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# WORKSITE FITNESS POLICY IN AN INTELLECTUAL CAPITAL FRAMEWORK

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Worksite Fitness Policy in an Intellectual Capital Framework

Key words: Intellectual Capital, Worksite Fitness Program, Human Resource Management, indicators, physical activity, physical fitness, policy, work ability

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To
Onni, Kati and Otto

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Education and learning can be seen as life-long processes. For me personally, this phrase is most true in many ways. First of all, I had the opportunity to study biomechanics with world-level colleagues at the University of Jyväskylä in the 1980's. Supervised by Professor Paavo V. Komi, I achieved relatively good results, but was unable to finish my PhD dissertation during that time. Following this, I had the opportunity to experience the "learning by doing" way. Working with top sportsmen and women in Kuortane Sports Institute and dealing with anti-doping issues in the Finnish Antidoping Agency prepared me for the challenges I was to meet in my present position in the Finnish Sport for All Association, a position I took up at the beginning of 1992.

In the Finnish Sport for All Association, I have had a position in which I could carry out practical research with companies concerning their employees' physical activity habits and physical fitness. In this work, the support I received from the then secretary general Heikki Niininen in the early years (1992-95) was very important. Later, the role of the managing director, Jorma Savola, both as a visionary superior and as a guiding friend was crucial – without his support, this thesis would have been impossible to finish. In addition, the entire staff of our Association has been important to me, both for their patient understanding concerning my study-leave periods and their positive attitude, which was always encouraging. In our Association, I received support not only from colleagues, but also from the board. The role of former president Kyösti Vesterinen was essential at the beginning of the Fitness Network process, and his successor, Jorma Varis, speeded up the process with the companies. Working with the present president MD, docent Timo Sahi, has a special meaning for me; his support as an experienced scientist has been more important than he himself has ever thought.

A significant phase in this study took place in early 1996, when Kyösti Vesterinen, president of the Finnish Sport for All Association at that time, called a meeting with a group of Finnish top managers to develop Finnish Worksite Fitness Programs. After the first meeting (held on the icebreaker ship 'Urho' on 8th October 1996), 15 Finnish conglomerates or public offices initiated a "Fitness Network" process. At this point, I have to mention people from these companies, such as Antero Eklund, Jaakko Erkkola, Liisa Järvelä, Anu Kaipainen, Jarmo Kammonen, Kari Koivunen, Pentti Kokko, Ilkka Launo, Arto Muukkonen, Kauko Palvalin, Ulla Peura, Matti Soini, Jarmo Sorsa, Sirkku Säilä-Pietilä, Eeva Tiainen, Markku Tunturi and Ilpo Väänänen.

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In such a long project, the support of family and friends is indispensable. It is impossible to thank everyone, but lifelong friends such as Jarmo Mäkelä and Olavi Pajala have to be mentioned. And my many friends in Kuortane! The positive attitude my family maintained towards my studies always – in the 1980's and in 2000's – meant a lot to me. I cannot thank my mother, Sirkka, and my sisters, Arja and Sirpa, enough in that respect. But the most important support is home! My wife, Pirjo, has lived with this project for many years! It has not always been easy, but a mutual trust ('It'll be done some day!') has been there all the time. Finally, I hope that my older children – Otto, now 21, and Kati, 18, – will be proud of their father. The youngest – Onni, now two years old – does not yet understand this at all, but I hope I can harness some of his boundless energy for my future challenges!

Helsinki 29th October 2006

Ossi Aura

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Abbreviations used in the thesis

| | |
|---|---|
| AG | Age Group (under 30y, 30-39y, 40-49y, 50-59y and over 59y) |
| APA | Total Amount of Physical Activity (minutes in a week) |
| BM | Behaviour Modification |
| CEO | Chief Executive Officer |
| HC | Human Capital |
| HEPA | Health Enhancing Physical Activity |
| HF | Health Factor |
| HRF | Health Related Fitness |
| HRM | Human Resource Management |
| IC | Intellectual Capital |
| IRF | Individual Related Factor (based on psycho-social questionnaire) |
| IPA | Intensity of Physical Activity (four digit scale; no activity, light, moderate and vigorous) |
| KM | Knowledge Management |
| MET | Metabolic Equivalent, metabolic rate during exercise divided by resting metabolic rate |
| MWA | Maintaining of Work Ability |
| NW | Nature of Work, white vs. blue collar workers |
| OHC | Occupational Health Care |
| PAG | Physical Activity Groups |
| PAI | Physical Activity Indicator, % of employees physically active enough |
| PFI | Physical Fitness Indicator, % of employees fit enough |
| RBV | Resource Based View of a firm |
| RC | Relational Capital |
| SC | Structural Capital |
| SCT | Social Cognitive Theory |
| SLD | Sick leave days (days/year) |
| TFV | Total Fitness Value, composed of estimations of cardio-respiratory and muscle fitness |
| TTM | Transtheoretical Model |
| WAE | Self-assessed Work Ability Estimation (on a scale of 0 to 10) |
| WFP | Worksite Fitness Program |
| WFPE | Indicator for participation in WFP-events, % of employees |
| WFPI | Indicator for regular (weekly) activity in WFP sport activities, % of employees |
| WRF | Work Related Factor (based on psycho-social questionnaire) |

# 1 INTRODUCTION

## *1.1 Background and positioning of the study*

The motives behind this study originate both from the researcher's and the practitioner's world. The researcher's interest (as a practitioner!) on the subject arose gradually in the 1990's whilst involved in work with customers. The never-ending questions such as: "How can we get everyone (physically) active enough?" and "How can I get our management committed to investing in a Worksite Fitness Program?" inspired the researcher to find answers. At the same time, in the late 1990's, the framework of Human Resource Accounting (HRA) was being examined with great interest in Finnish corporations. The model presented by Ahonen (1998) greatly influenced the researcher's ideas at the beginning of the study. Later, a more comprehensive framework of Intellectual Capital became positioned as the main theoretical model for the study.

The concept of a Worksite Fitness Program (WFP) as a scientific phenomenon has been studied mainly in the areas of medicine (especially sports medicine), physiology (especially sports and exercise physiology), psychology (especially sports psychology) and behavioural sciences focusing on changes of individual behaviour. Several comprehensive meta-analyses in different areas have been carried out; see, for example, Gebhardt & Crump (1990), Dishman & al 1998, and Shephard (1996). In the literature of management and human resource management, relatively little, indeed almost no, interest has been given to WFP. Most recent editions of handbooks of Human Resource Management (see e.g. Torrington & al. (2005)) give emphasis to physical activity in respect to rehabilitation from severe illness and managing work-related stress. A wider perspective is merely mentioned with a suspicious (or purely critical) attitude. As a result, a profound study of the effects of WFP on Intellectual Capital was seen to be needed.

The phenomenon of Intellectual Capital (IC) was developed from two perspectives; one focusing more on the financial elements of IC (see, for example, Brooking 1996, Stewart 1997, and Luthy 1998) and one focusing more on human and inter-relational elements (see, for example, Edvinsson & Malone 1997, Roos & al 1997, and Sveiby 1997). After an intensive four to six years of discussion a consensus was reached in practitioner-oriented, guiding outputs (see, for example, Meritum 2001, and the Danish Ministry of Science, Technology and Innovation 2003) to define IC to construct it of three parts which were named Human Capital (HC), Structural Capital (SC) and Relational Capital (RC). Although any satisfaction could be a first sign of decline in science this model was chosen to form the basis of IC in this study.

In IC literature, certain really deep human factors are missing despite the fact that HC is one of the main elements of IC. HC is usually defined as being constituted of numerical profiles of employees, the education and competence of employees and the commitment and motivation of employees. Certain personal facts, such as absenteeism because of sickness, work ability and wellness figures are mostly missing (Hussi 2005), although some early steps have been taken in that direction (Ahonen 2000). Physical activity as one of the bases for individual health (see, for example, the US Department of Health and Human Services (1996)) and wellbeing was seen to offer the possibility of new knowledge and value in the field of IC.

WFP has a long history in Finland; the wood and metal industry took care of their blue-collar employees as early as the 1930's by promoting sports activities besides other activities (Savola 1977). In the 1970-80's, WFPs were governed mainly by voluntary sport for all bodies in companies, in the early 1990's, occupational health (OHC) took the prominent role in developing WFP in a framework of maintaining work ability (MWA). In those years, WFP got its "official position" as a part of a company's MWA program. In the 1990's, the importance of physical activity from the point of view of health was further strengthened when health-enhancing physical activity (HEPA) became better-known among OHC, MWA and WFP practitioners.

In this study, the phenomenon of the interaction between WFP, physical activity and fitness on the one hand and Intellectual Capital and its different elements on the other was examined through HR-type measurements and follow-ups. In the preliminary phase, all material was collected in accordance of customer work, the companies paid for the services which were produced by researcher in his job at the Finnish Sport for All Association. However, the measures (questionnaires and fitness testing protocol) as well as the data collection procedures were kept standardized. HR-type measurements (for example, questionnaires) in this respect can be described more as short and practical than long and scientific. In the Physical Activity Barometer (see Appendix 1), the questionnaire was four to five pages, in other surveys the space was more limited. These considerations have to be borne in mind while observing this study from the point of view of the traditions of the discipline of sports medicine.

Positioning of the study

In science, ontology responds to the question "what is 'reality'"? Ontology focuses on being or existence and the various ways of being or existing. In this study, the observation of ontology must be divided into two parts: part of the study considers physical activity patterns and their effects in a very "numerical" way, thus representing positivistic realistic ontology almost at its most orthodox manner. The other part of the study focuses on IC, which is a diverse and highly multidisciplinary field and is still lacking a solid foundation in terms of both ontology and epistemology (O'Donnell 2004, Andriessen 2006, Jørgensen 2006).

In the field of IC, both realistic and relativistic ontologies has been provided. In his review, O'Donnell (2004) draws the conclusion *"An exploration of the ontological and methodological implications of this particular approach to research leads to the general argument for adopting a "relative view" (Arbnor and Bjerke, 1997) on both ontology and methodology in order to craft navigational routes into interdisciplinary social space in the IC field"*. Because of its highly intangible and invisible nature, IC seemed to be best approached from relativistic ontology.

Epistemology on the other hand, responds to the question: "what is knowledge?" Epistemology is thus the part of philosophy that studies knowledge; epistemology attempts to answer the question: what distinguishes true (adequate) from false (inadequate) knowledge?

In this study, the part containing physical activity, health, and work ability variables is studied according to the traditions of positivism. In the IC part of the study, a more epistemological view has been utilized. In researching a company's IC, several methods have to be used, which in turn causes the utilization of several epistemological settings. At the crucial point of assessing the elements of company-specific IC, a constructionist epistemology will be stated. IC is intangible and dependent on the company's situation and social surroundings and will thus be a relativistic construction of these elements. After the original assessment, the measurement of IC will be more or less positivistic.

In the field of organisational studies, positioning of the study is based on the resource-based view (RBV) of the firm (Barney 1991, derived from Porter (1980) and a knowledge-based view of the firm (among others Grant 1996 and Sveiby 2001a) derived in turn from that. According to Barney (1991), there are two elemental assumptions in the RBV: 1) Resources are distributed heterogeneously across firms, and 2) these productive resources cannot be transferred from firm to firm without cost. Furthermore, Barney provides two arguments which say that 1) resources that are both rare and valuable can produce competitive advantage, and 2) when such resources are also simultaneously not imitable, not substitutable, and not transferable, those resources may produce a competitive advantage that is long-term.

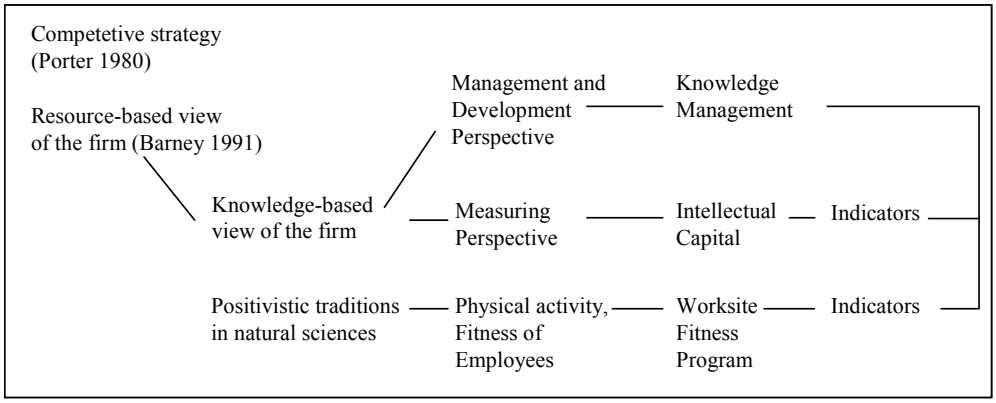


Figure 1. Positioning of the study in the field of organisational research beside the positivistic traditions of natural sciences.

### *1.2 Structure of the data and thesis*

The methodology of this study is triangular in several ways. First of all, a preliminary study was implemented primarily to define company level indicators for physical activity, worksite fitness program activity and physical fitness. In that phase, experimental data contains large material of physical activity questionnaires and fitness testing protocols. In four case studies, the material includes besides standardized measures of physical activity and fitness both qualitative and quantitative measures and their analyses. Figure 2. was drawn to clarify the overall structure of study.

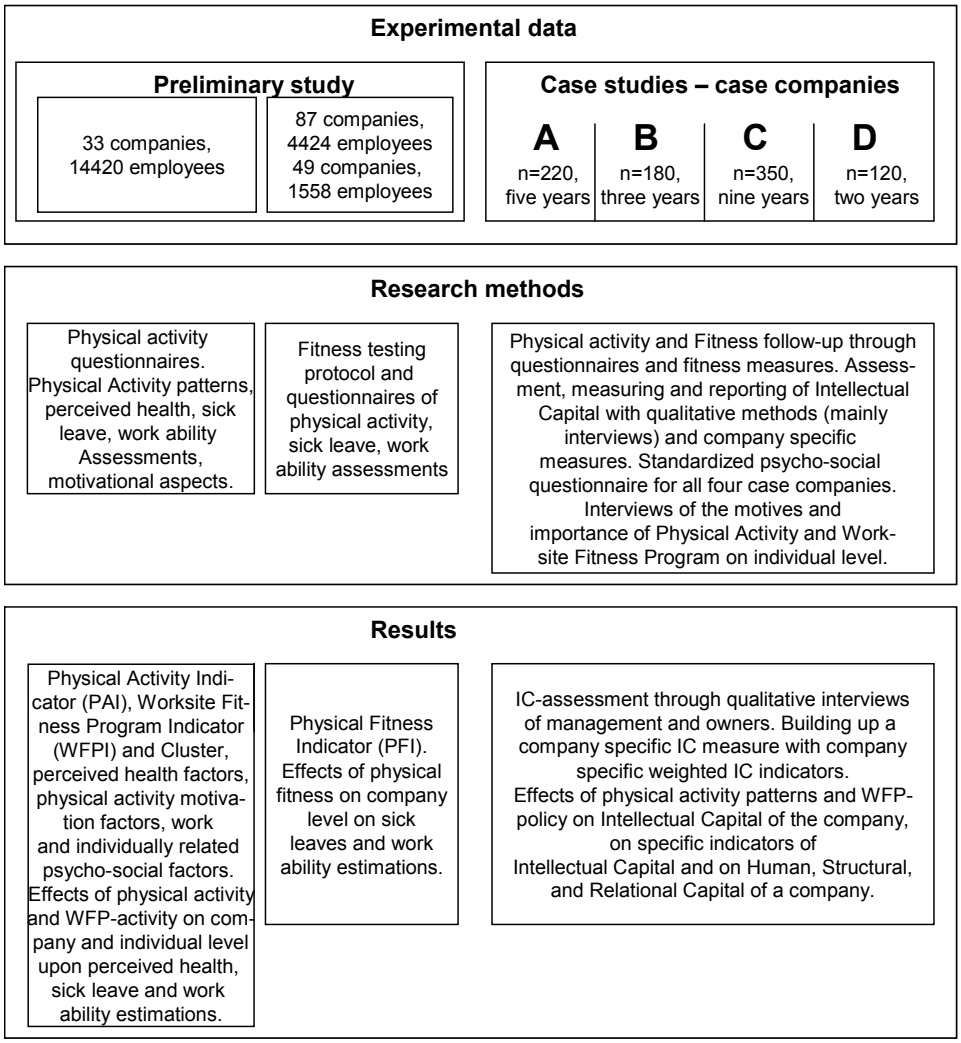


Figure 2. The overall schema of the study.

In the preliminary study, the experimental data for physical activity patterns was gathered with standardized questionnaires over the years 1996-2004 from 14 420 employees in 33 companies. Fitness testing protocols were utilized to gather data on physical fitness. In the firs step of this stage, 1998-2002, 4 424 people from 87 companies were tested to create a Physical Fitness Indicator. Further, a second set of fitness measures (2003-2004) assessed with questionnaires on physical activity patterns, sick leave days and self assesments of work ability was performed with 1 558 employees from 49 companies.

In four case companies, follow-up of physical activity and fitness was carried out for two to nine years. In Case C, two measures (from the years 1995 and 1999) could be

utilized retrospectively because of standardized questionnaires. Figure 2 presents a general overview of the research methods used in the study. Detailed structures of questionnaires and other methods are given in paragraph 3.

The results in Figure 2 divide in a way in two categories. Some results, mainly gained from the preliminary study were more or less methodological contributions which were used in the case studies to answer the main research questions. Thus, for example, the Physical Activity Indicator (PAI) and Health Factor (HF) were results of the preliminary study and were used in analysing the associations between WFP and IC.

The results of this study are given separately for the preliminary study and for each of the four case companies.

Figure 3 was drawn to present the structure of this thesis.

