development projects.

#### *4.2 Staff assessments of the development project*

Considering the target organizations the implementation happened quickly and with little training, which caused resistance both among managers and employees. The staff of the organization was suspicious about whether the evaluation practices developed in the development phase would treat different individuals and different units impartially fairly and equally. The change process of the pay system was received rather negatively, which surprised the developers. When the expectations of the staff were not met and negative feelings and lack of information piled up, the pay system development project affected the entire organization more than had been imagined. The lack of common agreement on, what the goals of the changes was further increased resistance to change. Managers felt that the change increased their workload, because in the evaluation based pay system the manager has an important role as an evaluator. For the official employees the pay system meant expectations of a better wage and uncertainty about what the change would mean in practice. It was unclear to them what components would form their pay after the reform and what kind of effect the managers would have on the pay of their subordinate employees.

#### *4.3 Planning and support of the management*

No shared view on successful or unsuccessful solutions could be formed based on the experiences of those who took part in the development activities of the target organizations, but instead the experiences were very different depending on the point of view the execution of the development was evaluated from. A representative of the organization looked at a development project from a different view point than a labor union representative. Looking at the assessments as a whole it seems that the labor union representatives representing the employees assessed the execution of the development project more critically than representatives of the organization. This seems obvious, as part of the role of a union representative has traditionally included the demand for criticality when looking after the interests of the employees.

The pay system development projects in the target organizations were launched by a management decision and as the steering group of the development project the management also set the boundaries and conditions for development work. The decision to implement a change was made due to the influence of an outside actor. A representative of the

management, in the study material a representative of human resources management, acted as the leader of the development project group and he was assessed to have more independent decisive power than, what later on turned out to be the case. Suggestions for development, structural and practical changes, were presented to and accepted by the steering group of the development project, and ultimately by the top management of the organization. Thus, suggestions for development were not always accepted or their practical implementation could differ from the suggestion. Indeed, those who took part in the development activities noted that they were unable to get the management of the organization to visibly commit to the development project. When the object of development is directly related to pay, representation must be taken into account, and even in the development work were existed a visible employer – employee division, where the role of the management according to the interviewees was to follow the collective agreements and other norms, especially with regard to developing the task specific pay component.

Based on the assessments of the developers, agreeing on the development project between the organizational management and the development group formed a critical stage, when it came to the success of the development. Apparently, as the development projects of the organizations were being launched, the work done in the agreeing phase was not accurate enough. According to the development group participants and those who took part in the development work, the status of the development project remained largely undefined. According to the interviewees, the relationship of the pay system development project to the strategy of the organization was also left open, as were the boundaries within which the development group could develop the pay system. There were collisions against these boundaries during the development project. In the beginning there was not a clear enough agreement on the costs of the development project and how to cover them. There was at first no common view on the goals of the development project.

The representatives of the organization noted that they were unable to get all of the staff to commit to the development project. This was partly related to the fact that the official employees of the operative organization could not directly take part in agreeing about the development project. The resistance was also partly due to lack of knowledge about the target of the development and the changes in practices the change would bring about. A change affecting the practices related to a pay system should take into account the other activities and structures of the organization. In one target organization the operational process of the organization had been taken into account when implementing the new evaluation system, so that both the closest manager of the production process and an administrative manager evaluated the employee's personal performance. Those who took part in the development noted in the interviews that there should have been more discussion about the values guiding the activities at the start of the development project. They also thought that the official employees affected by the pay system might have wanted more discussion about the principles, factors, indicators and practices, on which their pay would after the reform be based.

## **5 CONCLUSIONS**

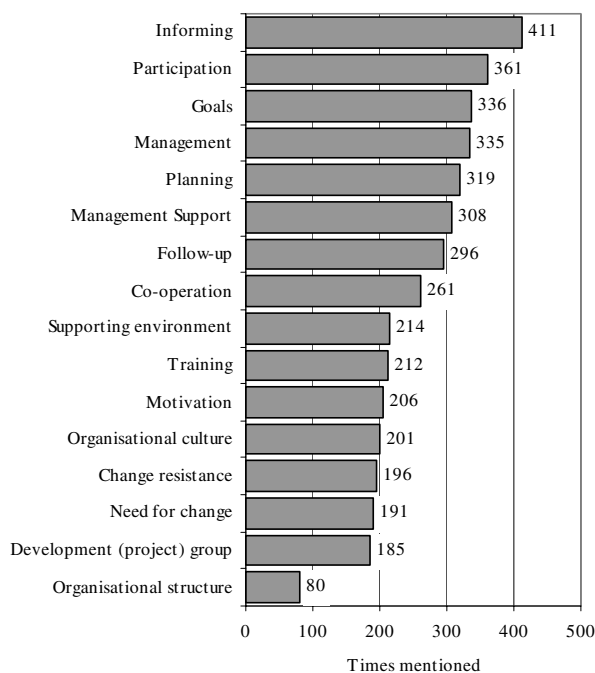
### *5.1 Critical success factors for implementing pay systems*

The intention of this paper was to clarify issues of change management in the target organizations” and to present based on the study material such critical factors that could be used



also more generally to support management in implementing changes related to pay systems. Interviewees often mentioned several issues, which belonged into either same or different critical factor categories. The portion of mentioned critical factors (i.e. how many times those factors appear on the study material) is presented in figure 1.

FIGURE 1 THE FACTORS THAT WERE MOST OFTEN MENTIONED IN THE STUDY MATERIAL BY CODING CLASS.



Based on this study, for the practices applied to development to better meet the challenges posed by pay system development, factors can be named critical success factors in the pay system reforms. The position has been formed that the recognized success factors of development projects have a positive effect on successfully developing and implementing a pay system.

### 5.2 Committing to the organization

Based on the results of this study, committing to the pay system development is affected by the goals and issues of management. The aims were an important critical factor in change management in the pay system development projects in the study material. One explanation for this find is likely to be that the goals of the development were unknown, unclear or difficult to understand both for the development group and amongst the staff. Success in setting the goals is still considered one of the cornerstones of the successful handling of a project, and especially in development project goals that are unclear and hard to realize make following the project and measuring the results difficult [28].

The issues of management as a critical success factor can in this study material be divided into two main categories: problems with the management's commitment and problems with management styles. The latter is a far smaller and more varied group than the former, including e.g. lacks in management skills and problems with different leadership styles. Related to management support the lack of commitment by the middle management and lack of support from the top management has often been mentioned.

Management commitment has been classified in this category and not in motivation and commitment problems, because it has effects different from those of the commitment of the other staff. The resources needed the prioritization of development measures and in the end the whole credibility of the development project in the eyes of the rest of the staff depend to a large extent on the management's commitment. Problems related to management surfaced in this study as one of the most important problem groups, even though some of those who took part in the study themselves represented the management. A result similar to that of this study was reached in the study by Salminen (2000), where in a questionnaire aimed at people responsible for development issues in Finnish companies management problems were mentioned as one of the most important problem groups in development projects.

### 5.3 Planning the development

Based on the results of the study this paper reports on, the planning and follow-up were the success factors affecting the change management. Planning was one of the most important critical factors of change management in pay system development projects. Planning or rather the lack of it caused problems in all three target organizations. In the interviews planning was mentioned through for example the following issues "modeling the classification work for job evaluation beforehand" and "planning and following up on the progress". Lacks in planning were reflected as other problems in the pay system development projects, such as gaps in information sharing, diversity in development project work and inclusion arousing suspicions. The fact that the planning of development activities surfaced as an important problem factor is somewhat surprising, and the surprising thing about it is the lack of planning in the pay system development projects of the target organizations of the study. According to Salminen's (2000) study project guidance is one of the three most important success factors in development projects. In addition to direct effects, planning and following up activities have indirect effects on success through motivation, for well organized development activities are credible and therefore also motivating [29].

When the follow-up was based on a project plan that was deficient or lacking for the development projects of the target organizations, it was not surprising that follow-up emerged as an important critical factor in development projects. In the interviews follow-up was mostly mentioned in relation to planning and organizing in the first phases of the development project, where some felt there had been major lacks. Follow-up does not only mean looking back, but also planning the advancement of the project based on the current situation [30]. The most important instruments of follow-up are regular meetings, which can be combined with the planning and development meetings of the development group, where the progress of the project and possible problems are handled. In the study material, according to the interviews the meeting work was conversational by nature and promoted development work, and indeed the work seemed to progress specially in the meetings. However, for the meeting practices, some hoped for agreement on common modes of operation, receiving instructions on them and committing to them by all parties participating in the development work.

### 5.4 Practicality in development

Based on the results of the study, the following success factors of development affected the realization of practicality in development: participation, management support and informing. In development group work the forming of the



groups creates an important foundation for the working process. Representational participation was applied in the target organizations of the study. The development groups consisted of a few representatives of the organization and labor union representatives representing the official employees. Based on the results of the study, the constitution of the groups was considered unsuccessful. It was also mentioned as a suggestion for improvement in the interviews that each member of the development group should be able to affect the course of the work being done. The possibility of participation does not always mean that everyone would want to be included. According to the study material, if the development project group would include members from all the units of the organization, that would already ensure information sharing in the organization and possibly generate new links across traditional organizational boundaries, which in the best case would survive even after the development project.

Support from the management has often been considered one of the basic prerequisites for development activities, and indeed it was one of the most important problem groups in this study as well. Management support or commitment was briefly mentioned in many interviews. In the interviews, the activities of the management were mentioned in such issues as "the example of the management", "inclusion of the management of the organization" and "the management's interest in development". Management commitment was often a prerequisite for adequate prioritization and resources. Commitment helped in defeating resistance to change and the lack thereof on the other hand decreased the willingness of the staff to participate. However, the staff did not support all development schemes supported by the management. According to Salminen (2000), management support could be considered a sort of "hygiene factor" for development projects, i.e. a factor necessary, but not adequate by itself, for success.