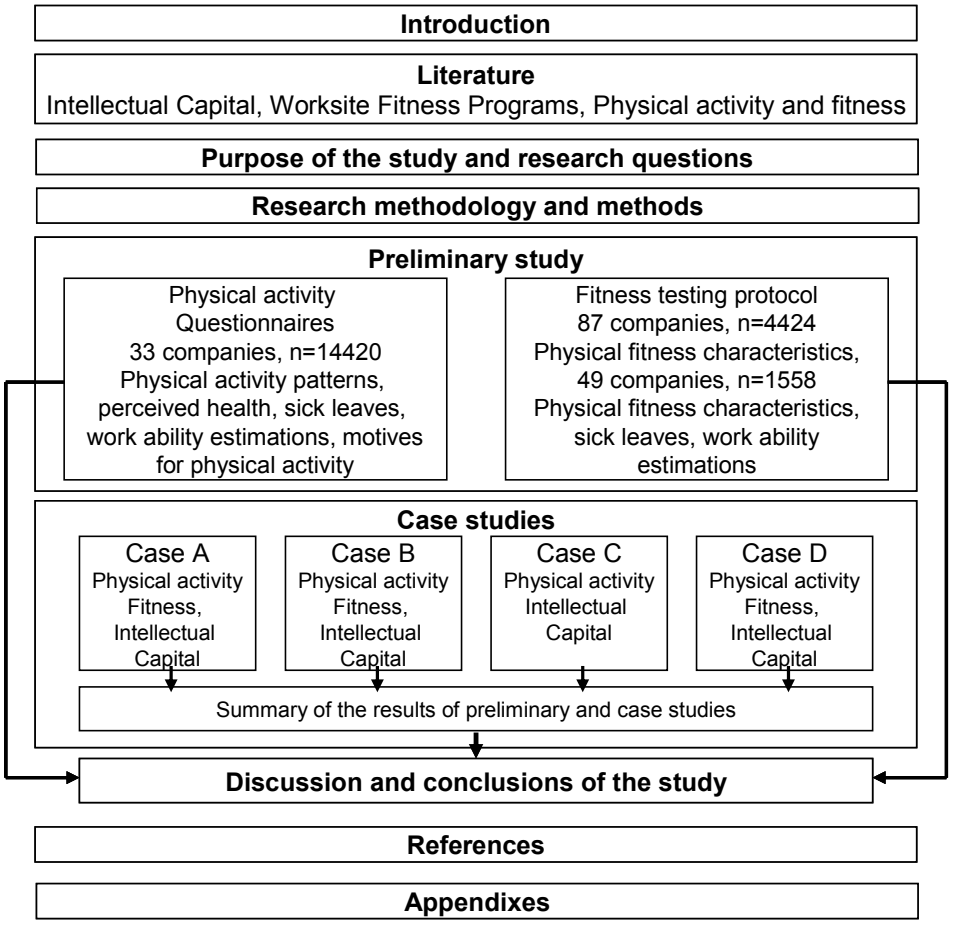


Figure 3. Structure of the thesis.

### *1.3 Limitations*

This study has several limitations which are brought out in this chapter. First of all, this study was carried out in Finland with Finns, who have relatively strong traditions in WFP. Secondly, from the cluster analyses performed, it could be concluded that the case companies all had a relatively long and profound history in WFP. Both these situations have to be taken into consideration when interpreting the results of this study.

In this study, both in the preliminary and case study phase, only relatively large companies were involved. The material does not have any small or medium size (SMS) companies. In addition, from the point of view of workforce stability, the case companies are very stable: few if any of the employees worked on an irregular basis.

## 2 LITERATURE

### *2.1 Intellectual Capital*

The scientific and practical basis for the concept of Intellectual Capital (IC) can be found in human resource accounting activities in the 1970's and 1980's, and in the rise of a new kind of economy in early 1990's. Estimations, measurements and even accounting activities of human resources were popular among researchers and practitioners in the 1970's, Flamholz being the most noted name in the field. In his book's (Human Resource Accounting) 2nd edition, Flamholtz (1985) defines the purpose of human resource accounting as follows: to provide a framework for human resource decision–making; to provide numerical information about the cost and value of people as organisational resources; and to motivate line managers to adopt a human resource perspective in their decision-making. In the business world, Human Resource Accounting (HRA) created space for future IC statements and reports.

The term and phenomenon "Intellectual Capital" has been intensively studied and written about during the 1990's. Tom Stewart brought IC firmly on to the management agenda in his 1991 article *Brain Power - How Intellectual Capital Is Becoming America's Most Valuable Asset* (Stewart 1991). He defines IC in his article as: *the sum of everything everybody in your company knows that gives you a competitive edge in the market place.* In the years 1996-98 several writers had used intellectual capital as a key factor in wealth creation within organisations and in the economy in general (Brooking, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). Their argument was that in the "new economy" (or Information Economy or Knowledge Society) a new kind of asset was becoming the most important basis for sustained wealth creation.

In the early 1990's, the concept of IC or intangible assets (later IA) arose to explain a company's market value over the book value, (e.g. Sveiby 1997; Lev, 2001; Edvinsson and Malone, 1997). A historical perspective of the phenomenon can be seen in Figure 4. In his article in 1998, Sveiby presented calculations of the Intangible Assets of all the companies making up the Dow Jones Index.

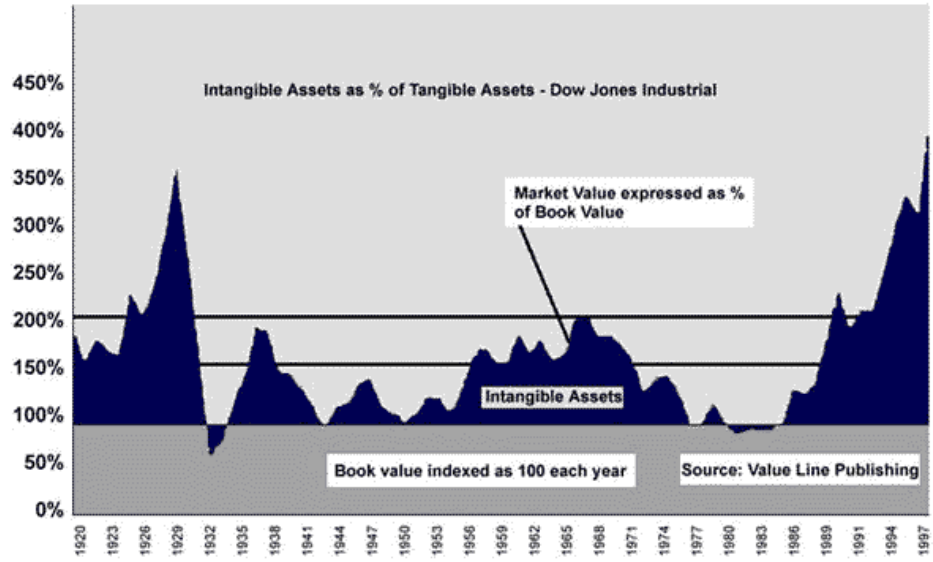


Figure 4. The book and market values in Dow Jones Industrial Stock Market over 1920-1997. From Sveiby (1998).

In Figure 4, the term "Intangible Assets" is used to describe the company's market value over the book value. Intangible assets have thus a specific financial meaning which is slightly different to the majority of definitions of IC. In the early literature of IC, these terms were used as synonyms, but later distinctions between these two have been made. On the other hand, the term "intangibles" represents more or less the same contents as IC.

### *2.1.1 Definitions of IC*

There are several slightly different definitions of intangible assets and intellectual capital that were outlined in the early phase of interest. These definitions have been seen as contradictory (Kaufmann & Schneider 2004) or enriching (Andriessen 2004b, O'Donnell 2005). Different authors interpret and use the terms quite differently. Some authors consider intangible assets and intellectual capital as synonyms (Brooking 1996; Lev 2001; Marr & Schiuma 2001), while some consider intellectual capital a subset of intangible assets (Bontis, 2001; Hussi & Ahonen, 2002) or vice versa (Ståhle & Grönroos, 2000). Many authors divide IC (or IA) into components. For example, Edvinsson and Malone (1997) divide intellectual capital first into human and structural capital, and then structural capital further into customer and organizational capital, which in turn is still divided into innovation and process capital. Sveiby (1997) divided IA into human competence and internal and external structures. Still other authors consider that there are different types of IC (or IA), e.g. generative and commercially exploitable intangibles (Ahonen, 2000) and potential and realized intellectual capital (Ståhle & Grönroos, 2000).

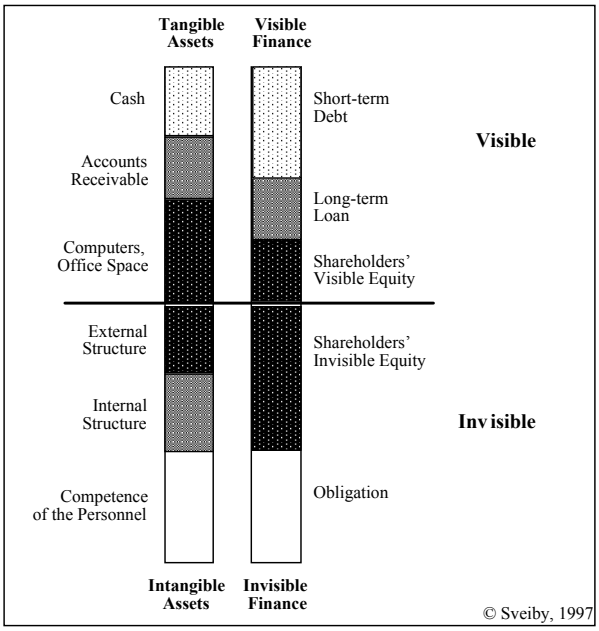


Figure 5. An example of a knowledge organization's balance sheet (Sveiby, 1997, p. 11.).

In addition, completely different definitions have been made, for example, Nahapiet & Ghoshal (1998) formulated their concept of "intellectual capital" "to refer to the knowledge and knowing capability of a social collectivity, such as an organization, intellectual community, or professional practice." This, in the context of their subject, seemed reasonable.

In financial accounting, the term "intangible assets" is used to refer to certain items on the balance sheet. These include, for example, research and development expenses, immaterial property rights and goodwill. Acceptable items vary according to different country, depending on the accounting standards used. The definition of intangible assets used in financial accounting is narrower than, for example, Sveiby's definition above. Thus, it can be stated that organizations have many kinds of intangible assets; some of them can be included on the balance sheet and some of them cannot. The International Accounting Standards Committee has developed a new accounting standard on intangible assets (standard IAS 38) which was approved in 2004. Although the IAS 38 provides for the disclosure of some IC elements in the annual report, most of the IC resources still remain undisclosed. (IASC 2004). A standardized, consolidated intellectual performance index, such as Return on Intellectual Capital (ROIC), which was expected by Roos & Roos (1997), is still to come.

During the intensive years of the development of the concept of IC, several authors gave their input to the discussion. Roos *et al.* (1997) stated that intellectual capital includes human capital and structural capital. They divided human capital into competence, atti-

tude and intellectual agility, and structural capital into relationships, organization and renewal and development.

Sveiby (1997) presented his model from the point of view of intangible assets, which principally in his definition is synonymous to intellectual capital. According to Sveiby (1997), IA is composed of an organization's external structure, internal structure and the competence of its personnel. Employee competence includes the skills and know-how of the employees. It results in the company's capacity to act and to create results. He explains that the internal structure consists of, for example, administrative systems, organizational culture, patents and concepts. The external structure, on the other hand, consists of, for example, the relationships with customers and suppliers, brands, trademarks and image.

Edvinsson & Malone (1997) and Edvinsson (1997) divide intellectual capital into human capital and structural capital. Human capital consists of, amongst other things, the knowledge, skills and innovativeness of employees (Edvinsson & Malone, 1997). Structural capital consists of customer capital and organizational capital. Customer capital refers, for example, to the strength and loyalty of the customer relationship. Organizational capital includes innovation and process capital. Process capital consists of the organization's processes and the techniques used, for example, to increase efficiency. Innovation capital includes intellectual properties, such as trademarks. Edvinsson & Malone (1997) were the first to draw a three-part model of IC in line with knowledge management function with it. Further, Sveiby (2001a) supplemented "nine knowledge management questions" in Figure 6, which was drawn according to Edvisson & Malone 1997, their original terms of SC and RC in brackets.*: (1. How can we improve the transfer of competence between people in the organisation? 2. How can the organisation's employees improve the competence of customers, suppliers and other stakeholders? 3. How can the organisation's customers, suppliers and other stakeholders improve the competence of the employees? 4. How can we improve the conversion of individually-held competence to systems, tools and templates? 5. How can we improve individuals' competence by using systems, tools and templates? 6. How can we enable conversation among the customers, suppliers and other stakeholders so they improve their competence? 7. How can competence from the customers, suppliers and other stakeholders improve the organisation's systems, tools and processes and products? 8. How can the organisation's systems, tools & processes and products improve the competence of the customers, suppliers and other stakeholders? and 9. How can the organisation's systems, tools and processes and products be effectively integrated?)*

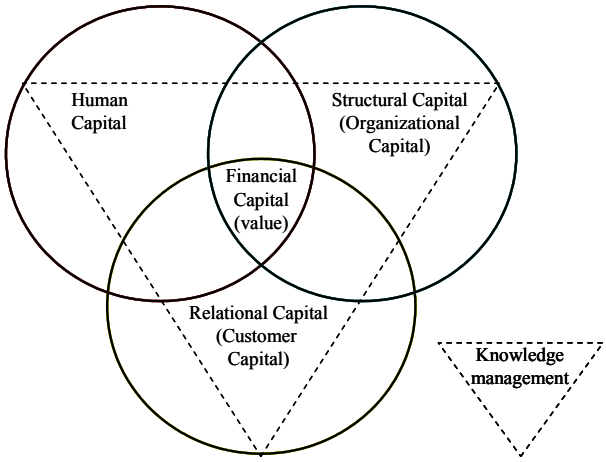


Figure 6. Merging of three types of capital along with knowledge management.

Stewart (1997) expressed IC is as "packaged useful knowledge". He also explains that this includes an organization's processes, technologies, patents, employees' skills, and information about customers, suppliers, and stakeholders.

In the OECD symposium in 1999 (OECD 1999), intellectual capital was defined as "the (estimated, imputed) economic value of intangible assets of a company. Intellectual capital may be broken down in two categories: (a) organizational ("structural") capital; and (b) human capital". Structural capital refers to,for example, software systems, distribution networks and supply chains. Human capital refers to human resources within the organization (employees' resources), and external to the organization (customers and suppliers). In addition to these two categories, there are also other forms of intangible assets, for instance a company's reputation. According to the OECD (1999), intellectual capital is a subset of intangible assets.

According to Ahonen (2000), intangible assets can be divided into generative and commercially exploitable intangibles. In their article in 2002, Hussi and Ahonen (2002) defined generative assets as including human capital, internal structure and external structure. Commercially exploitable assets include cost-efficiency, immaterial property rights, customer capital, expanding markets and management trust.

According to Mayo (2001), tangible assets are composed of financial and physical capital and intangible assets are the same as intellectual capital. Mayo (2001) focuses on the human capital of organizations, which consists of social, emotional, relationship and knowledge capital. Ahonen (1998) states that human capital can be examined from three perspectives: as the number of employees, as employees' personal properties and as a work community (organization).

Marr *et al.* (2002) use the concept "knowledge assets" to describe intellectual capital. The main components of knowledge assets are stakeholder resources and structural resources. Human resources are considered part of the stakeholder resources, whereas the

virtual infrastructure is part of the structural resources. In the virtual infrastructure, there are components of culture, routines & practices, and intellectual property.

In the early days of IC discussion, IC was seen as a property of a business company, but later also public employees and offices were seen to have IC (Serrano Cinca *et al.* 2003, Mouritsen *et al.* 2004b). These definitions highlight the role of IC as a more "human" perspective compared to the early focus on the "financial" point of view.

*2.1.2 Chronological development of IC*

In their article from 2000, Petty & Guthrie presented a chronological review of significant contributions to the identification, measurement and reporting of intellectual capital, and highlighted various milestones in IC (Petty & Guthrie (2000, Table II p. 161)).

Period Progress

Early 1980's: General notion of intangible value (often generically labelled "goodwill")

Mid-1980's :The "information age" takes hold and the gap between book value and market value widens noticeably for many companies

Late 1980's: Early attempts by practitioner consultants to construct statements/accounts that measure intellectual capital (Sveiby, 1988)

Early 1990's: Initiatives to measure and report systematically on company stocks of intellectual capital to external parties (e.g. Celemi and Skandia; SCSI, 1995) In 1990, Skandia AFS appoints Leif Edvinsson "Director of intellectual capital". This is the first time that the role of managing intellectual capital is elevated to a position of formal status and given an air of corporate legitimacy. Kaplan and Norton introduce the concept of a balanced scorecard (1992). The scorecard evolved around the premise that "what you measure is what you get"

Mid-1990's: Nonaka and Takeuchi (1995) present their highly influential work on "the knowledge creating company". Although the book concentrates on "knowledge", the distinction between knowledge and intellectual capital is sufficiently fine as to make the book relevant to those with a pure focus on intellectual capital. Celemi's Tango simulation tool is launched in 1994. Tango is the first widely marketed product to enable executive education on the importance of intangibles. Also in 1994, a supplement to Skandia's annual report is produced which focuses on presenting an evaluation of the company's stock of intellectual capital. "Visualizing intellectual capital" generates a great deal of interest from other companies seeking to follow Skandia's lead (Edvinsson, 1997). Another sensation is caused in 1995 when Celemi uses a "knowledge audit" to offer a detailed assessment of the state of its intellectual capital. Pioneers of the intellectual capital movement publish bestselling books on the topic (Kaplan and Norton, 1996; Edvinsson and Malone, 1997; Sveiby 1997). Edvinsson and Malone's work, in particular, is very much about the process and the "how" of measuring intellectual capital

Late 1990's: intellectual capital becomes a popular topic with researchers and academic conferences, working papers, and other publications find an audience. An increasing number of large-scale projects (e.g. the MERITUM project; Danish; Stockholm) commence which aim, in part, to introduce some academic rigour into research on intellectual capital. In 1999, the OECD convenes an international symposium in Amsterdam on intellectual capital

In the years 2000 to 2006 the definitions (or at least names) of IC's components were standardized in international consensus processes (see Meritum 2001 in the next chapter). Researchers and practitioners worked enthusiastically in the field of IC in the very beginning of 21th century; although at least some part of the huge intangible values were due to the well known information technology "bubble".

Both measuring and reporting of IC from different perspectives have been considerable over the last years. In this respect, academics from Nordic countries (e.g. Johansson *et al.* 2001b, Bukh 2002, Mouritsen *et al.* 2004a), Canada (mostly by Bontis 2001), Spain (e.g. Ordóñez de Pablos 2004, Sa´enz 2005), United Kingdom (Roslender & Fincham 2004) and in other parts of the world, for example, Guthrie (2000) from Australia, just to mention a few. Based on academics' work, several consultative products have been developed and reported; see Marr (2005) for details.

### *2.1.3 Consensus in the European level – Meritum 2001*

Later on, a consensus project in the European Union, Meritum, (Meritum 2001) clarified the definitions of IC as follows:

> *"Intellectual capital is the combination of the human, organizational and relational resources of an organization. The definition of these three categories is presented in Box 1.*

*Human capital is defined as the knowledge that employees take with them when they leave the firm. It includes the knowledge, skills, experiences and abilities of people. Some of this knowledge is unique to the individual, some may be generic. Examples are innovation capacity, creativity, know-how and previous experience, teamwork capacity, employee flexibility, tolerance for ambiguity, motivation, satisfaction, learning capacity, loyalty, formal training and education.*

*Structural capital is defined as the knowledge that stays within the firm at the end of the working day. It comprises the organizational routines, procedures, systems, cultures, databases, etc. Examples are organizational flexibility, a documentation service, the existence of a knowledge centre, the general use of Information Technologies, organizational learning capacity, etc. Some of them may be legally protected and become Intellectual Property Rights, legally owned by the firm under separate title.*

*Relational capital is defined as all resources linked to the external relationships of the firm, with customers, suppliers or R&D partners. It comprises that part of Human and Structural Capital involved with the company's relations with stakeholders (investors, creditors, customers, suppliers, etc.), plus the perceptions that they hold about the company. Examples of this category are image, customers loyalty, customer satisfaction, links with suppliers, commercial power, negotiating capacity with financial entities, environmental activities, etc "*

Meritum (2001) went on to define static and dynamic vision of intangibles according to Figure 7.

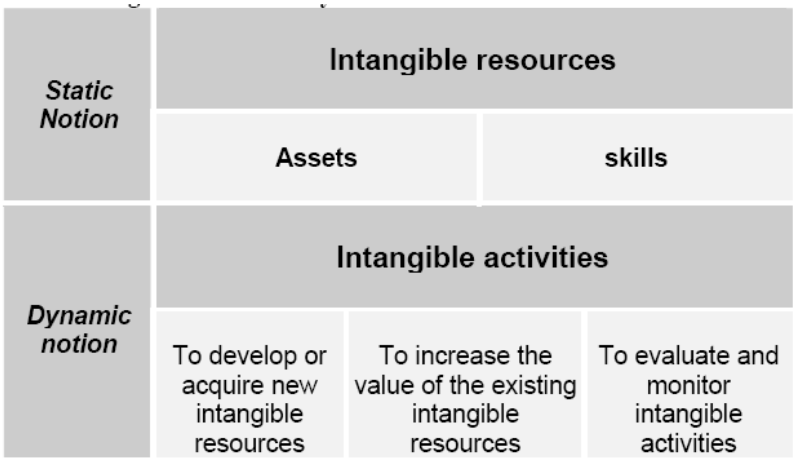


Figure 7. Intangibles static and dynamic vision (Meritum 2001).

*2.1.4 Measuring and reporting of IC*

From the early days of IC research, the question of measuring IC has gained great interest. On the one hand, IC presents a certain (relatively large) part of the value of a company, on the other hand, however, most components of IC are quite poorly suited to measurement. This is especially true when compared to traditional book-keeping procedures. In addition, IC reflects to a great extent the future and thus the IC concept has an *ex ante* perspective, where the financial accounting framework is grounded in an *ex poste* perspective

In the late 1990's, many useful tools have been developed by the most outstanding authors in the field of IC to help to understand IC and to create a structure to make it (or intangible assets) explicit (Sveiby 1997, Edvinsson & Malone 1997, Stewart 1997, Roos *et al.* 1997, Brooking 1996, Sullivan 2000). In addition, companies, especially in Northern Europe, started to develop models for measuring, managing and reporting intangibles (eg. Johanson *et al.* 2001a,b; Danish Ministry of Science, Technology and Innovation 2003).

The Balance Score Card (BSC) launched by Kaplan and Norton in the early 1990's (Kaplan & Norton 1992, Kaplan & Norton 1993) is used to measure and report a company's performance from four focuses: financial, customer, internal processes, and learning and growth. BSC has become enormously popular and it has many similarities with most of the SC methods described above, although a certain level of criticism has been directed at its rigidity or even tyranny (Voelpel *et al.* 2006).

The latest Danish guidelines (Danish Ministry of Science, Technology and Innovation 2003) emphasizes that IC reporting consists of four elements: knowledge narrative, management challenges, initiatives and indicators. This is in general in line with the Meritum (2001) guidelines, which focus on the vision of the firm, a summary of intangible resources and activities and the system of indicators.

Why measure

In his 2004 article, Andriessen (2004a) stated the need to examine the existing IC measurement concepts, motives and proposed methods; the aim is to separate of the corn from the chaff by assessing the rigor and effectiveness of the proposed methods, and finally to standardize and further develop the most promising methods.

The reasons for measuring IC can be divided into three groups:

1. Improving internal management, which includes seven subgroups: what gets measured gets managed, improving the management of intangible resources, creating resource-based strategies, monitoring effects from actions, translating business strategy into action, weighing possible courses of action and enhancing the management of the business as a whole.

2. Improving external reporting, which can be clustered into five categories: closing the value gap between book and market value, improving information to stakeholders about the real value and future performance of the enterprise, reducing information asymmetry, increasing the ability to raise capital and enhancing corporate reputation and affecting stock price.

3. Statutory and transactional issues, which consist of six themes: (1) transaction pricing and structuring for the sale, purchase, or license of an intangible asset, (2) Financing securitization and collateralization for both cash-flow-based financing and asset-based financing, (3) Taxation planning and compliance, with regard to all sorts of possible deductions, tax compliance, and estate planning, (4) Bankruptcy and reorganization, including the value of the estate in bankruptcy and the assessment of the impact of proposed reorganization plans, (5) Litigation support and dispute resolution, including infringement of intellectual property rights and breach of contract and (6) Impairment testing of goodwill as required by FASB statement no. 142 (Financial Accounting Standard Board, 2001).

In their review, Marr *et al* (2003) concluded five the reasons why organizations are seeking to measure IC:

(1) to help organizations formulate their strategy;
(2) assess strategy execution;
(3) assist in diversification and expansion decisions;
(4) use these as a basis for compensation; and finally
(5) to communicate measures to external stakeholders.

Still, according to Mouritsen *et al.* (2004a), most companies' objectives in public IC reporting were to show the importance of human resources, to show the innovativeness of the organization, to attract new employees and to show that knowledge is the most important asset of the company. These can to some extent be described as more or less PR manoeuvres. The internal objectives were more genuine, IC-reporting was done to support strategy, to ensure knowledge updates and systematic knowledge sharing and to implement systematic knowledge management.

Besides these above mentioned generally accepted reasons, Sveiby (2001c) points out the importance of measuring IC from the learning point of view. According to Sveiby (2001c), the IC measurement system can facilitate learning, although it is quite demanding. The indicators must be collected and reported openly to ensure the collective learning effect in a company.

#### 2.1.4.1 IC-reporting systems

The pioneers in this field (Brooking 1996, Edvinsson & Malone 1997, Stewart 1997, Sveiby 1997) have made their own IC reporting models with specific IC components in them. Although the models have differences, some major similarities can be found in certain basic components:

- knowledge and experience of the people, either formalised (copyrights, patents, brands, etc.) or tacit (business specific competencies of employees)
- organizational systems and processes, such as administrative systems, procedures and internal processes
- innovative capacity and technology of a company
- business relationships related with customers, suppliers and strategic partners (customer loyalty, reputation and image, etc).

The IC reporting approaches can be divided into four categories according to Luthy (1998), Williams (2000) and Sveiby (2001c). Other similar divisions have been made by, for example, Kannan & Aulbur (2004) and Andriessen (2004a).

**Direct Intellectual Capital methods (DIC).** These estimate the $-value of intangible assets by identifying their various components. Once these components are identified, they can be directly evaluated, either individually or as an aggregated coefficient. In this category belongs the pioneer work of Flamholtz (1985) in HR accounting. Other main authors in this section are Bontis (1996), Brooking (1996), Ahonen (1998), Hall *et al.* (2001) and Sullivan (2000).

**Market Capitalization Methods (MCM).** These calculate the difference between a company's market capitalization and its stockholders' equity as the value of its intellectual capital or intangible assets. Main authors in MCM methodology are Sveiby (1989), Stewart (1997) and Luthy (1998).

**Return on Assets methods (ROA).** With these, the average pre-tax earnings of a company for a period of time are divided by the average tangible assets of the company. The result is a company ROA that is then compared with its industry average. The difference

is multiplied by the company's average tangible assets to calculate an average annual earning from the Intangibles. Dividing the above-average earnings by the company's average cost of capital or an interest rate, one can derive an estimate of the value of its intangible assets or intellectual capital. The main authors in ROA-methodology are Stewart (1997) and Lev (see Mintz 1999).

**Scorecard Methods (SCM).** For these, the various components of IC (or IA) are identified and indicators and indices are generated and reported in scorecards or as graphs. SC methods are similar to DIS methods, except that no estimate is made of the $-value of the Intangible assets. A composite index may or may not be produced. The scorecard attempts to identify the various components of intangible assets by means of indicators. The main authors (or source of guidelines) in SC methodology are Kaplan & Norton (1992), Roos *et al.* (1997), Edvinsson & Malone (1997), Sveiby (1997), Meritum (2001), Lev (2001), Edvinsson (2002) and the Danish Ministry of Science, Technology and Innovation (2003).

To conclude, in measuring IC, a company will obviously need two methods: one to evaluate its primary IC and its components in its field of business, and one to monitor the changes in the IC and its components in yearly or quarterly basis. Several consultative products have been developed and reported; see Marr (2005) for details.

From the accounting point of view, IC reporting still has some problems, as described by Roos *et al.* (1997). They found three complexities to the measurement of IC, (1) Time delays, in which the flow of an investment in a particular aspect of IC can take its time to create its intended effects, (2) IC is not a zero-sum, which means that small investments can have an enormous impact and large investments may fail, (3) IC assets are not only measured in financial terms as other measurements are also used, such as numbers, hours, ratios, etc.

#### 2.1.4.2 Indicators in measuring IC

Indicators of Human, Structural and Relational (HC, SC, RC) Capital are essential in measuring IC (Edvinsson & Malone 1997; Sveiby 1997; Danish Ministry of Science, Technology and Innovation 2003). Basically, the number of indicators is not a problem and different authors list even hundreds of indicators (see, for example, Ordóñez de Pablos 2004).

Edvinsson & Malone (1997), in their Skandia Navigator, list indicators for their customer focus (RC), for example, market share (%); number of customers; annual sales/customer; customers lost; customers/employee; Satisfied Customer Index; IT investments/salesperson and service expense/customer/year. In process focus (SC), Edvinsson & Malone (1997) determine indicators to be, for example, administrative expense/total revenues; processing time, outpayments; PCs and laptops/employee; IT expense/employee; corporate quality performance (e.g. ISO 9000); IT performance/employee. In renewal and development and human focus (HC) Edvinsson & Malone (1997) listed indicators such as competence development expense/employee; Satisfied Employee Index; share of training hours; training expense/employee; share of employees under 40 years; Leadership Index; Motivation Index; number of employees;

employee turnover; time in training (days/year) and managers with advanced degrees (%).

Sveiby (1997) categorizes indicators of Competence of People, Internal Structures, and External Structures into three levels: indicators of growth and renewal, efficiency, and stability. Examples of Sveiby's indicators are presented in Table 1.

Table 1. An example of an Intangible Assets Monitor (Sveiby 1997, p. 200).

| Intangible Assets | | |
|---|---|---|
| **External Structure** | **Inernal Structure** | **Competence of People** |
| **Growth/Renewal**<br>Organic volume growth. Growth in market share. Satisfied customer index or Quality index | **Growth/Renewal**<br>Investmetns in IT. Share of time devoted to internal R&D activities. Attitude index of personnel toward managers, culture, customers. | **Growth/Renewal**<br>Share of sales from competence-enhancing customers. Growth in average professional experience (number of years). Competence turnover. |
| **Efficiency**<br>Profit per customer. Sales per professional | **Efficiency**<br>Proportion of support staff. Sales per support staff. | **Efficiency**<br>Change in added value per professional. Change in proportion of professionals. |
| **Stability**<br>Frequency of repeat orders. Age structure. | **Stability**<br>Age of the organization. Rookie ratio. | **Stability**<br>Turnover rate of professionals. |

Sveiby (1997) emphasizes still that the definition of IC and its components are based strongly on a company's strategy.

In recent guidelines (Danish Ministry of Science, Technology and Innovation 2003), several examples of company-based indicators are presented. In this study, the indicators of different IC components were chosen that were felt to be among the most important for creating change in a company's IC (cf. van der Meer-Kooistra J. & Siljstra S.M. (2001), Andriessen (2004a)).

### *2.1.5 Managing IC – Knowledge Management*

In the positioning this study (Figure 1) the role of Knowledge Management (KM) was emphasized. Also Figure 6 from Edvinsson and Malone (1997) highlight the importance of KM in managing and developing Intellectual Capital. Knowledge consists of codified explicit knowledge and more personal tacit knowledge. Polanyi (1983) was first to make formal distinction between tacit and explicit knowledge. Nonaka & Takeuchi (1995) developed this perspective further in their SECI (socialization, externalization, combination and internalization) model.

History of KM goes back to 1980's when three independent researchers (or research groups) made pioneer work in the field of KM. As Sveiby (2001b) stated: *"We can thus see that KM has an American Information/AI-origin, a Japanese Knowledge Creation/Innovation origin and a Swedish Strategy/Measuring origin."* The American research group worked to develop "artificial intelligence", while Swedish (Sveiby and his collaborators) and Japanese (Nonaka and his collaborators) worked in the field which nowadays defined as KM. Both Swedish and Japanese groups created KM in a framework of Intangible Assets or more generally "assets intangible in nature". Sveiby wrote his first publication with A. Risling (Sveiby & Risling 1986) about "The Knowhow Company", while Nonaka's landmark piece was "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation" (Nonaka & Takeuchi 1995).

From the early days, the KM has developed in several ways. In first phase the focus of KM was in learning organization, where the knowledge in the organization was developed with learning or giving knowledge to employees (see for example Senge 1990). The second generation of KM focused in knowledge creation mainly after elements presented by Nonaka & Takeuchi (1995), where knowledge creation was seen more as an interactive process. Nowadays, KM is widely seen as a way to ensure and increase a company's most important intangible asset – knowledge (Edvinsson & Malone 1997, Sveiby 1997). In large companies KM is very usual (Stovel & Bontis 2002), but in smaller size companies – at least in Finland - the role of KM is still minor (Salojärvi 2004). According to Salojärvi (2004) those smaller companies investing in KM will have better prognosis for future success.

In KM literature knowledge is usually seen in three developing hierarchies, data, information and knowledge (Davenport & Prusak 1998, Williams 2006), although also other views has been presented (Tuomi 1999). In a recent article Hicks and co-workers (Hicks et al 2006) defined the five-tier KM hierarchy consisting of individual knowledge, facts, influences, solutions and innovations. In the modern business world characterized by complicated structures and rapid changes a need for effective KM system is obvious. In the scope of this study a KM type solution with sophisticated ICT services would offer a good choice in developing a company specific WFP, and more widely also a wellness programme.

### *2.1.6 Summary and IC framework in this study*

Intellectual Capital as a concept was developed in 1990's by several pioneer writers. Stewart (1991) was first to mention the term "Intellectual Capital" and after him several writers used IC as a key factor in wealth creation within organizations and in the economy in general (Brooking, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). In early days several definitions of IC (and Intangible Assets) was seen (Brooking, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997) and descriptions of IC was written (for example Ahonen 2000, Mayo 2001, Mouritsen *et al* 2004b), until some kind of a consensus was reached (Meritum 2001).

In early 2000's the research of the IC phenomenon was rapidly spread through all continents and many countries. IC measurement and reporting activities have been carried out both by academics (e.g. Johansson *et al.* 2001b, Bukh 2002, Mouritsen *et al.* 2004a from Nordic countries; Bontis 2001 from Canada; Ordóñez de Pablos 2004 and Sa´enz 2005 from Spain; Chaminade *et* Roberts 2003 comparing Spain and Norway; Roslender & Fincham 2004 from United Kingdom; and Guthrie *et al* 2006 from Australia and Hong Kong ) and consultants, see Marr (2005) for details.

In the reporting activities of IC certain complexity is characteristic. Focusing on non-financial and intangible elements of a company, the IC measures haven't reached a solid approval of toughest accounting experts (see for example Roslender & Fincham 2001). From the researcher's point of view, IC should be managed effectively with the help of appropriate measures. Formal closings or statements would not maybe be so important.