Informing was the most critical factor in pay system development projects. In this study examples of informing and information sharing include openness, lack of informing and timeliness. Problems with informing are not surprising as such, for almost all development projects will meet with problems belonging to this group continuously, and there never seems to be enough information available. It is also possible that what to the management seems like resistance to change is to the staff a problem with communication. Dividing the operational responsibility amongst all levels of the organization also promotes commitment to the decisions made [31]. Apparently there did not exist agreed, shared modes of operation for all situations, which led to existing good instruments and channels not being exploited as much as could have been done. For the development project the purpose of informing and information sharing is to relay information and offer a channel for communication so that the aims of the development project can be reached as efficiently as possible. Because many new things are done in a short period of time in a development project, the staff needs information about the project and its progress in different phases of development. In this study problems in informing, or the lack thereof, were partially explainable through the planning of the development project, where a plan for informing was lacking.

As a summary it can be said that many factors important to the success of a change surfaced from the change processes of the target organizations. The issues were experienced to be the aims, management, planning, follow-up, participation, management support and informing received most attention and they were felt to be more important than other critical

factors. It is difficult to prove the relevance of any single factor for the development project, because the end result of the change is the sum of many different factors put together [32]. The study results this paper reports on are similar to studies where change management in development projects has been studied [33] - [35]. Therefore the critical factors of change management that emerged in the study can be assumed to exist in the context of organizations also in other development work related to pay systems that are project-like by nature.

## 6 DISCUSSION

### *6.1 Learning from change processes*

In the study this paper reports on evaluating the change projects of organizations has shown how challenging change management can be. One explanation for the continuously challenging nature of controlling a change process can according to studies be the fact that the changes being carried out in the organizations are more wide-reaching and important than before (see e.g. [36] - [41]). A pay system should correspond to the needs of a changing organization. This requires some sort of internalized model of continuous development for the organization. Commitment, being motivated to work and taking responsibility of organization based development by those partaking in the pay system development work emerge as crucial factors for project-like development work and especially for continuous development. The role of the management as guiding the development activities, which was apparent also in this study, is important for the sake of continuity. The management must show their support and focus enough resources to development work important for the future and current activities of the organization. If there is a hope that a development project would promote not only its object of development, but also the development of the entire organization, the project should also be taken advantage of from a learning perspective. As can be concluded from the results of this study, project group work is a possible forum for the creation of organizational learning processes. It is possible that controlling internal development projects would be easier, if they could be seen more clearly also as learning processes. In other words it would be accepted already when launching new projects that there are no "shortcuts" to success. A profound change will in any case advance only by being worked on for a long period of time and through the learning that will happen in this process. Change will not become change before it has taken place in the minds of all or at least most of the people working in the organization.

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# The meaning of procedural justice in the performance appraisal process

**Johanna Maaniemi<sup>1</sup>; Anu Hakonen<sup>2</sup>**

<sup>1</sup> Researcher, Helsinki University of Technology, Laboratory of Work Psychology and Leadership, johanna.maaniemi@tkk.fi <sup>2</sup> Researcher, Helsinki University of Technology, Laboratory of Work Psychology and Leadership, anu.hakonen@tkk.fi

**Keywords**—Performance appraisal, Justice, New pay systems, Governmental sector

## 1 INTRODUCTION

The pay systems based on evaluation are very popular in Finland, where the old pay systems will be and are being substituted by new evaluation based systems in all working life sectors – also in the government sector [1]. Pay systems based on evaluation have very different reward assumptions, pay structures and implementation processes compared to the old pay systems. The old pay systems were mainly based on job tenure, seniority and job titles when the new pay systems reward for skills, performance and the task requirements. [2], [3]. The role of the supervisor has also changed dramatically, because supervisor has the key role in determining especially performance based pay of an employee. These changes increase the need to understand the factors connected to perceived procedural justice and also to consider the traditional assumptions behind performance appraisal. Performance appraisal is threatened by many personal biases and interpersonal conflicts which make the appraisal's objectivity and neutrality challenged.[4.] Thus the success of the new pay systems lies on the accurate and functional evaluation systems but most of all on the skills of the applying supervisors. The object of this paper is to analyze employees' fairness arguments involving the performance appraisal interview and to understand the meaning of justice rules in the performance appraisal process.

## 2 ASSUMPTIONS AND REALITY BEHIND APPRAISALS

Performance appraisal may be defined as a structured formal interaction between a subordinate and supervisor where subordinate's work performance is evaluated. It usually takes the form of a periodic interview (annual or semi-annual). During the interview the work performance

of the subordinate is examined and discussed, with a view to identifying weaknesses and strengths as well as opportunities for improvement and skills development. Organizations have their own criteria (e.g. profitability, interactive skills) for desired performance and appraisals are conducted with the help of specific appraisal blank-forms and performance measure scales (e.g. 1-5 where 1 refers poor performance and 5 refers excellent performance). Performance appraisal is linked to the employees' pay. e.g.[5], [6.] In the Finnish government sector the maximum amount of performance based pay can be even 50 % of the person's base pay [1].

As the history of performance appraisal has shown, there is great difference between assumptions of ideal "scientific oriented", objective performance appraisals and how appraisals are actually been done [4]. The former orientation refers performance appraisal as a tool or an instrument, which fairness is dependent on the accuracy of the assessment of the performance. This means that appraisals are "tests" offering a valid and accurate representation of how a person under appraisal has actually been behaving. This perspective stresses the importance of the valid and functional measures in performance appraisal but leaves in the same time the users and the objects of the system to a minor role (if you have a good system and instructions, everybody can use it!). This perspective lies on three assumptions according to Folger and Cropanzano [4]; firstly, work arrangements allow for a reliable and valid performance assessment, secondly, raters can assess performance accurately and thirdly, a rational, unitary criterion exists. The reality is often very different. As previous research has declared, supervisors don't have enough opportunities to observe their subordinates performance and work or the output of the work is hard to observe and measure [7]. Also people are sometimes cognitive misers [e.g. 8], who use categories and other helpful heuristics when assessing social events [9]. Even if the cognitive processes are correct most of the time, errors occur [4]. More over, even if the accurate criterion exists, same criteria can be interpreted in many different ways



depending on the interpreter and his/her values and standards. This doesn't mean that the goal for accuracy is trivial. Accuracy of the appraisal is important but equally important is usually how appraisals are followed through and the results are declared. This makes the social side of the appraisals vivid. [4], [10.]

Folger and Cropanzano [4] suggest that instead of only reaching for "the scientific truth" we should also understand the impact of the procedures used and the social context of the appraisals. This means that the functionality of the appraisals is dependent on those contradictory needs, political elements (e.g. manipulation, impression management) and personal biases and interpretations which exist in every organization. Even though there exists contradictory demands, there is also cooperation, trust and friendly behavior. [4.] Individuals are concerned not only assessment's just outcome in other words distributive justice e.g. [11], [12], but also the process through which decisions are made, i.e. procedural justice e.g. [13], [14], [15], [16], and how they have been treated in this process, i.e. interactional/relational justice e.g. [17], [18]. This suggests that the satisfaction with the appraisal systems is naturally dependent on the outcomes gained but also heavily on the applied procedures [15], [19]. Thereby the perception of justice is not an irrelevant phenomena to an organization because it can have unexpected consequences. The perception of injustice is suggested to have relationship to many organizational and personal level outcomes like positive relation to personnel turnover, negative relationship with pay and job satisfaction, trust in supervisors and organizational commitment [20], [21], [22]. Thereby it is justified to say that organizational justice might have an important influence on organizations and their functioning.

### 3 APPRAISALS AND EXISTING JUSTICE RESEARCH

Procedural justice researchers have proposed two theoretical explanations for the psychological processes underlying procedural justice effects. The first one is instrumental control e.g. [13] and the second is relational concerns e.g. [15]. Instrumental control explanation emphasizes the short term perspective; disputing parties want control over the conflict resolution (made by third party) or decision process in order to gain better (or guarantee sufficient) outcomes for themselves. Control over process will assure that third party will get sufficient information and that is considered to make process and decision equitable. Relational perspective takes more long term focus. According to this perspective, people are interested in decision-making procedures because they reflect individuals' own relationship or standing to the authorities or institutions that employ the procedures. Such procedures have important implications for

individuals' self-worth and group standing. Procedures reflecting a positive, full-status relationship are viewed as fair because they manifest the basic process values in the institution or organization and also individuals' own organizational standing and status. [23.]

There are many suggestions about attributes that make procedures perceived as fair. *In this study these attributes are referred as "justice rules"*. Some researchers emphasize more instrumental value of the procedures while others are focusing on the relational side of the procedures. The study of "voice"[13] declares that individuals are more willing to perceive the decision or resolution process fair (and are contented with the result) if they are allowed to present their own view. Leventhal [14] expanded the attributes of the fair procedures to six items. These items or rules can be interpreted in performance appraisal context as following; a) *consistency* (maintaining consistency in performance standards over time and among employees), b) *bias-suppression* (constraining self-interest by discussing performance expectations and discrepancies), c) *accuracy* (training managers and employees to record performance accurately throughout the period and use this record to prepare and justify performance evaluations), d) *correctability* (instructing managers to listen to the employees opinions and change the evaluation if appropriate), e) *representativeness* (discussing concerns of the employee and manager throughout each stage of the process), f) *ethicality* (using procedures that are compatible with existing moral and ethical standards).