In this study, IC definitions, measurements and reporting were performed to explain the associations between WFP policy and the employees physical activity and a company's IC. To fulfil these requirements, a score card method ("IC measure") was developed to analyse the contents of IC and its components in each case company. The exact method is presented in Chapter 4.5. The proportions of IC components (HC, SC, RC) were estimated through a value assessment procedure, while indicators of each IC compound were measured by value measurement protocol (Andriessen 2004a).

In this study, IC is defined as being constructed from Human (HC), Structural (SC) and Relational Capital (RC) (Meritum 2001). The importance of each element was assessed with a weighting method derived from Roos *et al.* (1997). Essential elements and indicators for each component of IC (HC, RC, SC) were defined through a qualitative procedure where interviews with management and owners, and the company's strategy formulations were the main motives. The indicators were chosen from each case company's measures, or were in some cases collected by the researcher (physical activity and fitness, work ability and sick leave figures).

## *2.2 Worksite Fitness Policy*

### *2.2.1 Health, employee wellness, physical activity and physical fitness as background factors for WFP*

#### 2.2.1.1 The definition of health

The World Health Organization defines health as *"a state of complete physical, mental and social well-being, and does not consist only of the absence of disease or infirmity"* (World Health Organization 1946). In the WHO Ottawa Charter on Health Promotion (Ottawa charter 1986), health is expressed in more functional terms as a resource which permits people to lead an individually, socially and economically productive life: *"Health is a resource for everyday life, not the object of living. It is a positive concept emphasizing social and personal resources as well as physical capabilities".*

In physical activity sciences, the definition presented in the 1988 International Consensus Conference (Bouchard & al 1990) is widely cited: *"Health is a human condition with physical, social, and psychological dimensions, each characterized on a continuum with positive and negative poles. Positive health is associated with a capacity to enjoy life and to withstand challenges; it is not merely the absence of disease. Negative health is associated with morbidity and in the extreme with premature mortality. Morbidity can be defined as any departure, subjective or objective, from a state of physical or psychological well-being, short of death. Wellness is a holistic concept describing a state of positive health in the individual and comprising physical, social, and psychological well-being"*.

In this study, the broader definition of health is taken. Health is positive well-being or wellness. Important parameters are thus subjective estimations of one's health, while also sick-leave days are utilized. The wellness paradigm of health is also basis for the health enhancing physical activity (HEPA) in this study.

#### 2.2.1.2 Employee wellness

Employee wellness, work related wellbeing and work ability are to a large extent synonyms for the same phenomenon containing different wellness aspects in work life. The definitions and measurements of work ability vary greatly, but some unity has been concluded over recent years. Most comprehensibly, work ability can be seen as a combination of personal abilities and competences related to work-specific determinants. Recently, Ilmarinen (2001) has defined work ability according to Figure 8. In the USA and some other countries, Worksite Health Promotion has been the key protocol instead of work ability and Maintaining of Work Ability (MWA) (Shephard 1996, DeGroot & Kiker 2003).

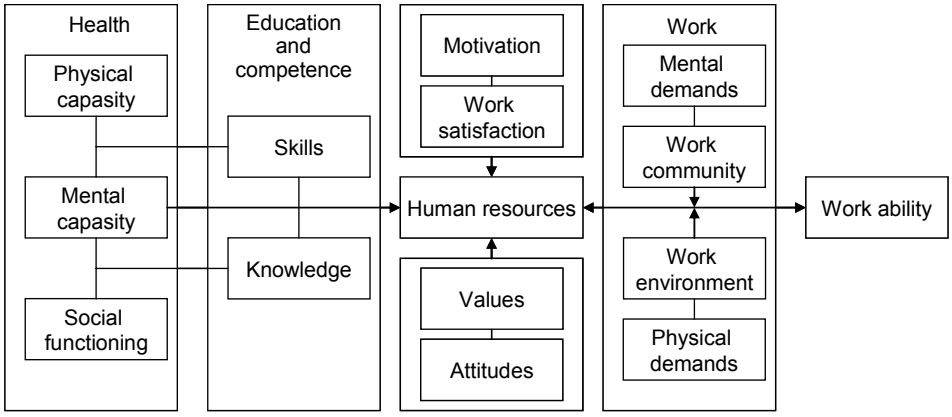


Figure 8. New concept of work ability, emphasising that individual work ability is a process of human resources in relation to work. (Ilmarinen 2001).

In measuring work ability, a Finnish innovation, the Work Ability Index (WAI), has gained wide approval (Tuomi *et al.* 1998, de Zwart *et al.* 2002). WAI consists of several parts: "Current work ability compared with lifetime best" (0-10 range of scores); "Work

ability in relation to the demands of the job" (2-10 range of scores); "Number of current diseases diagnosed by a physician" (1-7 range of scores); "Estimated work impairment due to diseases" (1-6 range of scores); "Sick leave during the past 12 months" (1-5 range of scores); "Personal prognosis of work ability 2 years from now" (1, 4 or 7 range of scores); and "Mental resources" (1-4 range of scores). The total score for WAI is thus 7-49 (Tuomi *et al.* 1998).

#### 2.2.1.3 Physical activity

Physical activity can be defined in several ways; Caspersen et al. (1985) had defined it as follows: *"any bodily movement produced by skeletal muscles that results in energy expenditure"*. The concepts of physical activity range from daily activities to competitive sports, differing greatly both in volumes and intensities as well as motives and purposes of activity. In English terminology, the most common words are "physical activity", "exercise", "sports", "fitness training" or "fitness regimens" and more commonly in recent years, "health enhancing physical activity". In Finland, the language offers even more alternatives (and possibilities for misunderstanding!) – at least 15 different words in a range from "daily activity" to "top sports" (TELI-toimikunta 2001, see also by Vuori (2005) in the text).

#### 2.2.1.4 Motivation on physical activity

Population surveys have typically revealed the most important motives for physically activity/exercise as being "to feel in good shape physically", "to improve or maintain health" and "to feel a sense of achievement" (e.g., The Sports Council and Health Education Authority, 1992). Moreover, for females, weight control and motives related to physical appearance have also been reported as significant. In the mainstream sport and exercise psychology research, the most common motives/reasons utilised in questionnaires and tests are these: exercising for interest/enjoyment, competence, fitness, body-related motives such as weight control, improving body tone and overall physical attractiveness, health/health pressures, ill-health avoidance, stress management, improving mood, affiliation, challenge, competition, revitalisation, and social recognition (Markland & Hardy, 1993; Silberstein *et al.* 1988, Lindwall 2004). These various motives/reasons for exercise seem to have different importance at different stages of exercise, with motives concerning appearance and weight-control being more pertinent in the initiation-stage, and enjoyment and revitalisation being more important for progression to the maintenance of regular exercise (Ingledew *et al.* 1998).

#### 2.2.1.5 Health enhancing physical activity

The health benefits of physical activity are evident and that has given the scientific world an opportunity to generate guidelines for health enhancing physical activity (HEPA). Two complementary sets of recommendations exist regarding the amount of physical activity required for health gain. These recommendations can be seen as a two step approach and are concerned with getting the population more active on a regular basis. The first recommendation proposes that sedentary individuals seek to accumulate at least 30 minutes of moderate intensity activity "most days of the week" or in some references even "at least five days of the week." The US Department of Health and Human Services (1996) stated: *"Significant health benefits can be obtained by includ-*

*ing a moderate amount of physical activity (e.g., 30 minutes of brisk walking or raking leave, 15 minutes of running, or 45 minutes of playing volleyball) on most, if not all, days of the week."*

The second recommendation is aimed at those who wish to improve health-related physical fitness and proposes participation in at least 20 minutes of vigorous intensity activity on three or more days a week. The US Department of Health and Human Services (1996) stated further that "additional health benefits can be gained through greater amounts of physical activity." To attain the greatest public health benefit, it is important that the first step i.e., *sedentary individuals obtain daily physical activity of a moderate intensity*, is given high priority.

In the latest national recommendations, the amount of physical activity is emphasized as being even higher. In Great Britain, the report from the Chief Medical Officer is named "At least five times a week" to give an impression of the importance of the amount of physical activity (Department of Health, Physical Activity, Health Improvement and Prevention, 2004).

In the documents mentioned above (US Department of Health and Human Services, 1996; Department of Health, Physical Activity, Health Improvement and Prevention, 2004), the focus of the message is on the amount of physical activity, at least that is how they are usually referred to. Just as important would be, as Vuori (2005) presents in his review (see Figure 10), to underline the importance of the intensity of physical activity in the health enhancing perspective.

#### 2.2.1.6 Physical fitness

Traditionally physical fitness has been defined as having three parts: 1 Cardiovascular fitness, 2 Muscle strength and endurance, and 3 Flexibility. Cardiovascular fitness is based on the function of lungs, hearth and vascular system and is often described as the ability of the human body to do heavy sustained work. The physiological factors behind cardiovascular fitness are maximal cardiac output, maximum heart rate, oxygen-carrying capacity of the blood, skeletal muscle characteristics and pulmonary diffusion capacity (Rusko 1989). Training of cardiovascular fitness consists of aerobic activities, such as step aerobics, exercise to music, walking, and jogging with special training regimens (Cooper 1982).

Muscle strength and endurance is based on the function of muscles and the nervous system. The nerve factors include the degree of co-operation, motivation and the ability to activate motor units. The muscular factor is related to the amount of contractile proteins (Viitasalo et al 1985, Rhea et al 2003).

Flexibility is based on the range of motion of human joints and the tissues around them. These tissues include adipose tissue, the joint capsule muscles, tendons and ligaments. To practise (or exercise) flexibility, very little space or equipment is needed: a thick carpet or mats are generally all that is necessary (American College of Sports Medicine 1998).

2.2.1.7 Health related fitness

One relatively new concept in the literature of sports medicine is the fitness concept "health-related fitness" (HRF), which was introduced by Caspersen *et al* (1985) and conceptualized by Bouchard & Shephard in 1994. The HRF concept is based on the relationships between physical activity, fitness, and health. The components of HRF are cardio-respiratory, motor, and musculoskeletal fitness; body composition; and metabolism (Bouchard & Shephard 1994, Skinner & Oja 1994, Oja 1995).

The basic elements in HRF are the positive effects of different fitness components on health. Generally cardiorespiratory fitness has positive effects on the prevention of coronary-heart diseases and the lowering of the all-cause mortality (Bouchard & Shephard 1994, Blair *et al.* 1989, Blair *et al.* 2001). Metabolic fitness and body composition have preventive effects on coronary heart diseases and type 2 diabetes, while good bone strength will decrease osteoporosis (Bouchard & Shephard 1994). Motor and muscular fitness has positive effects on perceived health and maintaining the functional capacity to ensure independent living at old age (Malmberg *et al.* 2002). For the measurement of cardiorespiratory fitness, body composition, and metabolism, standard laboratory methods are available. (Laukkanen *et al.* 1992, Suni *et al.* 1996, Suni *et al.* 1998).

### *2.2.2 Worksite fitness programs*

2.2.2.1 History and breadth of WFP

Physical activity or sports has been utilized in workplaces with different perspectives for decades (Schirmer 1925 reviewed by Gebhardt & Crump 1990). Principally the employer will facilitate by some means the physical activity of the employees. This activity is called by different terms, such as Worksite Fitness Programs (WFP), Corporate Fitness Programs (CFP), Employee Fitness Programs, Company Sports, etc (Kerr & Vos 1993, Shephard 1996). In this study, this phenomenon is called 'Worksite Fitness Programs' with the abbreviation of 'WFP'. Moreover this activity has been implemented in frameworks such as Occupational Health, Workplace Health Promotion, Maintaining Work Ability, Corporation Wellness Programs, Human Resource management, or voluntarily organized activities by employees (Shephard 1996, Chapman 2003, DeGroot & Kiker 2003). As the phrases for the activity demonstrate, different constructs have been used to describe the described activity. Terms such as "sports", "physical activity", "exercise" and "fitness" are most commonly used, which to some extent may cause interpretative problems (see Proper *et al.* 2002).

WFP activities vary on both national and company bases. In some views, the proper way to organize WFP is to have one's own facilities and instructors, whilst other researchers and practitioners believe more in educational and campaign-type programs. In practice, most of the WFPs are combinations of both initiatives. In the USA, for example, the evolution of health promotion programmes began with industrial recreation activities and the concept expanded to executive, white-collar only fitness programmes in the 1960's, then white and blue-collar fitness programmes in 1970's (Wanzel 1994).

In Finland, WFPs has been studied by several surveys. In the latest barometer study (Työpaikkaliikunnan barometri marraskuu 2005, Barometer of Worksite Physical Activity in Finland 2005), the Finnish Sport for All Association found that 85% of employees had the possibility to receive their employer's financial support in physical activity. All medium and large-sized employers supported WFP, while in small enterprises 80% were active. The main focus in WFP was maintaining of work ability, and the most common activities were support (or organizing) regular (gym activities in 74% of companies, swimming in 44% of companies, ball games in 47% of companies, etc) and recreational fitness activities (sporting days, courses, etc). According to employers' estimations, 39% of employees participated in WFP activities regularly. The financial input into WFP was on average 135 euros per employer in the companies supporting WFP (Työpaikkaliikunnan barometri marraskuu 2005). The investment rate had increased constantly over the last three years, from 80 euros in 2002 and 96 euros in 2003 to 135 euros in 2005. The results of TYKY-barometri 2001 (Työkykyä ylläpitävä ja edistävä toiminta suomalaisilla työpaikoilla vuonna, 2001) supported the results of Työpaikkaliikunnan barometri marraskuu 2005.

A solid contradiction exists in the activity of employees taking part in WFP. As was noted above, in Finland, 39% of the employees took part in WFPs, which would total 31% of the working population. There is evidence to the contrary, however, as in a large population survey the Finnish Sport for All Association (Suomen Kuntoliikuntaliitto 2006) found that 9% of the adult population (18-65 years) said to take part in WFPs. To take into consideration the unemployed, the figure would rise to 12%. Nonetheless, there remains a great discrepancy to those results found in Shephard's study in 1992). One reasonable explanation arises from the exact form of the question, answers given may respond to physical activity classes and courses given in the worksite, not all activities supported by employers.

The importance of WFP has been realized also by governmental agencies. Several guidelines have been published to help public actors and corporations to implement WFP successfully (Autonomous Government of Catalonia (1996), the US Department of Health and Human Services (1996), Health Canada (2001), Plotnikoff *et al.* (2003), The Canadian Council on Integrated Healthcare (2002), Department of Health, Physical Activity, Health Improvement and Prevention (2004). Also WHO has made an effort to define the policies in WFP (Kelly 1999). These guidelines all focus mainly on the health benefits of physical activity through motivating employees to be more active.

#### 2.2.2.2 Theories and perspectives behind WFP

One area of interest in WFPs has been motivating (or activating) employees in different programmes. All the above mentioned reviews testify that the low participation rate is the main problem in WFPs. Several theories have been utilized both to implement and study physical activity interventions, social cognitive theory (SCT) (Bandura 1986), behaviour modification (BM) (Bandura 1969, McAlister *et al.* 1982) and the transtheoretical model (TTM) (Prochaska & DiClemente 1983) being the most common.
Perceived working efficiency is a person's perception of his/her capability of successfully organizing and executing his/her skills and resources to perform an action that will lead to a desired result (Bandura 1977). The SCT determines that there are three self-

regulatory mechanisms influencing behaviour. These are perceived working efficiency for outcome attainment and expectations; and personal goal setting (Bandura 1986, Bandura 1998). The SCT builds up the interaction between the environment and personal behaviour, which is based on psychosocial functioning and self-determination. Human cognitive processes determine that behaviour. In participating physical activity individuals' beliefs of working efficiency are internally focused and central to their decisions. Outcome expectations, the second self-regulatory mechanism, refer to material consequences, social consequences, and self-reactions (Bandura 1986). When changes are applied to physical activity, the outcomes may include physiological adaptations, like increased basic endurance and muscle strength, and also improved general health.

Dzewaltowski (1989) examined the strength of working efficiency and outcome expectations with the prediction of participation in physical activity. He found that higher levels of working efficiency toward participating in physical activity were connected to higher levels of physical activity. Also, the more people believed that there were positive outcomes from activity and the greater satisfaction people felt with the outcomes, the more they activated to participate in physical activity. Dzewaltowski *et al.* (1990) found that in the undergraduate student group, working efficiency increased the prediction of physical activity significantly. Working efficiency had also a direct effect on behaviour and was a grounded predictor of exercise participation.

Baranowski *et al.* (1998) focused on mediating variables, such as attitudes, knowledge, working efficiency, self-motivation, positive and negative outcome expectations, exercise, efficacy, physical activity support, exercise behavioural capability, etc in explaining the changes in physical activity. In their review, these mediating variables were found to act as facilitating mediators in enhancing the physical activity level (Baranowski *et al.* 1998). Behavioural interventions for promoting physical activity have worked primarily when participants were motivated enough to volunteer. In most cases, behavioural or psychosocial theory accounted for 30% or less of the variability in physical activity behaviours.

Behaviour modification (BM) theory (Bandura 1969) is a framework which can be applied to set clearly defined steps for a health promotion programme. BM was applied, for example, by McAlister *et al.* (1982), who created a six step framework for a community level behavioural change process to decrease cardiovascular diseases in North Karelia in Finland.,The six steps (or elements) to enhance physical activity include knowledge of the positive effects of physical activity and its strengthening, persuasion of people (or employees) to take part in activities, teaching new skills to people (or employees), social support to encourage the behavioural change, environmental changes or better facilities to use to be physically active, and finally a successful way of organizing physical activity (or WFP) project. Besides these six steps proper, individual services should be implemented to make it possible for people to check their personal situation (Puska *et al.* 1985). In this study, BM was used to evaluate case companies' WFP-policy.

The Transtheoretical model (TTM) focuses on a personal level on the stages of behaviour change and the processes of change (Prochaska & DiClemente 1983, Prochaska *et al.* 1992). With this model, behaviour change is seen as a dynamic (spiral) process. The

five stages of change are precontemplation, contemplation, preparation, action, and maintenance. The precontemplation stage is when an individual is evaluating the advantages and disadvantages (pros and cons) of changing his or her behaviour; however, there is no desire yet to change that behaviour. During the contemplation stage, an individual has serious intent to change their behaviour, although one may remain in this stage for a long period of time. When the individual decides that the pros of behaviour change outweigh the cons and starts planning the action to change, she/he is in the preparation stage. This stage precedes the action stage, when actual behavioural changes are being made. After a period of steady change, the maintenance stage is reached, which is a continuation of the changed behaviour. This stage continues until the risk of returning to the old behaviour has been eliminated. In TTM, the stages of this model are dynamic; people may move in and out of each stage even several times.

In their quantitative meta-analysis, Marshall & Biddle (2001) found major support for TTM with respect to physical activity levels. They concluded, however, that the behavioural changes presented in TTM can not always be seen as sequences rather than adjacent segments of an underlying continuum. They also stated that in the physical activity domain, no higher order constructs are apparent. Blue *et al.* (2003) emphasized the importance of working efficiency both as an important mediator in explaining the exercise stage as well as a factor of readiness for exercise among blue-collar employees.

Human beings as a part of an ecological system, has been one research interest related to worksite fitness. The essence of ecological models is an emphasis on the environments in which people interact, such as their home, work, socio-cultural setting, and climate where they live. The ecological approach has been described as an attempt to simultaneously consider several levels of a person's life setting within an intervention (Prodaniuk *et al.* 2004). Futhermore, an ecological model for physical activity behaviour (Ecological Model of Physical Activity; EMPA) has been conceptualized (Spence & Lee 2003).

Based on the research of McLeroy *et al.* (1988) and Sallis and Owen (1997), Plotnikoff *et al.* (2003) developed an ecological workplace physical activity model identifying six overlapping environment levels in the workplace: (a) Individual (i.e., factors in the workplace addressing individual employee characteristics related to physical activity behaviour such as skills, knowledge, confidence, age, and gender); (b) Social (i.e., the influence of the corporate culture, social relationships, peer, and supervisor relationships related to physical activity behaviour of employees); (c) Organizational (i.e., infrastructure, leadership, and desire of the workplace to promote physical activity, how the organization is structured); (d) Community (i.e., how the workplace interacts, partners with, or utilizes other organizations, community based resources or government bodies that may foster physical activity behaviour of employees); (e) Policy (i.e., the workplace's policies regarding employees' physical activity behaviour); and (f) Physical Environment (i.e., the physical environment of the workplace including the buildings, workplace grounds, and surrounding area related to physical activity behaviour of employees).

Commuting activity is an essential part of ecological systems in physical activity, where much health-giving physical activity can result from simply installing showers and en-

couraging employees to walk or cycle to work (Vuori *et al.* 1994, Liikettä työmatkaan! 1999). Also, for example, enhancing the attractiveness of stairwells and instituting a competition to promote stair climbing may be more effective (Dunn *et al.* 1998, Sallis *et al.* 1998).

#### 2.2.2.3 The effects of WFP

The effects of WFPs has been studied mainly under the umbrella of sports medicine. Several distinctive reviews have been made to collect and compare the available knowledge (Gebhardt & Crump 1990, Wanzel 1994, Shephard 1996, Dishman *et al.* 1998, Proper *et al.* 2002). The focus of the research has been mainly on either WFP's physiological effects (fitness parameters, health parameters) or on health-financial effects (medical costs, cost-effectiveness). In the latter, the main contributor has been a reduction in sick leave, although some estimates on the effects of WFP on work productivity have been reported.

In their review in 1990, Gebhardt & Crump stated: *"Participation in fitness and health promotion programs has been shown to be beneficial in increasing fitness and reducing risk factors for CHD. These programs tend to reduce absenteeism, injuries, and health care costs. These benefits have been realized mostly in white collar settings with an average participation rate of only 15% to 30% of the eligible employees. To achieve greater success, a concerted effort must be made to promote increased participation in fitness and wellness programs among nonparticipants, "at risk" individuals, and blue collar workers. Furthermore, a multidisciplinary approach should be used to plan, implement, and evaluate the programs."*

Bouchard *et al.* (1990) wrote a consensus statement on costs and benefits of activity versus inactivity: "Although it is difficult to obtain vigorous epidemiological evidence, it is likely that the industrial benefits from appropriate types of fitness programming include an enhancement of corporate image, an increase of worker satisfaction and productivity, a decrease of absenteeism and personnel turnover, and in some situation, a decrease of industrial injuries." Relevant at that point of time, were the words *"although it is difficult to obtain vigorous epidemiological evidence, it is likely that"...* The scientific world (in the side of sports medicine) was confident of the benefits of WFP's.

In his review in 1996, Shephard concluded positive findings regarding WFP's improving physical fitness (a decrease of body fat by 10 to 15% and improvements of aerobic power, muscular strength and flexibility up to 20%). Effects of WFP's on health and health related risks were dominant, including a 35% to 45% reduction of cardiovascular risk following participation in a 3-year programme. Reductions in blood pressure levels and the cholesterol levels were also reported. The results in job satisfaction, performance and work related stress were not relevant, only studies without control groups reported on improved total well-being. Shephard goes on to say later that controlled studies indicate that activity programmes can involve a reduction of between $ 100 and $400 per worker year in respect of the utilisation of health care facilities.

Dishman *et al.* (1998) utilized quite strict criteria in collecting research data for their meta-analysis and the results they found were thus to some extent contrary to those of

Shephard (1996). Dishman *et al.* (1998) concluded that *"the results indicate that the typical worksite intervention has yet to demonstrate a statistically significant increase in physical activity or fitness. The few studies that have used an exemplary sample, research design, and outcome measure have also yielded small or no effects. The generally poor scientific quality of the literature on this topic precludes the judgment that interventions at worksites cannot increase physical activity or fitness, but such an increase remains to be demonstrated by studies using valid research designs and measures."*

Proper *et al.* (2002) utilized an even more strict method in approving studies in their meta-analysis, where they focused on work-related outcomes of the studies. After screening, eight studies were identified, although Proper *et al.* (2002) rated their methodological quality as being generally poor. The outcomes were absenteeism rates, job satisfaction, job stress, productivity, and employee turnover. The evidence of an effect was limited for absenteeism (e.g. Blair *et al.* 1986), inconclusive for job satisfaction, job stress and employee turnover, and nil for productivity. Proper *et al.* (2002) concluded that the scientific evidence on the effectiveness of physical activity programs at worksites is still limited. In their recent study, Proper *et al.* (2004) found an increase in the sick-leave of the control group compared to the intervention group. The difference was, however, not statistically significant. van den Heuvel *et al.* (2005) did discover, however, during a follow-up study of three years, that employees actively taking part in sports exercise had fewer sick leave days than employees not active in sports.

Physical activity has positive effects on mental health as will be described later (see Biddle 2000, Fox 1999, Lindwall 2004 and, Salmon 2001 in Chapter 2.2.3.4.). The effects of WFP on mental aspects have been recently studied. Brand *et al.* (2006) found that after 13 weeks of intervention there were already positive effects on perceptions of quality of life and physical and psychological perceived health. After three months follow-up, those effects held steady only for those who continued to exercise on their own. Thøgersen-Ntoumani *et al.* (2005) found direct and indirect effects of both physical activity and participation in WFP on general well-being as well as on job enthusiasm. Thøgersen-Ntoumani *et al.* (2005) conclude that their findings support the need to promote exercise and lifestyle physical activity as a means of enhancing the positive well-being of corporate employees.

The economic benefits of WFP have been studied with different approaches. In his review in, 1992, Shephard stated a need for a wide economic analysis of the benefits of WFP. That would include the transfer of benefits between various sectors of the economy, opportunity costs to participants, marginal costs and benefits, inflation, discounting, and the choice between cost-benefit and cost-effectiveness analyses. Suggested benefits include an improvement of corporate image, a decrease of employee turnover, gains of productivity, reduced absenteeism and medical costs, an improved employee lifestyle, and a decrease of industrial injuries. In practice, the corporate impact of a program is greatly attenuated, depending on prevalence of need, participation rate, program response of recruits, and continued employment of such individuals within a company. Costs to the corporation include promotion, facilities, equipment, and professional leadership. However, such items are often small relative to the opportunity costs incurred by the participant.

From a wider economic perspective, McGillivray (2002) concludes that WFP ('workplace fitness provision' in his definition) is a missed opportunity to enhance public health (and thus create nation-wide economic benefits), while organizations have made the same mistakes in WFPs as has been made in public health programmes, the programmes have not been able to motivate inactive people to take part in the activities.

In the area of Human Resource Management (HRM) physical activity programmes have been a part of corporation wellness programs. Wellness programs have been in place for a longer time in the USA, where the prime motivation has been the reduction of medical costs. In the UK, they have been seen more as an employee benefit in themselves, with the hope that providing them will also encourage higher productivity and reduce work absence levels (Torrington *et al.* 2005). In the current HRM context, the main motivator for WFP has been controlling mental stress and rehabilitating employees after surgery or illness (Torrington *et al.* 2005), although as early as 1979 Pyle (1979) wrote of performance measures in corporate fitness programs. Wider programs (than just WFP) had got more interest in HRM literature (e.g. DeGroot & Kiker 2003).

Ginn *et al.* (2001) view justifications for health promotion and wellness programs as generalized investments in human capital. Their definition of human capital is quite general and it varies remarkably from that of human capital in the definitions of intellectual capital (Edvinson & Malone 1997, Andriessen 2004). Despite that difference, Dinn *et al.*'s article gives a good insight into how to implant the rationales of wellness programs into wider concepts of economic or management theories. In that respect, Dinn *et al.* (2001) are in the same area as this study.

### *2.2.3 Phenomena related to WFP*

#### 2.2.3.1 Level of physical activity in working age population

Measures (e.g. research, surveys) of the level of physical activity give a starting point for Worksite Fitness Programs (WFP). Studies and surveys have been widely carried out internationally, partly with different methods and perspectives (for methods see chapter 4.1.2.). Despite the large range, some overview can be given to aid in positioning this study in a larger framework.

A Eurobarometer 2002 survey (Eurobarometer, Physical Activity 2002) was carried out in fifteen European Union member countries by applying the International Physical Activity Questionnaire (IPAQ) in face-to-face interviews of approximately 1000 people in each country. A common finding was that 24% of people responded that they had vigorous physical activity at least three days a week (31% of men, 18% of women). 31% of both men and women reported to have moderate physical activity at least four times a week. Finally, some 58% of the people were walking a certain amount at least four days a week. From the material of this Eurobarometer survey, it can be estimated that 35-40% of people in the European Union are physically active enough, and correspondingly 60-65% were physically not active enough when the health benefits of physical

activity were considered. 17% of the respondents were totally inactive (not even walking enough to count).

In European Union member countries, the young people were more active compared to older ones. 15-25 year old people were active in vigorous activity (at least three times a week, 32.6%), in moderate activity (at least four times a week, 34.3%) and also in walking (at least at four days a week, 68%). The respective numbers were for 26-44 year old age group 29.5%, 33.1% and 57.3%; for age group 45-64 years 22.4%, 31.2% and 57.5%; and finally for people over 65 years, the figures were 9.8%, 24.4% and 54.8%, Eurobarometer 2002 (Eurobarometer, Physical Activity 2002)

The same survey (Eurobarometer, Physical Activity 2002), showed quite large national differences in both vigorous and moderate physical activities. Across Member States, the rate of those who reported no vigorous physical activity in the last 7 days ranged from a low of 43.3% in the Netherlands to a high of 71.7% in Spain. Lower than average rates of non-participation in vigorous physical activity in the past week were reported in Germany (45.2%), Luxembourg (51.3%), and Finland (51.4%). High rates of non-participation in vigorous physical activity could be found, beside Spain, in Italy (63.9%), Ireland (62.3%), and Belgium (61.4%). The lowest rates of non-participation in moderate physical activity in the last 7 days could be found in the Netherlands (7.5%), Portugal (26.2%), Germany (28.6%), Denmark (30,6%), Luxembourg (33.9%), and Finland (35.9%). The highest rates of non-participation were reported in France (52.8%), Spain (51.3%), and Italy (50%).

In the USA, in different studies in the 1990's, 22-29% of the adult population was found to be totally inactive, while 21-23% was reported to be very active physically (5+ times per week for 30+ minutes per occasion) according to the US Department of Health and Human Services (1996). Comparing genders, males were less inactive than women (16-26% vs 27-31%), similarly men were more active than women (22-27% cf 19-21%). Both the inactivity and activity were age related; inactivity was higher in older age groups, while younger age groups were slightly more active than older ones. Socio-economic status had a high impact on the level of physical activity: in groups of greater education and higher incomes, the activity levels were higher compared to low education and income groups.

A Canadian study found that 55% of Canadians are physically inactive, the remainder are at least moderately active (Cameron *et al.* 2002). In the sub-group analysis, 59% of women and 52% of men were found to be inactive. According to age groups, the youngest adults (20-24 years) were less inactive (43% inactivity), while people over 65 years were most passive, (62% inactivity). Findings of socio-economic status were similar to thoseof the Surgeon General described above (US Department of Health and Human Services, 1996).

In England, a wide survey has been promoted over past years (OPCS Health in England 1998, 2000). In one of the recent studies (Health Survey for England 2003), 37% of men and 24% of women were found to meet the current recommended physical activity target (participation in activity of at least moderate intensity for at least 30 minutes on at least 5 days a week). The proportion of men with high activity levels decreased mark-

edly with age from 53% among men aged 16-24 to 8% among men 75 and over. The proportion of women with high activity levels remained stable for women aged 16-54 (29-31%) and decreased thereafter to 3% among women 75 and over.

In Finland, several surveys have produced a quite reliable degree of knowledge of the physical activity levels in Finland. The National Public Health Institute has completed a wide life-style mail survey starting from 1978 and physical activity has been a part of this survey. Results summarized in Figure 9 showed a steady increase in leisure time physical activity from 1978 up to 1997 and consequently a slight decrease in travelling to work by walking or cycling. After 1998, the activity has been fairly constant (Helakorpi *et al.* 2004).

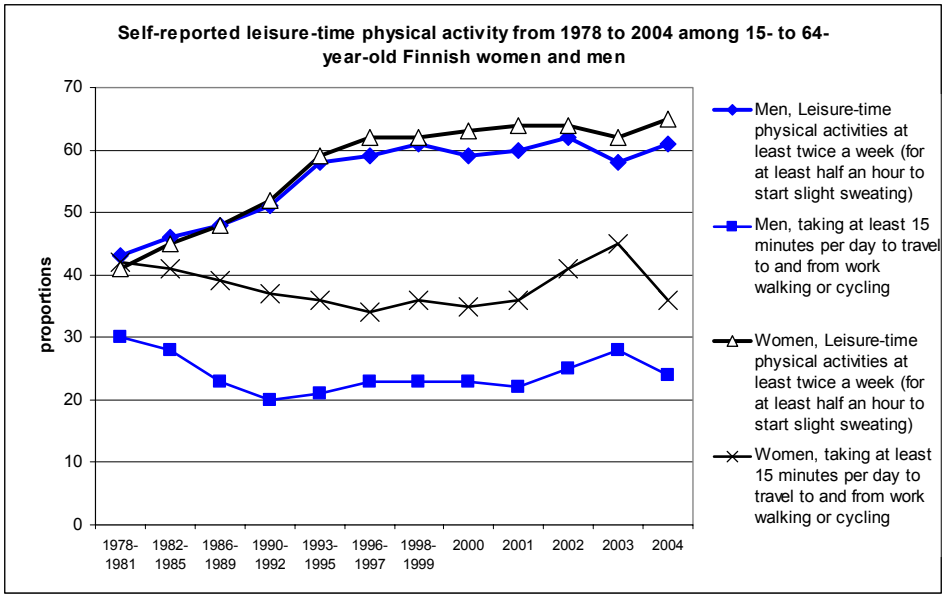


Figure 9. Self-reported leisure-time physical activity from 1978 to 2004 among 15- to 64-year-old Finnish women and men.

During the last few years, also more active physical activity regimens were asked about, and in 2004, 29.4% of men and 29.6% of women had leisure time physical activity at least four times a week (Helakorpi *et al.* 2004).

In telephone interviews, Suomen Kuntourheiluliitto (2002), and Suomen Kuntoliikuntaliitto (2006) did receive slightly higher figures in physical activity than Helakorpi *et al.* (2004). 82% of men and 90% of women were physically active at least two times a week, the criterion of a minimum of four times a week was achieved by 43% of men and 57% of women, though this activity included walking or cycling to work which were separated in Helakorpi *et al.*'s (2004) study. With the different criterion of health-enhancing physical activity Suomen Kuntourheiluliitto (2002) found that 49% of men and 58% of women were active enough (moderate or vigorous activity at least 3 times a week); in 2006, the respective figures were 54% for men and 61% for women. On the

other hand, with the criterion of "moderate or vigorous activity at least 4 times a week", 32% of men and 41% of women (36% of the whole adult population aged 19-65 years) were active enough (Suomen Kuntoliikuntaliitto (2006)).

In Finland, the physical activity was highest in the youngest (under 25 years) and oldest (over 50 years) age groups Suomen Kuntoliikuntaliitto (2006). With a criterion of at least four times a week in the youngest age group, 51% were active enough, while the figure was 46% in the age group 26-35 years, 44% in the age group 36-50 years, and 54% in the age group over 50 years. The same age-dependent results were found in Helakorpi *et al.* (2004). For men, 41.6% in the youngest age group (15-24 years) was active at least four times a week, while the number was 22.0% in 25-34 year olds, 22.4% in 35-44 years group, 24% in 45-54 year group and 37.3% in 55-64 year group. For women, the respective results were 32.9% (15-24 years), 25.5% (25-34 years), 26.3% (35-44 years), 29.1% (45-54 years) and 36.1% (55-64 years).