Tyler [18] [15] suggest that relational dimensions like individual's standing (status) in the organization, neutrality in decision making processes and trust in authorities' fair intentions are important determinants in perception of fairness. Individual's standing is thought to be conveyed by interpersonal treatment during social interaction. Rude treatment is a sign of lower "inclusion" or status in a group (interest are unlikely to be protected) and polite treatment refers to good status or strong inclusion in a given group or situation. [18.] Interactional or relational justice thus refers to quality of the interpersonal treatment received by an individual (see e.g [24], [17], [25]). Interactional justice is proposed to have at least two components by itself. The first one is *interpersonal sensitivity* which refers to politeness and respectfulness of the procedures. The second subpart is *explanations or social accounts*. People are more willing to accept decisions that are properly explained or justified. [17], [26.]

Summing up the above-mentioned instrumental and relational perspectives of the justice literature, Folger and Bies [27] have proposed seven rules that managers should follow in order to promote fair procedures: 1. consideration of employees' point of view, 2. bias-suppression, 3. consistency, 4. timely feedback about decision outcomes, 5. supervisors' truthfulness in



communications with employees, 6. polite and courtesy treatment of employees, 7. sufficient justification for an outcome decision [27].

The purpose of this paper is to improve the understanding of the justice elements that are important in the performance appraisal interview. The organizational psychological literature and research of justice relies heavily on the quantitative methodology tradition, which give little emphasis on individuals own perceptions and interpretation of the justice events and justice rules [28], [29]. These rules of justice are unquestionably very important but more research is needed to answer why they are important and what are the real actions or circumstances in performance appraisal context that violates these rules and makes them salient. Therefore, on one hand, this paper will be developing new methodology for studying procedural justice, but more significantly, the constructivist approach (see [30], [31]) here will enable researchers to look at an ontologically different angle on procedural justice, i.e., procedural justice as a subjective or collective experience instead of an externally-determined phenomenon with a single interpretation. According to this approach, this study takes a qualitative research approach to the justice construct stressing the subjectivity of the justice experience and gives voice to the individuals and their own explanations of the justice events and the contexts they are facing.

#### 4 RESEARCH QUESTIONS

The purpose is to increase the understanding of the contents of the justice rules named in the literature, i.e. what these justice rules mean in the context of performance appraisal interviews. By focusing on *injustice* expressions, the researchers supposed to get access to the construct of justice. The research question is double-barrelled and can be formulated as follows:

*Which justice rules are salient in performance appraisal interviews and why?*

The question “why” refers to the content of the injustice expressions and the question “which” refers to their theoretical connections to the existing literature (i.e. justice rules).

#### 5 METHODS

This study is a part of the larger research project, which studies evaluation based pay systems in three work life sectors in Finland; government, private and municipal. The data of this study was gathered in 2004 from one government sector organization, which launched evaluation based pay system during the year 2003. However the organization had practiced procedures involving this evaluation based pay system for four years, although evaluations did not have influence on pays during that time. The case organization can be characterized as an expert organization and it employs about 150 employees. For this case research, 27

employees were interviewed. Seven of them were supervisors. Interviews were semistructured (see different styles [32], [33]), focusing on the procedures and experiences involving the annual appraisal interviews. Themes of the interviews covered areas like the development of the pay system, procedures and processes involving the system and needed improvements. The interviews lasted from 30 minutes to one hour.

The method of the data analysis can be characterized as a mixture of both traditional deductive “theory driven” analysis [34] and grounded theory approach [35]. Although the research started with the open perspective to the justice concept, the influence of the previous research was recognized. However the role of the theory was more like analysis supporting than directive. Thus no main categories or themes of justice were decided in advance. Researchers started to read the text with open mind and let the categories and their subcategories “rise” form the text.

The data analysis was conducted according to grounded theory approach [35], [36]. The critical data reduction decision in qualitative studies is to determine the unit of analysis. In this study, the unit of analysis was mentions or expressions of the *injustice*. As a broader sense, injustice can be defined as a situation, where person feels that she/he has been treated badly. In other words, these situations violated the norms of justice e.g. made the justice construct salient. This refers to the question “why” represented in the research question. All the expressions or references to injustice were collected from the text and coded according to their content. Expressions or references could be either in first person (happened to me) or be general reference to injustice (happened to someone else / generally). Coding was a process of simultaneously reducing the data by dividing it into units of analysis and coding each unit. The process of analyze was divided to different phases (see Table 1). In the first phase, initial 207 expressions of injustice were identified from the text. In the next phase, reduced expressions form every initial expression were created. That way the essential message of each expression was identified. After these two preparation phase, the actual categorization process started. Each reduced expressions were categorized to 12 subcategories. These subcategories were reduced to 8 main categories which were eventually reduced to the final 3 theme categories. These categories and their subcategories were compared to justice rules existing in the literature and the question “which” represented in the research question was answered.

TABLE 1  
EXAMPLE OF THE DATA REDUCTION PROCESS

Initial expression	Reduced expressions	Subcategory	Main category	Final theme category
“...I have criticized this system because there are always individuals who don’t highlight their achievements because they are naturally unpretentious..” (H4_A_2)	disparagement	Subordinate’s style	Personal differences	Dynamics in the appraisal situation
“ I think it influences weather you are ready to defend your opinions and don’t just be satisfied with the points supervisor is offering..(H12_A_9)”	Defend			
“..some supervisors are more critical than others...they tolerate less mistakes than others...(H23_E_6)”	Criticism	Personality of the supervisor		
“You can say things very many ways...negative things can be also said in a constructive way...(H9_A_5)”	Constructive feedback	Feedback	Interaction	
“This is situation of interaction..it is important that I can also say what I think...then we discuss together about it..(H24 a_6)”	Voice	Quality of the interaction		

## 6 RESULTS

The expressions of injustice were coded to three categories according to their content (Table 2). The injustice expressions related either to 1) dynamics in the appraisal situation, 2) the measurement of the performance and 3) the premises behind the pay system. Each main category and their subcategories will be discussed next.

TABLE 2  
THE CREATED CATEGORIES, SUBCATEGORIES AND SUGGESTIONS FOR JUSTICE RULES SALIENCE (VIOLATIONS)

	Example	Violation of the justice rule(s)
1. DYNAMICS IN THE APPRAISAL SITUATION		
1.1 <u>Personal differences</u>		
<i>A. The influence of the subordinate's style</i>		
- disparagement	"...I have criticized this system because there are always individuals who don't highlight their achievements because they are naturally unpretentious.." (H4_A_2)	Consistency rule violation
- defending	" I think it influences whether you are ready to defend your opinions and don't just be satisfied with the points supervisor is offering..(H12_A_9)"	
- persuasion	Sometimes people try to willfully to manipulate their appraisals and that situation...(H21_A_4)	
<i>B. The personality of the supervisor</i>		
- criticality	"..some supervisors are more critical than others...they tolerate less mistakes than others...(H23_E_6)"	Representativeness, interactional treatment (sensitivity and explanations) and correctness rules violation
- optimism	" of course it matters..if your supervisor looks at people with positive view, you will also get more positive results in appraisal...(H19_A_6)	
1.2. <u>Interaction</u>		
<i>A. Quality of the interaction</i>		
- respect	"It is very important that supervisors also take account the emotions of the subordinate...respect that we are here talking about somebody's performance...(H6_A_2)"	Representativeness, interactional treatment (sensitivity and explanations) and correctness rules violation
- voice	This is situation of interaction..it is important that I can also say what I think...then we discuss together about it..(H24_a_6)	
- interpersonal chemistry	"..it is not very easy to rise above interpersonal conflict in a appraisal situation...some people just naturally come along better than others...of course it matters...(H16_a_5)"	
<i>B. Feedback</i>		
- lack of feedback	"My supervisor didn't explain why I got those points...she just put them...(H19_A_2)"	
- constructive feedback	"You can say things very many ways...negative things can be also said in a constructive way...(H9_A_5)"	
2. THE MEASUREMENT OF THE PERFORMANCE		
2.1. <u>Gathered information about performance</u>		
<i>A. Distance between the subordinate and the supervisor</i>	My supervisor don't know how I work, we don't see very often...(H4_A_3)"	
<i>B. Lack of supervisor's time</i>	Our supervisors are so busy... I wonder if they have time to examine properly their subordinates performance on a daily bases...(H12_A_3)"	
<i>C. Lack of experience/knowledge (of subordinate)</i>	"It is not fair, if new supervisors have to do these appraisals...they just can't...(H3_A_6)	
2.2. <u>Appraisal scale</u>		
<i>A. Lack of clear definitions</i>	"..And I have always said that I wont use these upper scales before somebody tells me difference between 4 and 5 in performance...(H5_E_8)"	Accuracy and consistency rules violation
<i>B. Variety of interpretations</i>	"...Before there is clear definitions, variety of interpretations exists...we can call this stage same but actually we are talking about different things...it is always subjective...(H6_A_5)"	
2.3. <u>Performance criteria</u>		
<i>A. Vagueness and variety of interpretations</i>	"What does this mean? These criteria are abstract and overlapping with each other...(H5_E_8)"	
<i>B. Lack of verification</i>	How do you verify criterion "interaction skills" in real life...there are no facts..(H8_E_5)"	
3. PREMISES BEHIND THE PAY SYSTEM		
3.1 <u>Limiting frames of the pay system</u>	"Is it ok, that there cannot be differences between different working units...in reality some unit can have better performers than other...(H2_E_5)"	Accuracy and representativeness rules violation
3.2 <u>Basis of the pay</u>	"We gain our goals usually in a team...how can be individual contribution separated from the result of the team...(H2_E_2)"	

## 7 DYNAMICS IN THE APPRAISAL SITUATION

### 7.1 *Personal Differences*

Both supervisor and subordinate bring their personal styles and values to the appraisal situation. Subordinate's injustice experiences related to claims that subordinates with different personal styles could influence the supervisor's appraisal process and the result. Employees vary in a way they are acting in a performance appraisal interview. This means that some employees give more resistance to the supervisor and even can influence to the final result. Also the personality of the supervisor was seen to be threat to the objective appraisals. Some supervisors are more critical and tolerate less performance mistakes than more positive ones. Thus the definition of "good performance" is seen very much dependent on the interpreter that is the person who is measuring the performance. Personal differences were seen as threat to the consistency rule of justice.

### 7.2 *Interaction*

This category included two subcategories; quality of interaction and the feedback. Quality of the interaction refers to interpersonal respect, voice and chemistry in a performance appraisal. Feedback refers to the amount of explanation or justification, that supervisor gives to the subordinate concerning the appraisal result. These four elements (respect, voice, chemistry and feedback) are closely interrelated. Respect between the evaluator and the object of evaluation seems to characterize a successful appraisal process. When both parties respect each other, appraisal will more likely occur in a polite, up front and constructive climate. Lack of respect enhanced the feelings of indignity and flak because it can be interpreted to violate the justice rule of interactional sensitivity. Also the chance to express one's feelings or opinions about things under evaluation seems to be very important to subordinates. The existence of "voice" seems to represent two aims; on the other hand it was a way to influence or correct the opinions of the supervisor (concerning the performance of the subordinate), on the other hand the existence of voice in appraisal situation reflects the feeling of respect and dignity; one is heard, respected and his/her opinions are important. Thus these reflected the justice rules of interactional sensitivity and representativeness and correctability. Also the awareness of interpersonal chemistry aroused expressions of injustice. If personal relationship is damaged between supervisor and subordinate, it can have negative influence on the performance appraisal. This could be seen as a threat to the rules of consistency and sensitivity of interaction. Successful interaction in the appraisal situation involves also proper feedback or justification about given appraisals. The lack of feedback was interpreted as unfair because without proper feedback

individuals were left alone wondering how they can improve their performance or why they got certain results in appraisals. Subordinates were also concerned how the supervisors gave the feedback. Constructive and justified feedback was more likely interpreted as fair and proper, while unconstructive (without justification, rude etc) was interpreted as demeaning. This made the justice rules of explanation and sensitivity salient.

## 8 THE MEASUREMENT OF THE PERFORMANCE

This category consisted of expressions, which referred to justice of the used measure (i.e. the used appraisal scales and the performance criteria) and the gathered information about performance. All these expressions of injustice made the justice rules of accuracy and consistency salient.

### 8.1 *Gathered Information about Performance*

Expressions of injustice in this subcategory referred to situations, where the information about the performance under evaluation or measures used were not accurate. Distance between supervisor and subordinate refers to situation where supervisor is not working equally close to every subordinate. This creates a situation, where supervisor knows the work and performance of one subordinate better than some other's. Thus evaluations between different subordinates are based on different amount of either facts or mental impressions depending on how closely supervisor and subordinate are working in everyday life. The subordinate can also work very autonomously, which creates also a challenge to evaluate his/her performance properly. The inaccuracy of gathered performance information was also seen due to supervisor's lack of time. Many interviewees felt that nowadays supervisors don't have enough time to examine and monitor subordinates' performance properly. Also supervisor's lack of experience or knowledge of working unit or its personnel and their performance aroused feelings of injustice, e.g. newcomer supervisor had to carry out performance appraisals without proper knowledge of his/her subordinates and their performance.

### 8.2 *The Appraisal Scale*

The used appraisal scale (e.g. 1=poor, 5=excellent performance) rose questions about interpretation. The lack of clear definitions of each step of the scale was seen as a threat to the equal measurement of performance. It was argued, that for example "good" performance is strictly dependent on the interpreter. Clear examples of the each step of the scale were needed. The lack of clear definition of the scale creates a situation where exists many competing interpretations. The variety of interpretations was seen as threat to the consistent and unbiased appraisals.

### 8.3 *The Performance Criteria*

The injustice expressions related to the performance



criteria were very similar to expressions related to the appraisal scale. The used performance criteria were seen as abstract and vague, which easily created multiple criteria interpretations. This was seen to harm the accuracy and consistency of the appraisals. Also the verification of these performance criteria in real life performance was seen blurred; e.g. how to verify criterion “interaction skills” in everyday performance?

## 9 PREMISES BEHIND THE PAY SYSTEM

This category consisted of two characteristics of the pay system that was perceived to create feelings of injustice; the limiting frames and the base of the pay system.

### 9.1 *The Limiting Frames of the Pay System and the Basis of the Pay*

The source of injustice was directed to the pay system's overall frame of reference. This means premises, where individual supervisor has to apply and execute the appraisals. First, limiting frames of the pay system were seen as a risk for just and fair appraisals. Reaching for the normal curve in the appraisals at the organizational level was seen disturbing and distorted. Strive for normal curve enforced supervisors to execute individual appraisals according to wholeness; everybody can not be a good performer. The logic behind “ideal mean” of given appraisals or the normal curve mindset is to ensure the consistent use of the scale between different supervisors. If one unit differs radically from other units in performance appraisals, its appraisals can be scaled downwards afterwards. This goal was seen contradictory; strive for consistent and just evaluations using normal curve idea decreases the possibility to find out real the differences in performance between individuals or the working units. However it prevents the possibility of biased and groundless appraisal results between units. This was evaluated to decrease the meaning of the pay system.

The base of the performance appraisal is usually individual. This assumption was questioned by asking how individual effort can be separated from the team effort. Individual based pay was seen as a biased base of pay. Expressions of injustice in this category could be seen threatening the justice rules of accuracy and representativeness.

## 10 CONCLUSION AND DISCUSSION

This paper can agree the previous research in the claim that the construct of justice is very important dimension in the performance appraisal interview. In this study, consistency, accuracy, representativeness, correctability [14] and interactional treatment (sensitivity and explanations) [17], [18] were the most salient rules of justice when individuals were assessing and evaluating their performance appraisal interview. The context or the source of these justice rule violations related to appraisal

situation itself (personalities and interaction), measures of the performance (gathered information, used scales and criteria) and the premises behind the whole pay system (frames and the base of the pay).

It is also evitable, that the “objective test” metaphor [4] behind the performance appraisal is insufficient and we must recognize the humanity as a natural part of the appraisals. To improve the feeling of justice in the performance appraisal interviews, the dynamics of the appraisal situation should be recognized. According to the results in this study, mutual respectful and constructive interaction serves both relational and instrumental concerns of an individual (see e.g. [37]). For example the lack of “voice” can though harm both the influence possibilities of an individual and also increase the feeling on inclusion and low status. These results emphasize the importance of the interaction's quality in appraisals; striving for correct results is not just enough.

The injustice expressions related to the measurement of the performance are also connected to the interaction, especially communication. The accuracy and consistency of the used measure's criteria and scales are dependent on the shared understanding of their content. This goal for shared understanding between the organization's members requires communication. By sharing the interpretations related to used scales and criteria, the mutual definition or shared interpretations start to develop. This means that organizations should encourage informal discussion or support interactive training with free discussion.

The overall frames of the pay system must be decided in every organization. In practice this refers to the balance between freedom in pay questions distributed to the supervisors and on the other hand the assurance of consistent exercise of the pay system between supervisors. This is also a matter of communication; the accuracy and consistency of the appraisals should be gained through mutual understanding of the criteria and scales used – not with artificial scaling afterwards. It is also important to notice the base of the pay. The use of individual or group based pay is always dependent on the jobs, demanded performance and how these are organized in a given organization.

All the above mentioned results make it easy to stress the human side of the performance appraisal. A fine technical pay system by itself doesn't guarantee the effectiveness of the system; implementing individuals are in the key role when the acceptance and success of the pay system are evaluated. Although these results are very dependent on the context, they provide useful viewpoints to other organizations implementing similar pay systems. It is possible that the salience of the justice rules differs in the different contexts, e.g. according to organizational size, accumulated experience with the appraisals and the demographic factors.

This study generated some questions, which could

not be answered within this paper. There is a possibility that supervisors and subordinates emphasize different justice aspects, which is due to their different roles in the process of appraisals. If supervisors and subordinates stress the different justice dimensions, it is understandable that conflicts arise easily in performance appraisal. Also the impact of actually gained pay on the content of the injustice expressions should be noticed. These could be fruitful approaches for a future research.

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# Labor Market Regulations and European Venture Capital Investment

**Ant Bozkaya**, *Harvard University John F. Kennedy School of Government Cambridge, MA*  
**William R. Kerr**, *Professor, Harvard Business School Boston, MA Presenting and Corresponding Author*

**Abstract:** Venture capital investment is a significant factor in explaining the entrepreneurial and innovative successes of the US over the past three decades. VC investment in most European regions, however, has been much slower to develop. This paper identifies the institutional factors and government policies that have inhibited this funding historically, discusses recent advances made in several European regions to attract domestic and foreign investors, and documents current investment levels. Specific attention is devoted to labor market regulations and how government choices between employment protection regulations and unemployment insurance benefits affect VC investment levels and entrepreneurship.

**Key words:** employment protection regulations, dismissal costs, unemployment insurance benefits, private equity, venture capital, buy-outs, entrepreneurship.

**JEL Classifications:** J11, J21, J31, J61, M13.

Comments are appreciated and can be sent to [wkerr@hbs.edu](mailto:wkerr@hbs.edu). The authors are grateful to the EVCA for providing data for this project; to David Autor, Josh Lerner, and Mika Maliranta for helpful comments; and to Harvard Business School for financial support.

## 1. INTRODUCTION

Venture capital (VC) firms are an essential ingredient for the dynamic US economy. These private equity firms provide start-up ventures with financial capital, market knowledge and technical advice, business introductions and reputations, and so on in exchange for equity stakes. While the individual success stories of VC-backed companies like Apple, Microsoft, Cisco, and Google are well known, the deeper economic benefits of the VC-supported innovation system are perhaps more hidden.