The socio-economic differences in Finland were found to be the same as in the USA and Canada (US Department of Health and Human Services, 1996, Cameron *et al.* 2002). The only exception was found in Helakorpi *et al.* (2004), where the physical activity of the unemployed was relatively high.

To conclude, the level of physical activity varies to some extent between nations and socio-economic groups. With slightly different criteria for health-enhancing physical activity, a proportion of 21-42% of the population is found to be physically active enough. In these comparisons, Finland can be determined to be one of the most active countries in this respect.

#### 2.2.3.2 The general effects of physical activity on physical fitness

Biologically, the effects of physical activity (here as a general word for all kinds of physical activity) can be divided into the effects upon physical fitness and its components as well as upon health and its components. The effects of physical activity in mental health vary from the support of human growth to mental well-being in adolescence and older age. In connection to working life, physical activity has some notable effects on the work ability concept.

The effects of physical activity on physical fitness and its components has certain traditional concepts. To improve one's endurance (capacity of heart and pulmonary functions), one has to exercise a minimum two, preferably four times a week, 30-45 minutes at a time, at an intensity of 60-80% of person's maximum $VO_2$ capacity (e.g. Cooper 1982, Rusko 1989, American College of Sports Medicine 1998). In strength training regimens, the most important aspects are exercise movements, exercise intensity (as a percentage of one's maximum strength) and exercise volumes (e.g. Viitasalo *et al* 1985, Hirvonen and Aura 1989, Rhea *et al.* 2003). Physical activity (especially exercise) has remarkable effects on motor skills, speed, balance (American College of Sports Medicine 1998) and other components of physical fitness.

2.2.3.3 The general effects of physical activity on biological health

The effects of physical activity on health are commonly accepted (Pate *et al* 1995, US Department of Health and Human Services 1996, Kesäniemi *et al.* 2001). Physical activity has been linked to overall healthy living and longevity, and been shown as providing protection against coronary heart diseases and stroke, obesity, hypertension, osteoporosis and diabetes.

According to Booth *et al.* (2002) the genetic background of human beings require physical activity – man was made to move. The main effects of physical inactivity and activity are summarized by researcher according to Booth *et al.* (2002) in Table 2.

Table 2. Illnesses and symptoms in which physical activity has preventive (p), treating (t) or rehabilitative (r) role.

| |
|---|
| CARDIOVASCULAR DISEASES |
| Coronary Artery Disease (p, t, r) |
| Myocardial Infarction (p, r) |
| Hypertension (p, t) |
| Stroke (p, r) |
| METABOLIC DISEASES |
| Type 2 Diabetes (p, t) |
| Obesity (p, t, r) |
| MUSCULOSKELETAL DISORDERS |
| Osteoarthritis (t) |
| Osteoporosis (p) |
| NEUROLOGICAL DISORDERS |
| Cognitive Dysfunction (t) |

The mechanisms behind the health effects presented in Table 2 are based on biological changes in different functions, such as consistency of blood, an increase in the amount or diameter of blood vessels, change the lipid concentration in blood. In the case of coronary heart disease, an expert panel made the following conclusions and recommendations (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (2001)):

*"Physical inactivity is likewise a major, underlying risk factor for coronary artery disease. It augments the lipid and non-lipid risk factors of the metabolic syndrome. It further may enhance risk by impairing cardiovascular fitness and coronary blood flow. Regular physical activity reduces very low-density lipoprotein levels, raises HDL cholesterol, and in some persons, lowers LDL levels. It also can lower blood pressure, reduce insulin resistance, and favorably influence cardiovascular function. Thus, ATP III recommends that regular physical activity become a routine component in management of high serum cholesterol."*

The Surgeon General report (US Department of Health and Human Services 1996) stated following conclusions:

1. People of all ages, both male and female, benefit from regular physical activity.
2. Significant health benefits can be obtained by including a moderate amount of physical activity (e.g., 30 minutes of brisk walking or raking leave, 15 minutes of running, or 45 minutes of playing volleyball) on most, if not all, days of the week. Through a modest increase in daily activity, most Americans can improve their health and quality of life.
3. Additional health benefits can be gained through greater amounts of physical activity. People who can maintain a regular regimen of activity that is of longer duration or of more vigorous intensity are likely to derive greater benefit.
4. Physical activity reduces the risk of premature mortality in general, and of coronary heart disease, hypertension, colon cancer, and diabetes mellitus in particular. Physical activity also improves mental health and is important for the health of muscles, bones, and joints.

Physical activity has specific mechanisms in all the different illnesses mentioned in Table 2. (and further in many other illnesses), which will not be listed here in detail. In the scope of this study, what is most important is to see and interpret the general effects of physical activity on health. That can be seen in Vuori's (2005) summary figure below.

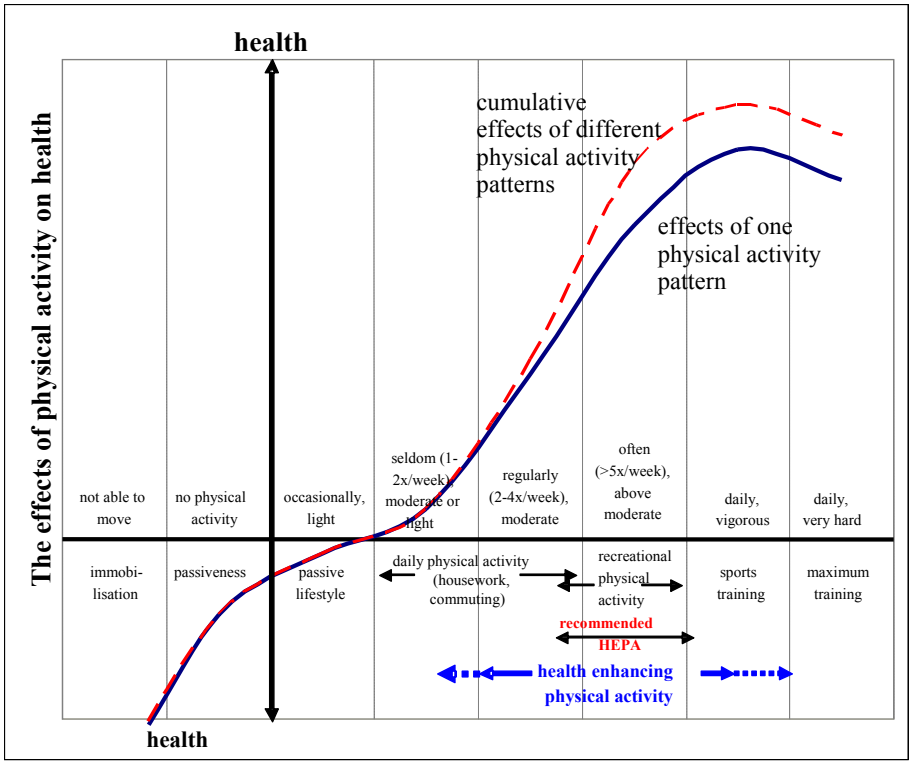


Figure 10. The general effects of physical activity on health, Vuori (2005).

In Figure 10, Vuori (2005) shows the gradual effects of physical activity on health as general. The horizontal baseline represents an "individual normal health" which can be maintained with moderate physical activity (daily activity in restful to moderate intensity 1-2 times a week). The health benefits of physical activity rise steeply when the amount of physical activity is increased to four times a week and the intensity is set to moderate. The best advantages of physical activity are gained in the recreational physical activity (fitness training) pattern, where the amount exceeds five times a week and intensity is above moderate.

In Figure 10, the dotted line represents health benefits of cumulative physical activity. This means, for example, the effects of regular moderate physical activity 2-4 times a week plus the effects of daily light physical activity (for instance, transportation). In Figure 10, the most effective (recommended) area for health enhancing physical activity (HEPA) is also highlighted, while the whole range of health enhancing physical activity ranges from daily light activities to sports training.

The effects of physical activity on health and on fitness are the basis for the assessment of physical activity groups (PAG) and the Physical Activity Indicator (PAI) in this study. The procedures will be presented later in chapter 4.1.2.

#### 2.2.3.4 The general effects of physical activity on mental health

The role of physical activity in the facilitation and maintenance of positive mental health and well-being is well documented (for reviews, see Biddle 2000). Physical activity will provide positive feelings, better self esteem, general well-being, etc. (Petruzzello *et al* 1991, Fox 2000, Lindwall 2004). More specifically, physical activity has positive effects as it decreases the risk of developing clinical depression, and also physical activity provides an effective treatment method for depression (Fox 1999). Fox goes on to say that the association between physical activity and indices of subjective well-being seems to be relevant, and there are also studies that support a positive effect on mood for moderate intensity exercise. Fox (1999) finished his summary with the statement ''exercise makes you feel good''.

Several mechanisms have been suggested to explain the positive relationship between physical activity and mental health (Salmon, 2001). Two main mechanisms according to Lindwall (2004) are:

1. a distraction hypothesis, which proposes that the time-out associated with physical activity or exercise may function as a vital and health distractor from destructive and unsound thoughts, rumination, and stressors and hassles of everyday life, thereby contributing to the perceived mental health effect; and
2. a mastery hypothesis, that the sensation of being able to master a highly valued task (e.g., running 10Km without stopping or managing to follow an aerobic-class) may facilitate, for instance, the enhancement of mood or self-esteem (Biddle & Mutrie (2001), Petruzello *et al.* (1991)).

Besides those mentioned above, there are also social contacts in physical activity, better self esteem and principally also better physical health are mechanisms by which physi-

cal activity may affect mental health (Fox 1999). In his dissertation, Lindwall (2004) states regarding the theories behind the effects of physical activity on mental health that: "*However, it is very unlikely that one single theory will suffice to explain the effects of exercise on mental health. Rather, the various biochemical and psychological mechanisms underlying the somatopsychic processes that create the perceived mental health effects probably overlap and work together in a complex pattern that also is affected by the cultural and social context in which exercise occurs."*

The benefits of physical activity on mental health are obvious. Despite these well-known advantages, scientists and practitioners face two major challenges: (a) a great part of the population is still physically inactive (US Department of Health and Human Services (1996), British Heart Foundation (2000), Helakorpi *et al.* (2004)), and (b) a dropout rate of about 50% in the beginning in supervised exercise programs all around the world (Dishman, 1988).

#### 2.2.3.5 The general effects of physical activity on work ability

The classical investigation on the effects of physical activity on work ability is the 11-year follow-up study of aging municipal workers in Finland, which was reported by, for example, Ilmarinen *et al.* (1997) and Tuomi *et al.* (2001). In that study, it was found that an increase in brisk physical activity at least twice a week was one of the three main predictors of improved work ability over the 10 years. In addition, a decline in brisk exercise was one of the four most powerful predictors of decreased work ability over the 10 years. The effects of physical activity on work ability were independent of work type (physical, mental, or physical-mental work) and gender (Ilmarinen *et al.* (1997) and Tuomi *et al.* (2001)).

In shorter intervention or follow-up studies and in cross-sectional designs, the effect of physical activity on work ability has been found to be positive or negligible. In a follow-up study, Smolander *et al.* (2000) found that the work ability of the physically active people stayed constant, while in sedentary people a decline was observed. In their intervention study, Nurminen *et al.* (2002) found a higher increase in the proportion of workers with "good" or "excellent" work ability in the intervention group compared to the control group. Ohta *et al.* (2004) had demonstrated that already 12 weeks of intervention in physical activity can reflect in higher contributions in work ability estimates. An example of the cross-sectional studies is Kaleta *et al.* (2004), who found a high correlation between physical activity and Work Ability Index in Polish employees.

The Finnish Institute of Occupational Health has done highly qualitative research in the field of work ability. In their magazine's Työterveys (Occupational Health) special issue from 1999, Korhonen (1999) widens the spectrum of physical activity in relation to work ability as follows: *"Through physical exercise, people can improve all aspects of their health - physical, mental and social. Better health enhances our performance both at work and in our recreational pursuits. Regular exercise also helps us to recover faster from physical and psychosocial stress. The fact that exercise also prevents depression, one of the most common health problems today, is another important matter: it has been postulated that depression and stress lasting six months or longer may atrophy the frontal lobe and reduce learning capacity. Physical exercise is an excellent al-*

*ternative to antidepressants, which are being consumed in alarming quantities. Physically fit workers are also an asset to their employers: the money invested in improving employees' fitness will pay for itself through reduced absenteeism, lower insurance costs, more stable careers and greater productivity."*

### *2.2.4 Concluding remarks on WFP*

Physical activity patterns will influence a great deal on the health related aspects in human beings (US Department of Health and Human Services 1996, Kesäniemi *et al* 2001, Vuori 2005). In this respect health can be defined as a wider definition of *"a resource for everyday life, a positive concept emphasizing social and personal resources as well as physical capabilities"* (Ottawa charter 1986). In line with these general trends, active participation in WFP has been to a some extent seen to decrease risks in coronary and heart deceases (Gebhardt & Crump 1990, Shephard 1996); and caused (or being associated with) the decreased absenteeism (Blair *et al* 1986, Gebhardt & Crump 1990, van den Heuvel *et al* 2005). Restriction for even better effects is a quite limited participation in WFP.

The positive mental effects of physical activity are universally accepted. Physical activity will provide positive feelings, better self esteem, general well-being, and has positive effects as it decreases the risk of developing clinical depression (Fox 1999, Biddle 2000, Lindwall 2004). In respect to these findings active participation in WFP has been shown to increase worker's satisfaction (Bouchard *et al* 1990); Thøgersen-Ntoumani *et al.* (2005) found effects of participation in WFP on general well-being and on job enthusiasm; and Brand *et al.* (2006) found that WFP-intervention had positive effects on perceptions of quality of life and psychological perceived health.

In respect to work ability (or wellness at work) the effects of physical activity are based both from physical and psychological origin. In long (Ilmarinen *et al* 1997) and shorter interventions (Nurminen *et al* 2002, Ohta *et al* 2004) positive effects of physical activity on work ability was found. Some of the effects are most probably based on the collective nature of WFP-activities.

To conclude, worksite fitness programs have been utilized and researched actively for decades. Most of the reports and publications have been popular articles, although written by highly skilled practitioners. Because of their non-scholarly nature, they have not been referred to in this text. On the other hand, in scientific research, the main interest in WFP has been in the fields of sports medicine and behavioural sciences. In some review articles the general scientific level of these studies has been described quite low (Dishman *et al* 1998, Proper *et al* 2002). Surprisingly, very little interest in WFP has been focused on the areas of management and human resource management in particular. The research traditions have been based more or less on positivism, with very few exceptions. In his work, McGillivray characterised WFP first as being a missed opportunity (McGillivray 2002) and in a later work, (McGillivray 2005) he called upon researchers to see the WFP discourse as being wider than simply a way to increase a company's productivity.

## 3 PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study was to research the connections and associations of Worksite Fitness Program -policies on Intellectual Capital and its three elements. As a background variables of WFP-policy employees' physical activity and fitness patterns were investigated. This study is exploratory in nature, and does not seek to test specific hypotheses. To find answers to the research questions in a most natural situation, the four case companies operated in the follow-up period with no external funding and resources. Research problems are stated with five research questions.

In the literature, reviewed in previous chapter, Worksite Fitness Programs has been widely researched in the areas of sports medicine, sports physiology and sports psychology. Interest in more management related fields has been restricted. In the area of Human Resource Management (HRM) WFP have been a part of corporation wellness programs. In the most recent HRM handbooks, the main motivator for WFP has been controlling mental stress and rehabilitating employees after surgery or illness (Torrington *et al.* 2005).

In the field of Intellectual Capital great emphasis has been generated to find explanations for the intangible value companies create. In this work different assessment and measurement procedures with hundreds of different indicators has been utilized. From the Finnish (and probably the whole Scandinavian as well) viewpoint astonishingly little attention has been paid to see health and work related wellness as a part of IC. If that would be the case, it would be natural to see physical activity and WFP as a part of IC, especially as a part of Human Capital. On the other hand the framework of IC offers two other perspectives (Structural Capital and Relational Capital) in evaluating the overall value of WFP.

To create new knowledge and to find new perspectives on the development of Intellectual Capital a first research question was phrased:

Q 1. What is the connection of the company-specific fitness policy on Intellectual Capital?

- Q 1.1. On Human Capital and its indicators
- Q 1.2. On Structural Capital and its indicators
- Q 1.3. On Relational Capital and its indicators

In question 1. company-specific fitness policy (WFP-policy) is seen as an overall and long-term policy a company (and its management) provides recourses and carries out the investments of WFP. In this study the answers to the question 1. will be reached mainly through different qualitative research methods in four case companies.

In Finland most of employers (85-90%, Työpaikkaliikunnan barometri 2005) support their employee's physical activity by arranging or financially supporting different sports. Employers want to benefit on these investments through better work ability and health of employees. Research has shown, in this respect contradictory results (see reviews of Gebhardt & Crump 1990, Shephard 1996 and Dishman *et al* 1998). Recently Brand *et al.* (2006) and Thøgersen-Ntoumani *et al.* (2005) had found promising results

on the mental outputs of WFPs. To deepen the knowledge of the role of WFP, a second research question was phrased:

Q 2. What are the associations and interactions of the employees' activity in the Worksite Fitness Program on Intellectual Capital?