First, VC-backed firms contribute substantially to US technology formation, an area traditionally dominated by the R&D efforts of large corporations. Moreover, they do so very efficiently, with a greater quantity of innovations per dollar invested (Kortum and Lerner 2000). With their focus on scaleable and replicable applications, VC-sponsored innovations also reach further into the US economy and impact foreign markets more. More than half of VC-backed firms were technology focused in 2002.

Second, VC-backed firms are important catalysts for dynamic restructuring of the US economy, with capital flowing quickly to high-growth opportunities. Despite only getting truly underway in the 1980s, VC-backed ventures today account for over 10% of the US GDP and over 30% of the total market value of US public companies (e.g., Gompers and Lerner 2001, Guler and Guillen 2005). Emerging industries like communications and computing technologies and biotechnology have been built around VC-backed ventures.

Many European policy makers, economists, and business leaders want to replicate the innovation and economic growth spurred by VCs in the US. Both the European Union and OECD are urging member states to promote the availability of VC financing for ent-

repreneurs (OECD 2004a). A number of European governments are also investigating which policies best facilitate the development of home-grown VCs and the companies in which they invest.

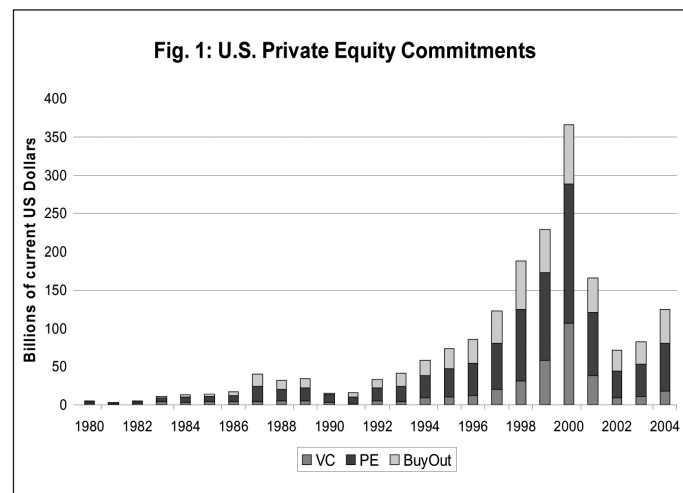
This conference report reviews the current state of private equity investment in Europe and discusses recent research on the institutional factors that contribute to or hinder this financial development. Section 2 begins by briefly reviewing the formative years of the US VC industry as a background for discussing current developments in Europe. This section outlines the typical functions and motivations of VC firms.<sup>1</sup> Section 3 then introduces this study's EVCA data and documents the current state of the European private equity investment.

The fourth section of this report presents recent research undertaken by authors regarding the role of employment protection regulations for reducing private equity investment. European countries substitute between stricter employment protection regulations versus more generous unemployment insurance benefits in the provision of labor market insurance to workers. This research discusses theoretically and empirically why regimes favoring unemployment insurance benefits are more attractive to private equity investors. The final section concludes.

## 2. INTRODUCTION TO VC FIRMS AND THEIR US DEVELOPMENT

VC has been an important element behind innovation and wealth creation in the US economy for the past thirty years.<sup>2</sup> Figure 1 documents the funds flowing into VC and buy-outs in the US since 1980.<sup>3</sup> Many very successful high-tech companies have been initially financed with VC, and this form of innovation financing is rapidly spreading to both industrialized and emerging economies. Between 1972 and 2000, more than 2000 VC-backed firms reached an aggregate market capitalization of over \$2.7 trillion.

Young entrepreneurial firms often struggle with financing the pursuit of their innovations or business concepts. These start-ups have few tangible assets that can be pledged for a bank loan, and traditional financial institutions often lack the expertise to assess



the creditworthiness of the proposed ventures. VCs screen entrepreneurial projects, structure financing deals, and monitor the performance of their portfolio companies. Without these financial intermediaries, many entrepreneurs would not attract the resources required to achieve commercial success.

American Research and Development (ARD) was founded in 1946 as the first modern VC firm. ARD was a publicly traded, closed-end investment company focusing on the US. Initially, ARD was not particularly successful, as the firm failed to attract sufficient institutional investors. The first VC organized as a limited partnership - Draper, Gaither, and Anderson - was formed in 1958. Partnerships differed from closed-end funds in that they were exempt from securities regulations. Unlike closed-end funds, partnerships were also organized for predetermined, finite lifetimes of usually ten years, after which they were required to return the assets to investors.

Fearing lagging American technology after the Soviet Sputnik launch in 1957, the US government launched the Small Business Investment Companies (SBIC) program in 1958. These tax-advantaged corporations were licensed by the US Small Business Administration (SBA) to provide professionally managed capital to risky companies. The SBIC program suffered, however, from a lack of institutional investors and weaker investment managers. Nevertheless, SBICs offered valued access to low-cost SBA loans and provided more start-up funding than ARD.<sup>4</sup>

Three important changes dramatically boosted the VC industry. The first change was in the US Department of Labor's interpretation of the 'prudent man' provision of the Employee Retirement Income Security Act (ERISA). This provision had traditionally been interpreted as prohibiting investments in new companies or VC funds. A 1979 revision allowed such investments provided the entire portfolio was not endangered.<sup>5</sup> The second change was the reduction in maximum capital gains tax rates from 49.5% to 28% in 1978 and to 20% in 1981 (Lerner 1999).

The third shift was to widespread use of limited partnerships (LPs) as an investment form. While only a small fraction of VC investments were structured in this way in the 1970s, over 80% of the capital committed took this form during the 1980s and 1990s (Lerner 2001). The LP form has a number of advantages, especially its exemption from US corporate tax (and distributed secu-

rities are not taxed until they are sold).

To qualify, a fund must have a predetermined, finite lifetime (typically ten years with one to three year extensions allowed). The transfer or withdrawal of partnership units are severely restricted, and limited partners cannot participate in the day-to-day management of the fund. The general partners (GPs) who run the fund are generally liable, but the funds usually do not borrow or engage in activities that overly expose them. These GPs are compensated through a fixed component (often 1.5-3.0% of net asset value) and a variable component (often ~20% of profits).

The main document governing the relationship between the VC and the portfolio company is the "stock purchase agreement" that specifies the amount and timing of the investments. VC financing is frequently undertaken in stages, with multiple firms participating in each round. Through staging, VCs maximize the option value of investment continuation decisions. The amount invested typically grows with each round as the business concept becomes proven and financing needs increase. Through syndication, with multiple firms participating in funding the same venture, VCs diversify their risk and deepen the non-financial resources of the young enterprise.

VCs typically use convertible preferred stock that allows the conversion of debt to equity depending upon the venture's outcome. VCs also seek liquidation preference and control rights or covenants. This special instrument specifically addresses the entrepreneurial environment. Most investments yield poor returns, requiring control and liquidation preference, but the convertible option also affords the VC full returns from very successful investments. These instruments further help separate valuation from control rights in the deal structure.<sup>6</sup>

VCs often require key employees in start-ups to execute employment contracts with non-compete clauses. These personnel further accept lower salaries in return for equity participation. Finally, the agreements usually specify extensive operational and financial reporting and the right to inspect-at-will. These clauses, similar to the covenants and liquidation preference, are very important given the asymmetric information and moral hazard inherent in these investments.

The exit options are, of course, very important for the VC who must return funds to investors in a limited timeframe. A develo-

**Table 1: European Private Equity Funds Raised and Investments**

	Funds Raised			Investments			Buy-Out Share	
	1995	2000	2004	1995	2000	2004	1998-2000	2001-2004
Austria	1,290	234,584	121,812	1,044	163,136	140,535	18	30
Belgium	159,923	806,978	563,781	111,427	564,771	297,769	3	28
Denmark	28,034	852,298	536,215	30,801	273,587	394,734	21	19
Finland	52,510	569,590	220,739	33,661	384,240	222,867	46	29
France	792,726	7,480,737	2,411,289	850,662	5,304,090	5,226,682	51	55
Germany	210,006	6,113,854	1,983,130	665,576	4,766,595	3,765,790	19	36
Greece	14,948	305,156	5,366	8,255	195,002	5,080	18	6
Ireland	12,350	197,523	47,357	19,145	223,368	61,193	22	14
Italy	264,046	2,924,756	1,663,331	253,425	2,968,515	1,480,130	34	50
Netherlands	257,451	2,791,823	3,207,011	467,225	1,916,486	1,658,984	29	62
Norway	45,735	497,204	560,159	119,765	296,097	308,112	13	23
Portugal	86,156	151,687	248,031	54,819	183,175	160,706	17	14
Spain	141,706	1,914,189	1,577,006	162,514	1,126,792	1,966,762	31	30
Sweden	438,183	3,628,572	3,650,732	85,542	2,299,757	1,621,909	51	66
Switzerland	47,993	985,262	175,714	48,386	626,358	272,442	23	30
UK	1,840,837	17,661,558	10,056,741	2,632,841	13,179,838	19,085,981	74	82
Sum Europe-16	4,393,893	47,115,771	27,028,414	5,545,088	34,471,807	36,669,675	29	36
US (VC Only)	7,813,389	114,870,465	14,653,429	6,240,245	114,623,958	16,877,080		

Notes: Figures are in thousands of Euros. Authors' calculations from EVCA (2005) and NVCA (2005). European figures include VC, buy-outs, and other private equity forms. US figures include VC investments only.



ped stock market facilitates an initial public offering (IPO) of a company. VCs can convert their shares upon an IPO and sell them to the public soon after. IPOs often represent the best returns to initial investors, and many researchers suggest VC develops faster in economies with strong stock markets (e.g., US, UK) compared to bank-centered economies (e.g., Continental Europe, Japan).<sup>7</sup>

Portfolio companies are often sold to larger firms in the industry too. These sales allow VCs to exit, while often requiring the start-up's employees to remain with the acquiring firm for a fixed duration. Many US high-tech firms are known for acquiring innovative start-ups in their technology space as a complement to traditional R&D (e.g., Cisco, Google). In some cases, this process yields very efficient industrial organization, with small firms undertaking innovation and larger firms production and marketing.