- Q 2.1. On Human Capital and its indicators
- Q 2.2. On Structural Capital and its indicators
- Q 2.3. On Relational Capital and its indicators

Question 2. will be investigated with various statistical analyses using several quantitative data, originated both from preliminary study and case studies. The main methods will be comparisons between WFP active and non-active employees on individual and group levels. WFP activity will serve also as an independent variable in regression analyses made. In respect to the role of WFP activity on Structural and Relational Capital some qualitative methods will be used.

Physical activity habits can be seen as both input and output parameters in relation to WFP. That means that physically already active employees will most probably participate activities in WFP. On the other hand a proper WFP will activate employees to become physically more active. In this study the causality between WFP and physical activity couldn't be determined and thus physical activity as *pre se* was seen to have possible influence on Intellectual Capital. A third research question was phrased:

Q 3: What are the associations and interactions of Physical Activity Patterns on Intellectual Capital?

- Q 3.1. On Human Capital and its indicators
- Q 3.2. On Structural Capital and its indicators
- Q 3.3. On Relational Capital and its indicators

Question 3. will be examined with various statistical analyses using quantitative data both from preliminary study and case studies. Parameters of physical activity patterns (especially amount and intensity of exercise) will serve as independent variables in multivariate analyses. Also some comparisons between Physical Activity Groups and physically active enough and not active enough groups will be done. In respect to the role of physical activity on Structural and Relational Capital some qualitative methods will be utilized as well.

In modern work life the working tasks requiring physical fitness and strength have been decreased. A transition from blue collar to white collar work has also raised the safety standards of work. In this quite universal situation the role of physical fitness in respect to Intellectual Capital is interesting. Related to health, increase of physical fitness has been seen to have more positive effects on health than increase in physical activity (see e.g. Blair *et al* 2001). On the other hand, both in population and worksite level it's more difficult to have an impact on physical fitness compared to physical activity. A fourth research question was phrased:

Q 4. What are the associations and interactions of Physical Fitness on Intellectual Capital?

- Q 4.1. On Human Capital and its indicators
- Q 4.2. On Structural Capital and its indicators
- Q 4.3. On Relational Capital and its indicators

In this study the associations of physical fitness on IC will be examined in case studies. Because of the very personal nature of fitness testing protocol (compared to the anonymous questionnaires) only limited parameters of IC can be gathered in connection with fitness testing. In evaluating the connections of physical fitness on Structural and Relational Capital some qualitative methods will be utilized.

In management sciences a search of exact truth is often a strict goal. In relation to human aspects estimations, measurements and even accounting activities were popular among researchers and practitioners in the 1970's, Flamholz (1985) being the most noted name in the field. Since 1970's hundreds of indicators have been generated (see review of Ordóñez de Pablos 2004). In the field of WFP connected to human or upper management of a company no validated, uniform indicators have been reported. The fifth, and quite practical purpose of this study was to create measures and indicators for WFP, physical activity and fitness. A fifth research question was phrased:

Q 5. What are the indicators for measuring and managing the Worksite Fitness Program and Physical Activity and Fitness Patterns in an Intellectual Capital framework?

- Q 5.1. What are indicators for the Worksite Fitness Program of a company?
- Q 5.2. What are indicators for the physical activity patterns of employees?
- Q 5.3. What are indicators for the physical fitness patterns of employees?

To find answers to question 5. conceptual models of indicators will be designed; and after that data collected in preliminary study will be utilized to set criteria for the indicators.

In this study, certain assumptions and definitions are made in order to clarify the research questions above. A Worksite Fitness Program is seen as a comprehensive unity where employers financially support employees' fitness activities, arrange joint WFP events and provide motivational opportunities for employees as well as sufficient internal media about WFP. Intellectual Capital is defined as being a combination of Human, Structural and Relational Capital, where Human Capital consists of human capabilities and competencies, Structural Capital is based on a company's internal activities, cultures and efficiency, and Relational Capital includes all connections to the external world, such as customers, suppliers and other stakeholders of a company. Physical Activity Patterns includes the amount, intensity and forms of individual physical activity habits.

# 4 METHODS

In this study, a large range of both qualitative and quantitative research methods were used. In this section the methods are presented in chronological order. In the whole study, especially in the writing phase, balancing between qualitative and quantitative research methods was constant. That is quite normal in management research, as in social sciences more widely (Silverman 2005). During the research period (from 1999 to 2006) a clear shift was seen from pure quantitative methodology toward more qualitative approaches. The data containing variables of physical activity, fitness and wellness parameters was collected and analysed with highest possible quantitative standards. That data, both in preliminary study and case studies enabled the utilization of the most sophisticated statistical methods. In the phases of the study, where Intellectual Capital and especially the role of WFP-policy in IC-framework were analysed more and more qualitative methods were used. The associations between physical activity patterns and certain IC-indicators could be tested with statistical (quantitative) methods, where as the conclusions of the main research questions could be drawn with the help of qualitative methodology.

## *4.1 Preliminary study – the Physical Activity Indicator and its counterparts*

Standardized questionnaires (see Appendix 1) were designed to collect data on physical activity, motives for physical activity, perceived health, sick leave, and individual assesments of work ability. Questionnaire data was collected from 33 companies and 14 420 persons; the response-rate ranged from 48-77%. The data collected was first coded in Excel worksheets and later imported into SPSS software for statistical analysis (Afifi & Clark 1999).

### *4.1.1 Background parameters and anthropometry*

In the standardized questionnaires, certain background parameters were determined. Information was requested on the respondents' gender (male, female) and age group (under 30 years, 30-39 years, 40-49 years, 50-59 years and over 60 years). The working unit was determined on a company basis, but the nature of the work (white collar or blue collar) was asked in all surveys.

The anthropometrical data contained the subject's height (in centimetres) and weight (in kilograms), both of which were simply requested from the respondents and not measured, because of the nature of the survey.

### *4.1.2 Physical activity*

A great variety of questionnaires has been used to measure (or estimate) physical activity in population or worksite levels (Pols *et al.* 1997, Booth 2000, Suomen Kuntoliikuntaliitto 2006, Craig *et al.* 2003, Shephard 2003, Helakorpi *et al.* 2004). Shephard (2003) has criticized the wide range of questionnaires used, and in this respect, a European cooperation is focusing in a European-wide, standardized questionnaire: the International Physical Activity Questionnaires, or IPAQ.

The International Physical Activity Questionnaires is composed of a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health-related physical activity. The short version of IPAQ consists of questions on frequency and duration of physical activity and inactivity (sitting hours a day). In the long version, more detailed questions are focused on physical activity at work, transportation, housework and leisure time with the questions of inactivity (sitting hours a day).

In Finnish large surveys, a certain tradition regarding questionnaires has been established. Both in Helakorpi *et al.* (2004), Suomen Kuntourheilun Edistämissäätiö (1994) and Suomen Liikunta ja Urheilu ry and Suomen Kuntourheiluliitto ry (1998) the focus was on discovering the average amount of physical activity in a normal week. In Helakorpi *et al.* (2004) a certain criterion was assessed for physical activity (at least 30 minutes, at least mild breathing and sweating), while in Suomen Kuntourheiluliitto (2002) the duration and intensity of the activity were asked. Concerning intensity, a four digit scale was used (no activity, light activity, moderate activity and vigorous activity).

In this study, the above-mentioned Finnish tradition was carried forward. By utilizing the same principles as in Suomen Liikunta ja Urheilu and Suomen Kuntourheiluliitto (1998) and Helakorpi *et al.* (2004), direct comparisons were made possible.

Physical activity was questioned separately for fitness activities and commuting activity (walking or cycling to work). See Appendix 1. (questions 2. and 3.) for details.

Variables for statistical analyses were derived from the questionnaire as follows:

- total amount of physical activity (APA): (frequency fitness activity x duration of physical activity)+ (community activity frequency x duration of community activity). APA is expressed as minutes / week
- in community activity, half of the year was considered to be summer-time and half to be winter-time
- in duration, the mean of each alternative range was used (e.g. in duration 40-60 min, a mean of 50 min was used in calculation.
- The intensity of physical activity (IPA) was asked using four categories (no activity – light – moderate – vigorous) which afterwards were given numerical values based on their absolute intensity in METs Taking into consideration the age variations in this study (see Table 2-4 presented in page 33 in US Department of Health and Human Services (1996) and the levels of assessed physical fitness (see Table 2 presented by Kesäniemi *et al* 2001). the following numerical estimates for different intensities were concluded:

| | |
|---|---|
| no activity | 2.0 |
| light activity | 4.0 |
| moderate activity | 6.0 |
| vigorous activity | 8.0 |

4.1.2.1 Physical activity groups and Physical Activity Indicator (PAI)

In creating the physical activity groups and further Physical Activity Index, a total number and dominant intensity of physical activity were determined. For the amount of physical activity, the number of fitness activities and commuting activities were summed to produce a total amount of physical activity. The dominant intensity was determined to be an intensity of either fitness or commuting activity, whichever of the two was quantitatively dominant. In most cases (97%), the fitness activity was dominant (usually moderate or vigorous).

Referring Vuori (2005) physical activity groups were determined according to Figure 11.

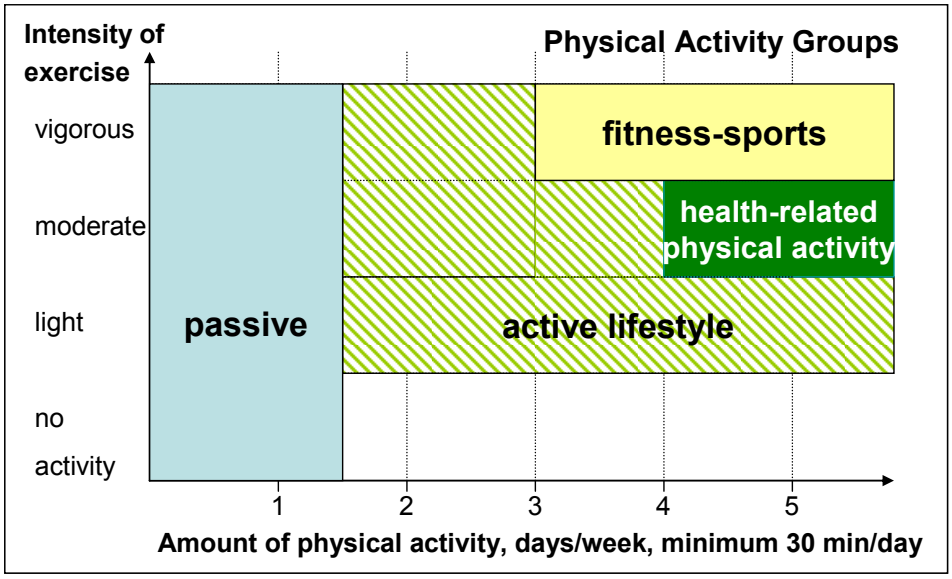


Figure 11. Determination of physical activity groups by amount and intensity of physical activity.

The Physical Activity Groups can be described:

- passive: no or very little physical activity, sedentary people
- active lifestyle: regular physical activity at 1,5 to seven days a week with light, 1,5 to four days a week with moderate or 1,5 to three days a week with vigorous intensity
- health related physical activity: physical activity at least four days a week with moderate intensity
- fitness-sports: physical activity at least three days a week with vigorous intensity

To calculate a company-based Physical Activity Indicator (PAI) the fractions of health-related physical activity- and fitness-sports groups were summed. Thus PAI reflects the

fraction (%) of the employees in a company who are physically active enough in respect to health. The results of physical activity are presented as fractions of the physical activity groups and as a fraction of PAI in different subgroups.

#### 4.1.2.2 Worksite Fitness Program Indicator (WFPI)

In the questionnaire, a specific question was posited to discover if a person was actively taking part in WFP supported by the employer: "Your employer financially supports worksite fitness program activities. In what WFP activities have you taken part regularly and how many times a week?" (see Appendix 1 for more details).

The Worksite Fitness Program Indicator (WFPI) was determined to be the fraction (%) of employees who regularly took part in WFP activities supported by the employer.

#### 4.1.2.3 Worksite Fitness Program Events Indicator (WFPE)

In the questionnaire, a specific question was posited to discover if a person was actively taking part in WFP events supported or arranged by the employer: "Which WFP events do you take part and how often?" (see Appendix 1. for more details).

Worksite Fitness Program Events Indicator (WFPE) was determined to be the fraction (%) of employees who took part in WFP events arranged by employer.

### *4.1.3 Motives for physical activity*

As referred to in Chapter 2.2.2.3., the motives for physical activity vary between age groups, genders and according to the stage of activity. In the preliminary study, motives for physical activity were investigated with an 11-digit, five-scale, Likert-like question (see Appendix 1. for details).

The results of the motives questions are presented in two forms, first as a fraction of answers "extremely important" and "important." To further analyse the motives, a factor analysis (Varimax rotation, eigenvalues over 1,0) was run to obtain specific motive-factors. Four factors were identified, that explain 65.1% of the total variance.

Based on the results of the factor analysis, new parameters were constructed. First, the numerical values of the answers were presented in reverse order and the corresponding answers were summed to generate four new parameters. This was done to help interpret the results with practitioners in corresponding companies. The correlation coefficient between such newly-constructed parameters and correlation factors obtained from the analysis were in a range of 0,89 to 0,95, which were all highly significant ($p<0,001$).

Motive factor 1. Basic motives (general health, physical fitness, enjoyment, relaxation) will have numerical values between 4 and 20. The mean of the factor was 16,08 and SD 2,74.

Motive factor 2. Specific health motives (shoulder symptoms, stress tolerance, mental stamina) will have numerical values between 3 and 15. The mean of the factor was 10,12 and SD 2,73.

Motive factor 3. Social motives (social reasons, competing) will have numerical values between 2 and 10. The mean of the factor was 4,50 and SD 1,91.

Motive factor 4. Weight control motives (lose weight, firm the body) will have numerical values between 2 and 10. The mean of the factor was 6,00 and SD 2,24.

*4.1.4 Perceived health*

In the preliminary study and in case company C. a twelve digit questionnaire with five (in some cases three) Likert like scale question were implemented to get results of the perceived health of the subjects. See the questionnaire in Appendix 1.

The results of the perceived health questions are presented in two forms. First as averages of each answer, and second, to further analyse the phenomenon of perceived health a factor analysis (Varimax rotation, eigenvalues over 1,0) was run to get specific health-factors. Four factors was got, which explained 67,9% of the total variance.

Based on the results of the factor analysis, new parameters were constructed. First, the numerical values of the answers were in some questions presented in reverse order in such a way that the best answer always received the highest value. After that, the corresponding answers were summed to generate four new parameters. This was done to help interpret the results with practitioners in corresponding companies. The correlation coefficient between such newly-constructed parameters and correlation factors obtained from the analysis were in a range of 0,94 to 0,98, which all were highly significant ($p<0,001$).

Health factor 1. Health Factor (How would you describe your health?, How would you estimate your health compared with the people your age and gender? and Has there been changes in your health during last five years?) will have numerical values between 3 and 15. The mean of the factor was 10,00 and SD 1,75.

Health factor 2. Health Respect Factor (How interested are your generarly on your health?, How important is your health to you? and How much do you thing you can influence on your own health?) will have numerical values between 3 and 15. The mean of the factor was 12,75 and SD 1,61.

Health factor 3. Shoulder Health Factor (Do you have pain in your neck and shoulder region? and Does the possible neck- or shoulder pain harm your work or leisure time?) will have numerical values between 3 and 11. The mean of the factor was 8,14 and SD 1,94.

Health factor 4. Back Health Factor (Do you have pain in your back? and Does the possible back pain harm your work or leisure time?) will have numerical values between 3 and 11. The mean of the factor was 8,57 and SD 1,85.

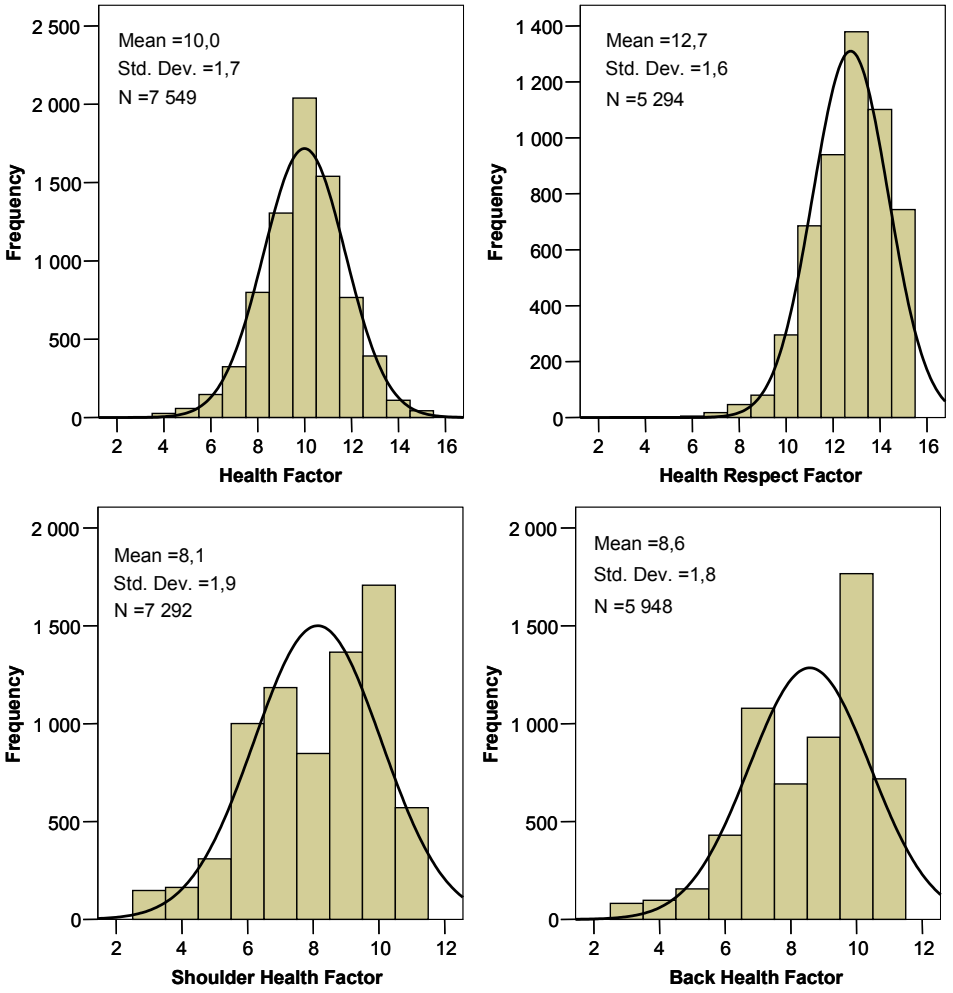


Figure 12. The histograms of the health factors

Figure 12 shows that especially the Health Factor is very good parameter, normally distributed and thus proper for further analysis.