These formal financial and management approaches spurred the creation of VC industry over the last three decades, in the process pushing the US to the technology frontier and generating substantial economic growth. Not surprisingly, a number of researchers and policy makers are interested in quantifying closely the factors that contribute to the formation of this sector. The next section reviews the current state of European private equity and its recent growth; the fourth section then examines labor market regulations and VC development.

### 3. CURRENT STATE OF EUROPEAN VC AND BUY-OUT MARKETS - DRAFT!

This section describes some prominent features of current VC activity in Europe. Our data are taken from annual surveys sponsored by the European Private Equity and Venture Capital Association (EVCA) and conducted by PriceWaterhouse Coopers and Thompson Financial. The EVCA graciously provided us detailed industrial statistics on sixteen nations for 1989 to 2004 (hereafter Europe-16).<sup>8</sup> Throughout this section and the next, we also detail US VC data published by National Venture Capital Association (NVCA). These US trends provide a baseline for comparing the European activity.<sup>9</sup>

**Table 3: Distribution of Private Equity Sources of Finance**

	Institutional Investors				Corporations				Financial Institutions			
	1990	1995	2000	2004	1990	1995	2000	2004	1990	1995	2000	2004
Austria	0	0	9	1	50	0	4	1	50	35	60	73
Belgium	0	16	0	2	1	3	18	2	42	17	49	21
Denmark	34	14	38	32	9	0	3	9	48	53	31	27
Finland	0	15	19	6	38	0	8	9	53	70	46	59
France	18	10	14	11	3	7	11	7	53	50	48	55
Germany	0	9	6	0	5	10	9	2	74	65	52	59
Greece	na	0	0	0	na	5	7	3	na	44	76	0
Ireland	0	34	24	10	0	12	10	0	65	30	43	12
Italy	9	0	3	16	14	1	26	11	21	17	55	55
Netherlands	7	0	16	8	2	0	18	8	27	59	49	37
Norway	6	0	1	15	26	32	14	42	47	0	24	22
Portugal	0	0	0	9	44	1	0	4	33	81	38	69
Spain	0	12	6	12	22	7	10	3	69	52	54	65
Sweden	22	55	31	26	1	6	7	0	75	10	31	37
Switzerland	23	19	12	9	31	9	5	66	35	29	28	24
UK	23	48	40	24	2	4	8	5	52	31	37	36
Avg. Europe-16	10	14	14	11	16	6	10	11	50	40	45	41
US	76	59	61	55	5	5	4	5	6	20	23	21

Notes: Figures are in percentages. Authors' calculations from EVCA (2005) and NVCA (2005). Institutional Investors include academic and pension funds; Corporations include investments by industrial corporations (with dedicated corporate venture capital); Financial Institutions include commercial banks, insurance companies, and funds raised from capital markets and fund-of-funds; Others Sources include individuals, realized capital gains, and others.

**Table 2: Distribution of Private Equity by Stages**

	Early Stage Investments				Later Stage Investments			
	1990	1995	2000	2004	1990	1995	2000	2004
Austria	24	28	37	12	76	72	63	88
Belgium	11	6	47	16	89	94	53	84
Denmark	40	11	12	42	60	89	88	58
Finland	45	23	35	18	55	77	65	82
France	12	3	22	8	88	97	78	92
Germany	6	13	35	9	94	87	65	91
Greece	0	39	5	59	100	61	95	41
Ireland	3	5	50	45	97	95	50	55
Italy	6	18	18	2	94	82	82	98
Netherlands	9	16	19	2	91	84	81	98
Norway	13	4	35	10	87	96	65	90
Portugal	22	8	17	22	78	92	83	78
Spain	15	11	18	4	85	89	82	96
Sweden	4	7	10	14	96	93	90	86
Switzerland	28	1	9	22	72	99	91	78
UK	6	1	12	4	94	99	88	96
Avg. Europe-16	15	12	24	18	85	88	76	82

Notes: Figures are in percentages. Authors' calculations from EVCA (2005). Early stage investments include start-up and seed stage investments.

Table 1 documents European VC commitments and investments from 1995 to 2004. The largest European VC communities are the UK, Sweden, and the Netherlands, with the sizeable economies of France, Germany, Italy, and Spain not too far behind. Relative to the US, the overall size of these private equity investments was quite small until recently. As late as 1996, the US VC pool was about three times larger than the total VC pool in other high-income nations. (Note that the US comparison in Table 1 only includes VC investment, while the EVCA data contain buy-out investments too.)

During the second half of the 1990s, the supply of VC in most of European countries increased significantly. Drivers of this strong growth include the more favorable treatments of VC financing by European governments, policy deregulations to

encourage entrepreneurship, the opening of several stock markets emulating the US NASDAQ, the conversion of the European Investment Fund into a major investor in VC funds, and so on. Of course, the formation of the technology bubble in the US also played a role in the late 1990s increase. Along with the US VC community, European activity declined significantly after the 2000 US bubble bursting. Yet, European investment levels remain significantly higher than where they were a decade ago.

The majority of VC funding, both in Europe and in the US, is allocated to expansion-stage investments. These investments are for portfolio companies who have survived the start-up phase and proven their business concepts, and now require substantial, but lower-risk, capital for achieving revenues and market share prior to IPOs or trade sales. Table 2 illustrates that European VCs are concentrating more of their investments in recent years on early stage financing, which doubled as a share of VC investments from 1995 to 2000. Since 2000, Europe has devoted relatively more

**Table 3 Continued**

	Government Sources				Other Sources			
	1990	1995	2000	2004	1990	1995	2000	2004
Austria	0	59	16	0	0	6	12	26
Belgium	1	7	6	5	56	57	27	70
Denmark	0	22	3	7	9	11	24	25
Finland	5	7	20	4	4	8	8	22
France	0	2	1	3	25	32	26	24
Germany	7	8	16	16	14	9	17	22
Greece	na	0	0	77	na	51	16	20
Ireland	0	0	11	6	35	24	12	71
Italy	35	13	2	4	20	69	14	14
Netherlands	0	0	6	3	64	41	12	44
Norway	10	0	0	5	11	68	61	17
Portugal	0	12	15	8	24	6	47	11
Spain	0	11	5	12	9	18	26	7
Sweden	1	0	2	2	2	28	29	34
Switzerland	0	0	3	0	12	43	53	1
UK	0	1	4	4	23	15	12	31
Avg. Europe-16	4	9	7	10	21	30	25	28
US	0	0	0	0	13	16	12	19

resources than the US to these early stage investments, although the absolute amount is about one-fifth of the US level.

Table 3 shows a substantial difference in the structure of VC funding in Europe. While pension funds, insurance companies, and endowments contribute nearly two-thirds of US VC funds, these institutional investors account for less than one-third of European funding sources. European VCs are instead more dependent upon funds controlled by financial or corporate entities (i.e., 'captive' funds). Government funding is also more prominent in Europe.<sup>10</sup> This sharp contrast in fund sources reflects different capital market structures. Banks remain more central to Europe's financial structure, and these financial institutions further control large portions of the mutual fund industry and the nascent pension fund industry. These differences are therefore likely to persist and to influence the behavior of local VC firms.

Finally, Table 4 describes the distribution of VC investments across sectors. The greater concentration of high-tech investments in the US is clear, while agriculture, finance, and especially manufacturing (including consumer and industrial products) play a much more central role in Europe. These differences should be treated with some caution due to the difficulty in aligning classification systems and the lack of detailed buy-out data for the US. They describe, nevertheless, general differences in sector placement are evident.

#### 4. EMPLOYMENT PROTECTION, UNEMPLOYMENT INSURANCE, AND PRIVATE EQUITY

This fourth section of the conference report returns to the factors contributing to or hindering private equity investments. It reports recent research undertaken by the authors regarding labor market regulations, taking evidence from the EVCA data detailed in Section 3. Interested readers should consult Bozkaya and Kerr (2006) for further details.

In the academic and popular business press, strict labor market regulations are often blamed for persistently higher European unemployment and slower productivity growth relative to the US. The usual suspects include stronger European unions and collective bargaining, rigid employment protection regulations, high minimum wages, maximum work week hours, large tax wedges, and so on. Nickell et al. (2005) reviews the academic literature on labor market rigidities and highlights the central role of employment protection regulations discussed in this section.

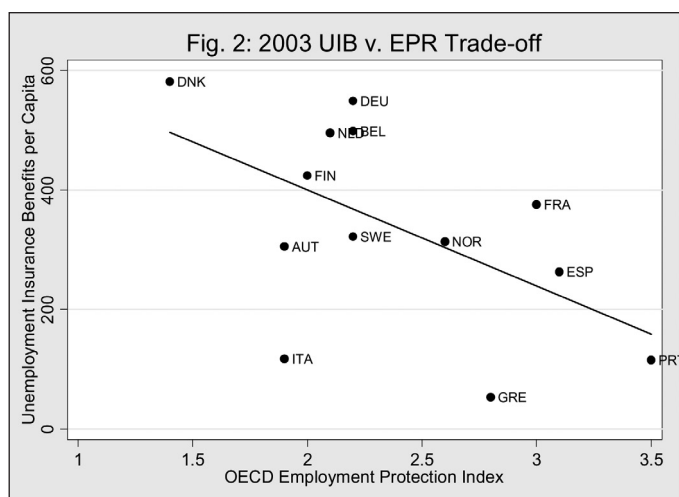
These regulations are thought to influence entrepreneurship rates across countries too (e.g., Ilmakunnas and Kanninen 2001; Kanninen and Leppamäki 2000; Kanninen and Vesala 2005). Sahlman (1990) argues that labor market rigidities form a large 'barrier' to the success of entrepreneurship and VC investment in

**Table 4: Distribution of Private Equity Investments by Sector**

	Biomedical				Computer				Electronics			
	1990	1995	2000	2004	1990	1995	2000	2004	1990	1995	2000	2004
Austria	16	0	8	22	37	0	16	30	2	0	2	2
Belgium	19	9	9	10	12	1	20	9	9	4	2	0
Denmark	11	9	29	44	20	7	8	11	1	10	18	2
Finland	12	14	17	19	4	5	15	15	8	14	2	2
France	8	8	6	7	8	10	14	7	1	4	12	1
Germany	3	2	16	24	6	8	22	3	8	7	3	3
Greece	na	0	0	41	na	7	29	44	na	0	0	0
Ireland	0	0	6	27	11	12	47	32	8	10	12	4
Italy	1	2	3	3	3	1	6	1	5	2	0	1
Netherlands	9	9	6	15	16	14	16	22	6	7	1	0
Norway	5	1	5	4	5	13	18	9	1	11	10	1
Portugal	3	3	1	14	4	0	16	7	1	3	0	0
Spain	0	1	6	8	2	1	14	4	2	1	2	1
Sweden	5	7	8	10	12	8	7	8	13	5	2	2
Switzerland	18	12	5	15	7	18	8	17	7	1	7	1
UK	6	10	15	7	6	5	11	5	2	4	2	1

**Table 4 Continued**

	Telecom				Manufacturing				Other			
	1990	1995	2000	2004	1990	1995	2000	2004	1990	1995	2000	2004
Austria	0	0	25	4	44	100	34	35	0	0	15	7
Belgium	1	1	25	17	30	68	18	53	30	17	25	11
Denmark	6	15	0	12	51	54	20	31	12	5	25	0
Finland	4	3	21	6	57	61	35	44	16	3	9	14
France	7	1	18	15	39	65	38	39	36	12	12	31
Germany	1	4	12	3	58	45	29	38	23	33	18	29
Greece	na	5	31	14	na	36	34	0	na	52	6	0
Ireland	0	12	22	24	77	54	12	10	3	12	1	3
Italy	0	0	22	13	80	55	55	62	10	40	14	21
Netherlands	3	18	15	5	34	33	39	37	31	18	23	21
Norway	1	0	14	8	74	44	27	41	14	31	26	37
Portugal	5	2	18	0	79	52	38	73	8	40	28	6
Spain	3	2	13	27	66	58	42	28	27	37	23	33
Sweden	7	1	10	10	50	76	68	49	14	3	5	22
Switzerland	6	9	0	11	59	48	77	26	3	11	2	31
UK	1	5	10	15	60	56	52	45	24	21	10	27
Avg. Europe-16	3	5	16	11	57	57	39	38	17	21	15	18
US	12	18	17	17	13	12	7	6	14	15	4	5



Germany and Japan. Heckman (2003) likewise cites labor market regulations as a deterrent to European entrepreneurship and growth, emphasizing the weaker incentives for human-capital accumulation and skill development. Scholars of the entrepreneurial business culture in Silicon Valley frequently emphasize its flexibility, nonhierarchical structures, networking, and labor mobility across firms (e.g., Saxenian 1996, Gilson 1997, Hyde 1998).

Our work on labor market regulations builds on two simple observations. First, European nations generally seek to provide higher levels of worker security than the US or UK. While this greater emphasis on social protection is well-known, a more subtle empirical fact is that European governments tend to substitute between employment protection regulations (EPRs) and unemployment insurance benefits (UIBs) as the mechanism for providing this labor market insurance.<sup>11</sup>

Figure 2 shows the basic cross-sectional relationship between EPRs and UIBs from 2003. The vertical axis documents the average UIBs per capita for 2001-2003.<sup>12</sup> The horizontal axis provides an EPR index from 2003 developed by the OECD. Higher EPR scores indicate more heavily regulated labor markets, factoring in a wide variety of legislation concerning the individual and collective dismissals of both temporary and regular workers.

Economies with higher UIBs per capita have weaker EPRs. Denmark has the lowest EPR rating at 1.4, but provides the highest the UIBs.<sup>13</sup> This reflects the well-publicized Danish 'flexicurity' approach that stresses high job mobility facilitated by generous out-of-work benefits and active labor market programs to promote worker re-entry. Portugal, on the other hand, provides very strong security to employed workers but weaker benefits to the unemployed. The empirical trade-off between EPRs and UIBs is statistically significant and present in data extending back to the late 1980s.

While EPRs and UIBs may substitute for worker security, they have different implications for the costs firms face. EPRs are likely to have a stronger impact on the adjustment margins of firms. Even if general taxation to firms is higher to support UIBs, the direct incidence on labor adjustments that firms wish to make should be weaker in regimes favoring UIBs than in strict EPR regimes. (The appendix outlines this argument in greater detail.)

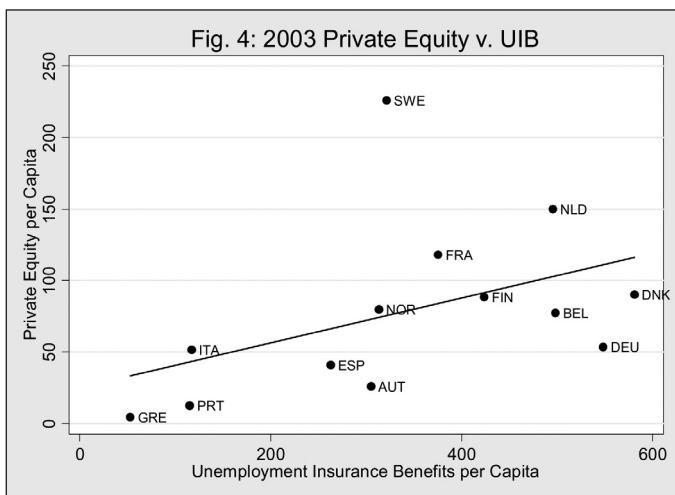
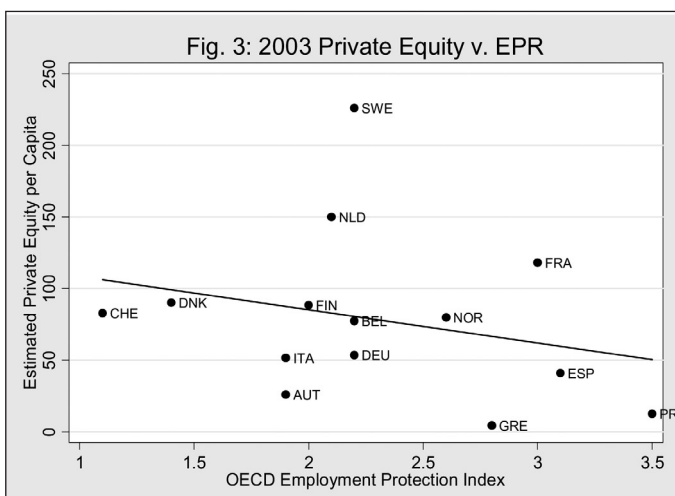
The second observation is that the VC industry, by its very nature, thrives in dynamic industries that require frequent labor adjustments. This VC focus on high-growth opportunities and rapid restructuring underlies the US success stories discussed above. It is also necessary for achieving sufficient returns in a business environment with low success probabilities and limited VC fund life.

Combining these two observations, nations emphasizing UIBs over EPRs should be more attractive for the development of VC financing. Even if UIBs and EPRs substitute for worker security,

the manner in which they tax firms is very different. Regimes emphasizing UIBs and flexible labor markets, like the Danish 'flexicurity' approach, should better support VC operations.<sup>14</sup>

Our research efforts investigate this hypothesis using the EVCA data. The introduction thus far emphasizes VC activity related to start-up ventures, but buy-out investments should similarly favor UIB regimes over EPR regimes. Buy-out investors frequently acquire inefficient companies with the expectation of restructuring poor operations and making a profit from better management. The direct tax of the EPR regimes on labor adjustments of firms will reduce the attractiveness of these opportunities.

Figures 3 and 4 show that choices between EPRs and UIBs do influence private equity placement. European countries with stricter EPR regimes do have lower private equity investments, while those favoring UIBs are more attractive to these financial



forms. Along with Figure 2's empirical trade-off between EPRs and UIBs across European nations, either Figure 3 or Figure 4 would imply the other.

The private equity measures in Figures 3 and 4 include both VC and buy-out investments; they also include funds sourced from the US along with European financing. The relationship of these investments to EPRs and UIBs is present within each subcategory as well (i.e., examining US-sourced VC investments or European-sourced buy-out investments). These relationships are also present in data extending back to the 1980s.

Bozkaya and Kerr (2006) provide a more detailed empirical analysis of these relationships. This academic study illustrates the regularity of these patterns across the 1990-2005 period, tests the

robustness of this pattern for alternative national features that are known to influence private equity funding, and examines sector differences in greater detail. This report is available upon request.

## 5. CONCLUSIONS

European economies empirically substitute employment protection regulations (EPRs) with unemployment insurance benefits (UIBs) as mechanisms for providing worker security. Policy choices regarding the optimal levels and mechanisms of labor market insurance are complex and should consider many economic and non-economic factors.<sup>15</sup> This study highlights one factor that should influence the EPR versus UIB decision.

A growing body of theoretical and empirical evidence finds EPRs act as a tax on firm adjustments, while the incidence of UIBs on this margin is less direct. These retarded adjustments in EPR regimes can hinder the restructurings - both within and across industries - that are critical for economic growth. The stagnation exists at the firm-level and aggregates up to economy-level.

This study provides new evidence regarding this trade-off by examining private equity investments across European countries. Many European policy makers, economists, and business leaders envy the growth stimulus provided to the US economy through its VC and buy-out communities. These financing types are generally responsive changes in economic and institutional factors (Lerner 2002), so it is quite possible for nations to foster their entry.

These private equity groups, however, explicitly focus on achieving high returns through dynamic growth. This growth process requires frequent adjustments to labor forces that are more difficult in countries with heavy labor market regulations. Accordingly, they are more likely to flourish in European economies favoring UIBs over EPRs. The empirical evidence supports this claim.

These results are informative of the institutional factors governing VC placement. This work also contributes more broadly to a growing body of academic and policy research examining how labor market regulations influence entrepreneurship and productivity growth. The VC and buy-out funds studied here directly support firm creation and restructuring. As such, they provide a complementary measure to studies seeking entrepreneurship rates directly.

## APPENDIX OF EMPLOYMENT PROTECTION REGULATIONS AND LABOR ADJUSTMENT COSTS

The theoretical implications of EPRs are complex, with the impact for firms and overall social welfare depending upon subtle economic modeling assumptions. This report draws some basic results from the standard competitive model of the labor market to frame the discussion. These basic findings are common to multiple classes of economic models; interested readers should consult Autor et al. (2006) for an extended discussion of the theoretical implications of EPRs.

In the standard competitive model of the labor market, wages and equilibrium employment levels are set where labor supply equals labor demand. There are no frictions that restrict wage adjustments necessary to keep the labor market in equilibrium (e.g., wage floors, collective bargaining). Unemployment is voluntary in the sense that workers out of the labor force are not willing to supply labor for the equilibrium wage.

EPRs in this model are economically equivalent to mandated employment benefits. Benefit mandates raise the cost of employing

workers, leading to a decline in labor demand for a given wage rate. To the extent that workers value the mandate, they will increase their labor supply at a given wage. If workers value the mandated benefit at its marginal cost of provision, then equilibrium employment levels are unchanged and wages fall to cover exactly the cost of the benefit. In this scenario, the mandate is efficient and the Coase theorem applies (e.g., Summers 1989; Lazear 1990).

While there are no productivity or employment consequences in this base scenario, deviations from this framework yield efficiency costs. First, workers may value the mandates at less than their marginal cost of provision, leading to a weaker growth in labor supply. Equivalently, some of the termination benefit may accrue to a third-party, such as an attorney. Collective bargaining could also restrict the adjustments. In these cases, EPRs drive a wedge between the private and social cost of job separations, creating a deadweight loss. Because dismissal costs are only paid when workers and firms separate, EPRs create labor adjustment cost to firms (i.e., a tax on separations).

This labor adjustment cost feature of EPRs motivates our comparison to UIBs. To some extent, EPRs and UIBs are substitutes for insuring workers against labor market risks. EPRs, however, are likely to have a stronger impact on the adjustment margins of firms. Even if general taxation to firms is higher to support UIBs, the direct incidence of firm labor adjustments should be weaker than in strict EPR regimes.<sup>16</sup>

These labor adjustments are critical for the two forms of private equity - VC and buy-out funds - that this study considers. VC focuses on young firms during their high-growth phase. Tremendous uncertainty exists about these firms prospects, however, and labor adjustments are frequently required. Strict EPRs exacerbate the costs of these adjustments. Davidsson and Henrekson (2002) discuss that strict employment security provisions are more harmful for smaller, more entrepreneurial and faster-growing employers.

Buy-outs may be even more hindered by EPRs. Buy-outs are often undertaken for inefficient firms. The heavy debt burden disciplines management to be efficient in operations. In many cases, excess labor is shed from the firm to facilitate leaner operations. EPRs raise the costs of these adjustments. Autor et al. (2006) find that US firms reduce their annual labor turnover when state-level EPRs are passed.



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## Footnotes

<sup>1</sup> The footnotes of Section 2 highlight relevant academic literature on institutional factors that support the development of private equity investment. This review pulls from the older literature focusing on the US experience, as well as the more recent work comparing investment levels across countries.

<sup>2</sup> This section draws from Gompers and Lerner (2001, 2002); Leachman et al. (2003); and Allen and Song (2005).

<sup>3</sup> Buy-out firms are private equity financiers that enable management or investors to buy-out an existing business from its current owners. The new ownership seeks to profit from the acquisition through better management, maintaining a strict cost focus, and achieving leaner operations. These funds typically have larger investment sizes than VC firms. This section concentrates on the VC industry's development, but the empirical work below considers buy-outs too. These forms of private equity are frequently discussed together and reported in the same statistics.

<sup>4</sup> The prudence of active government intervention in the VC space is debated. A number of case studies suggest government seed investments crowd-out private investors, but Jeng and Wells (2000) find that an active government role generates VC investments where they otherwise would not have existed. This study focuses on the more

passive government role of national regulations that influence the VC environment.

<sup>5</sup> Pension funds, insurance companies, and other collective investment mechanisms continue to contribute substantially to US VC funds. Jeng and Wells (2000) find suggestive evidence that these capital providers are important across a broad grouping of European nations.

<sup>6</sup> Several studies examine the institutional and legal factors influencing VC development, including strong and transparent legal systems and accounting standards (e.g., La Porta et al. 1997, 1998), property rights (Johnson et al. 2002), and local reform (Berkowitz and DeJong 2000). These studies closely relate to the financial market development studies below as legal systems influence the growth of external financing. Bottazzi et al. (2004) and Lerner and Schoar (2005) consider how VCs structure their operations and contracts differently for alternative legal regimes.

<sup>7</sup> Black and Gilson (1998) first explored financing characteristics as determinants of VC. They argue an active IPO market is a key determinant of VC activity due to quick, profitable exits for the investors. Ritter (2003) also concludes that the greater opportunities for IPOs in the US have helped to create and fund innovative companies in their early stages. Ritter argues VCs are willing to finance firms knowing that an active IPO market will allow them to exit if internal frictions develop or if the firm succeeds. Jeng and Wells (2000) find a well-developed stock market to be the most important factor for VC development.

<sup>8</sup> Europe-16 countries in this study include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK.

<sup>9</sup> The US data are also important for providing a comprehensive view of European investment levels. The EVCA surveys all VC firms with a physical presence in Europe, regardless of EVCA membership status. US-based VC firms, however, also invest into Europe. These off-shore investments were especially important in the early years of Europe's private equity development, when many deals were financed without the opening of physical offices in Europe. In Section 4's investigation of employment protection regulations, we supplement the EVCA data with additional US-sourced investments into Europe developed from the Thompson Financial's Venture Economics database. Venture Economics contains deal-level for over 5000 US VC firms that allow us to tally investments originating in the US for a European portfolio firm. For simplicity, these are excluded from the EVCA-based trends presented in this section.

<sup>10</sup> SBIC funds, however, are not included in the US statistics.

<sup>11</sup> OECD (2004b) and Clark and Postel-Vinay (2005) discuss the greater efficiency of UIBs versus EPRs for achieving higher worker perceptions of job security as measured in opinion surveys. Algan and Cahuc (2005) discuss the importance of civic attitudes for achieving the Danish model.

<sup>12</sup> The UIBs are out-of-work income maintenance expenditures in Euros taken from Eurostat.

<sup>13</sup> The Danish ranking is higher than the US (0.2) and UK (0.7). For simplicity, the UK and Ireland are excluded from these graphs but considered in the more detailed empirical exercises in Bozkaya and Kerr (2006).

<sup>14</sup> Heavy labor market regulations also reduce the demand for VC funds by weakening incentives for entrepreneurship. Channels include greater benefits during employment (e.g., extended vacation periods, paid pregnancy leave), greater difficulty or loss of social standing should the venture fail, and so on. These issues would exist under both EPR and UIB regimes and so are de-emphasized in this report.

<sup>15</sup> Kugler and Pica (2004) find in their study of Italian EPR that labor market deregulation is most effective when accompanied by parallel reductions in administrative burdens and other regulations that create barriers to entrepreneurship.

<sup>16</sup> An Experience Rating system links employer UIB contributions to the dismissal history of the firm. This system is employed by the US but otherwise fairly rare. The adjustment costs to firms here is only a partial incidence that remains weaker than EPR regimes.

# Basis of proposal

The European Productivity Conference (EPC 2006) was held at the Dipoli Congress Centre in Espoo, Finland from 30 August to 1 September 2006. The decision to organise the conference was based on preliminary research carried out in autumn 2004 among Finnish and European decision-makers concerning the need for such a conference and on what areas it should focus.

The initiative to hold and organise the conference was taken by Finland's Ministry of Trade and Industry, the Ministry of Labour, the Ministry of Social Affairs and Health, the Ministry of Finance, Confederation of Finnish Industries (EK), the Central Organisation of Finnish Trade Unions (SAK), the Finnish Confederation of Salaried Employees (STTK), the Confederation of Unions for Academic

Professionals (AKAVA) and the Federation of Finnish Enterprises, the Association of Finnish Local and Regional Authorities, Tampere University of Technology and other technical universities and the European Association of National Productivity Centres (EANPC). CONGREX / Blue & White Conferences Oy, Yrittäjäröyvi Oy and JTO School of Management (JTO Palvelut Oy) were invited to coordinate the conference arrangements.

The work of deciding the content and focus areas of the conference was facilitated by the formation of an Advisory Board whose membership included the managing directors of international and national organisations.

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