#### *4.1.5 Sick leave*

Sick leave is an essential part in absenteeism, which has been one of the main interests in the research into WFP (Shephard 1992). The are a wide variety of methods for determining sick leave (Hensing 2004). According to Revicki *et al.* (1994) self-reported information on sick-leave days and the employer's register were in substantial agreement.

In this study, a standardized questionnaire was utilized where the subjects were asked to provide the total number of sick leave days during the last year. The time period was pointed out clearly by expressing the year in question (e.g. the year 2002). Further, the subjects were asked to divide the total sick leave days into three categories: flu and other minor causes, muscular-skeletal problems and cardiovascular deceases. For details see Appendix 1.

The results were presented in averages of the total sick leave days in different subgroups.

#### *4.1.6 Self-assessed work ability estimations*

In assessing work ability, a personal assessment was used. The final section of the WAI questionnaire (Tuomi *et al.* 1998) was utilized (Estimate your current work ability compared with the lifetime best so that 10 = the best work ability you ever have had and 0 = inability to work at the moment). Abbreviation of this number is WAE in this study. In 2001, Ilmarinen emphasized the importance of this question in self-assessment of work ability. For details see Appendix 1.

### *4.2 Preliminary study – physical fitness indicator*

Standardized fitness test protocol: a height, weight, 12 min $VO_2$ ergometer test (Lange Andersen *et al.* 1971) and an abdominal muscle strength test (Viljanen *et al.* 1991) were used to gather data on physical fitness from 87 companies and 4,424 person. To create a 5-step total fitness value (TFV) for each individual, values for fitness and abdominal muscle strength were determined. These values of TFV were used to calculate a company specific Physical Fitness Indicator. In the second phase of the preliminary study in 2003-2004 same procedures were performed complemented with questionnaires of sick leave and self-assessments of work ability. 1556 employees from 49 companies participated in these measurements.

#### *4.2.1 Background parameters and anthropometry*

In the standardized questionnaires, certain background parameters were determined. Information on the respondents' gender (male, female) and age were requested. The

working unit was determined on a company basis, but the nature of the work (white collar or blue collar) was questioned in all surveys.

The anthropometrical data contained the subject's height (in centimetres), which was simply requested, and weight (in kilograms), which was measured. From the height and weight a body mass index (BMI was calculated according to normal routines.

BMI = weight/height$^2$, where weight in kg and height in m

*4.2.2 Fitness values for cardio-respiratory- and muscle fitness*

In calculating the fitness value for cardio-respiratory fitness ($VO_2$-value), the results of Kujala *et al.* (1994) were utilized to create formulas for men and women:

Formula 1.

men: $VO_2$-value = 0,222*(((-35+age)*0,4)+$VO_2$)-6,333 and
women: $VO_2$-value = 0,222*(((-35+age)*0,4)+( $VO_2$+4))-6,333.
In the formula, age is expressed in years and $VO_2$ is in ml x $kg_{-1}$ x $min_{-1}$

In calculating the fitness value (Abd-value) for abdominal muscles, the results of Viljanen *et al.* (1991) were used to create formulas for men and women, respectively:

Formula 2.

men: Abd-value = 0,333*(((-45+age)*0,325)+abdominals)-2,5 and
women: Abd-value = 0,333*(((-40+age)*0,275)+ abdominals)-0,83,
where "abdominals" was the number of repetitions made in 30 seconds

*4.2.3 Total fitness value and Physical Fitness Indicator*

The values of cardio-respiratory and muscle fitness were averaged to produce a total fitness value, TFV, numerically ranged from 1 to 5. Furthermore, in calculating a corporation's Physical Fitness Index (PFI), all individual TFV values over 3.0 were taken in to account to provide a % fraction of the personnel that is "fit enough".

### *4.3 Psycho-social factors at work and worksite*

All four case companies had different, even changing, surveys for employee satisfaction and worksite psycho-social relations. To gain some generalized understanding of that phenomenon, a standardized questionnaire was applied to the people involved in the interventions in the case companies during the last year of follow-up. The questionnaire was an application of QPSNordic questionnaire (Dallner *et al.* 2000). While all the case companies routinely carried out surveys of their own, this questionnaire was limited to as few questions as possible that would still reflect the phenomenon. For details see Appendix 3.

The results of "Psycho-social factors at work and worksite" questionnaire were presented as average (±SD) of each question in different subgroup. To analyse more the psycho-social phenomena in relation to physical activity patterns several analysis were made. First a factor analysis (Varimax rotation, eigenvalues over 1,0) was performed which produced two factors according to Figure 13.

**Rotated Component Matrix[a]**

| | Component | |
|---|---|---|
| | 1 | 2 |
| 3. Work unit climate encouraging and supportive. | **,817** | ,011 |
| 2. If needed, can you get support and help with your work from your immediate superior? ... | **,812** | ,008 |
| 1. Is there sufficient communication between staff and management in your department? | **,787** | -,185 |
| 8. How satisfied are you at your present job? | **,642** | ,285 |
| 7. This organization really inspires me to give my very best job performance | **,482** | ,171 |
| 5. How often you have problems to carry on your job? | ,150 | **,829** |
| 4. How often do you feel stress because of unfinished job? | -,199 | **,768** |
| 6. How often you have a good working efficiency at work? | ,457 | **,568** |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 3 iterations.

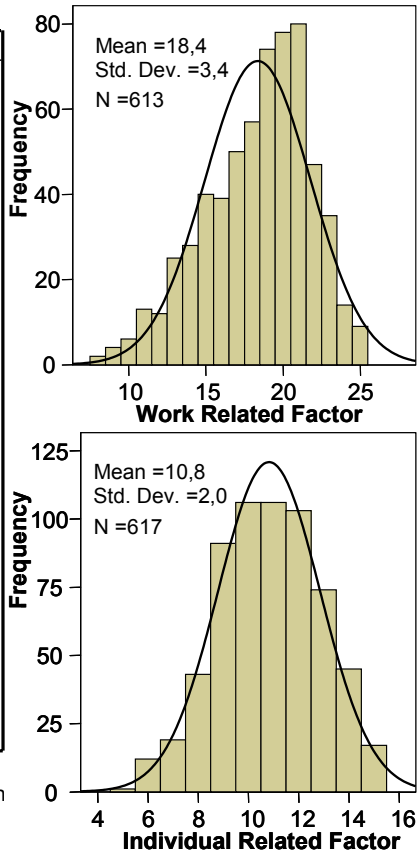


Figure 13. Rotated component matrix from the factor analysis of the psycho-social questionnaire with all four case companies, and histograms of the Work Related Factor (WRF) and Individual Related Factor (IRF) of the psycho-social questionnaire.

New variables were composed according to the results of the factor analysis. The Work Related Factor (WRF) was composed from questions 1, 2, 3, 7 and 8, thus giving a total range of 5 to 25 points (correlation coefficient with the original factor scores $r=0,987$, $p<0,001$). The Individually Related Factor (IRF) was composed from questions 4, 5 and 6, giving thus a total range of 3 to 15 points (correlation coefficient with the original factor scores $r=0,974$, $p<0,001$). Histograms of the calculated factor variables WRF and IRF are presented in Figure 13.

### *4.4 Worksite Fitness Program evaluation*

Worksite Fitness Programs of the case companies were evaluated through a qualitative procedure according to behaviour modification (BM) theory (see Bandura 1969). Behaviour modification is a framework which sets clearly defined steps for a health promotion program. In this study, the framework presented by McAlister *et al.* (1982) was applied.

The evaluation of WFP was performed during the second, interpretative interviews in the case companies after the follow-up period. Two to four employees in each case company took part in this part of the interview. Table 3 shows the six elements of behaviour modification and the questions set by the researcher for the interviewees. The employees described their impressions of each element and gave their evaluation via the numbers one to five (1 = excellent, 2 = good, 3 = average, 4 = fair, 5 = poor).

Table 3. Evaluation procedure of the elements of behaviour modification in case companies.

| Element of Behaviour Modification | Action in Case Company (Questions by researcher in quotation marks) | Evaluation by employees |
|---|---|---|
| Knowledge | "What kind of knowledge (and information) is available for employees and how is this knowledge (and information) available for employees?" | |
| Persuasion | "What are the actions in persuasion, and who (position, expertise, etc) gives this persuasion?" | |
| Teaching skills | "What are the activities for teaching new skills in physical activity or different sports events?" | |
| Social support | "What kind of social support have you got to increase or maintain your physical activity pattern? How is this social support given to the | |
| Environment, facilities | "What are the facilities for the Worksite Fitness Program (sports events) and for commuting activities?" | |
| Organising WFP | "How is the Worksite Fitness Program organized in your company?" | |

In addition to the evaluation made by a few employees, the researcher made his evaluation based on all the material and knowledge of each case company's WFP.

The framework of the Social Cognitive Theory (Bandura 1986) was used when qualitative analyses of the environmental factors were carried out. Great attention was given to analysing the behaviour of management and occupational health care in this respect.

### *4.5 Intellectual Capital – assessment and measurement*

The purpose of assessing and measuring IC in this study was basically to discover the possible effects of physical activity patterns and physical fitness on IC and its components. These phenomena were to be measured in four follow-up case studies. In addition to this, certain IC-related factors were measured in more cross-sectional settings in the preliminary study (physical activity and fitness patterns vs. sick leave, perceived health and work ability estimations) and in case studies (in addition to previous company climate, job satisfaction and other psycho-social aspects). In this chapter, the assessment, measurement and reporting of IC in the case companies is presented. Figure 14 expresses the process as a whole.

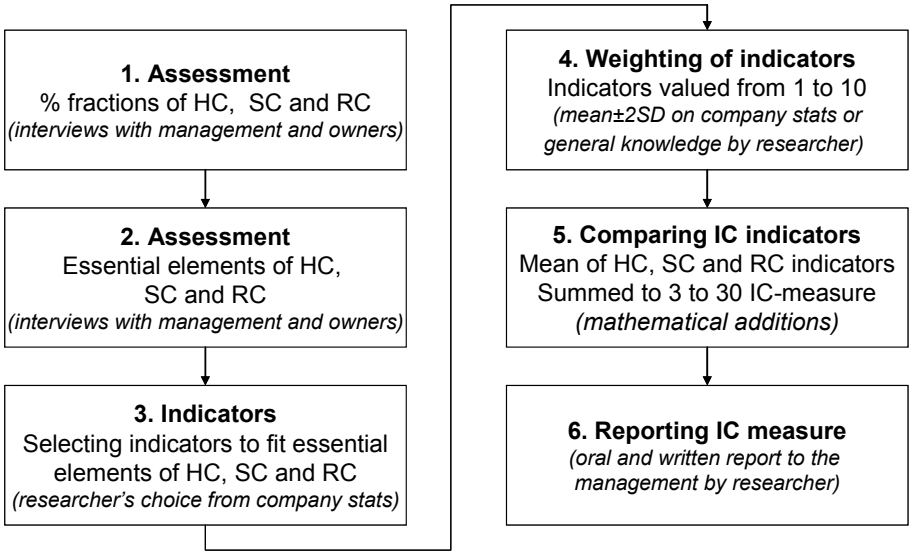


Figure 14. The process of IC's assessment, measurement and reporting in case companies.

In analysing the associations of physical activity and fitness patterns on the IC of the case companies (through chosen indicators), phases 4 to 6 in the IC process presented in Figure 14 have been unnecessary. The management of the case companies insisted on having an overview of their companies' IC. To fulfil those demands, an "IC measure" was constructed and presented to the management with great interest.

#### *4.5.1 Assessment of IC's components*

The main purpose of the assessment of Intellectual Capital (IC) was to define the fractions of different components of IC (Human Capital, HC, Structural Capital, SR and Relational Capital, RC) in each of the case companies. Thus, the differences in IC based on the industry and nature of each case company could be better taken into consideration (see, e.g. Meritum 2001, Andriessen 2004a, Mouritsen *et al.* 2004b, Sveiby 2004).

The assessment of IC was done through a qualitative process, where the interviews of management and owners were the main resource. Written material (Annual statements, client magazines, etc) and interviews of the personnel were used to confirm the definitions made by management and owners. In a semi-structured interview (Appendix 2), the structure of IC and some examples of the essential elements in each component of IC were first described to the interviewees by showing them the papers presented in Figure 15. The papers were shown and put away immediately, after which the interviewees were asked to prioritize the three component of IC: "which of the three components of IC is the most important in this (case) company, which is of secondary importance and which is least important?"

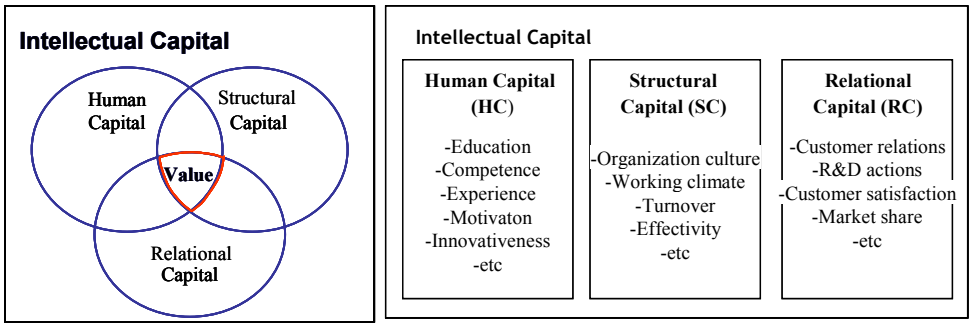


Figure 15. The material presented during interviews in assessing IC.

The management and owners were usually quite confident in defining this priority of IC components; in contrast, the personnel had more difficulties in this respect. The priorities were then weighted according to the weighting principles of Roos *et al.* (1997) in order to obtain the distribution of IC components in numerical form. In the assessment, the most important component received 3 points, the second received 2 points, and the least important, one point. To further calculations, the most important was weighted as 50% (3/6), the second as 33% (2/6) and the third as 17% (1/6). Other alternatives are presented by way of example in Table 4.

Table 4. Weighting principle in assessing IC's components.

| | priority (points) | weight | | priority (points) | weight | | priority (points) | weight |
|---|---|---|---|---|---|---|---|---|
| HC | 1 (3) | 50 % | | 1 (3) | 50 % | | 1 (2) | 33 % |
| SC | 2 (2) | 33 % | | 2 (1,5) | 25 % | | 1 (2) | 33 % |
| RC | 3 (1) | 17 % | | 2 (1,5) | 25 % | | 1 (2) | 33 % |

An average of all management members' and owners' (four to seven persons) definitions was defined to be the final assessment of IC in each case company.

*4.5.2 Assessment of IC's components' essential elements*

The assessment was used to define the essential elements of each component of IC. In this phase, the important features of, for example, Relational Capital were found in each case company. In the interviews of management members and owners, more deep and detailed questions were asked in order to define the essential elements of each IC component, for instance, "What are the most important elements (or phenomena) in Structural Capital, can you describe them according to your knowledge and experience of this company?" In this phase, the transcripts were analysed according to the principles of narrative analysis, using analytic induction and selective coding (Bryman & Bell 2003). In the final phase, two to four "essential elements" were defined by the researcher in each of the components of IC in each company (see next chapter for details).

Table 5. Principle in inducting IC-indicators from interviews, example from Case D.

| **Mentions in interviews** | **Essential elements of IC** | **Indicators** |
|---|---|---|
| **Human Capital** | **Human Capital** | **Human Capital** |
| attitude to develop him/herself | Competence of the personnel | Staff training |
| attitude to work hard | Competence of the personnel | Competence self-estimation |
| commitment in joint goals | Experience of the personnel | Job career |
| competence (8 mentions) | Values | No constant indicator found |
| education | | |
| experience | | |
| values (3 mentions) | | |
| **Structural Capital** | **Structural Capital** | **Structural Capital** |
| commitment in work | Job satisfaction | Job satisfaction |
| efficient processes (2 mentions) | Work unit climate | Social relationships |
| job satisfaction | Work unit climate | Satisfaction to management |
| long job careers | Efficiency of work | Process time |
| management style (4 mentions) | | |
| team work | | |
| work unit climate (4 mentions) | | |
| **Relational Capital** | **Relational Capital** | **Relational Capital** |
| community responsibility | The quality of work | Service feedback |
| co-operation in community level (7 mentions) | co-operation in community level | No constant indicator found |
| customer satisfaction (2 mentions) | | |
| effective processes (2 mentions) | | |
| quality of service | | |

*4.5.3 Indicators of IC*

The next phase in assessing and measuring IC was to define specific indicators for the essential elements of each IC component. In this process, the indicators or measures each case company had were utilized. In some cases, the original indicators were recalculated to produce more comprehensive indicators; these are discussed in more detail in

section 4, where the results of the case companies are presented. The choice of each indicator was made by the researcher after the interpretative interviews with the management. For some essential elements, no indicators were found in the company's measures. In those cases, these essential elements had to omitted from the analysis of IC. This was the case for, for example, job satisfaction for case companies A, B and C, where the questionnaire in job satisfaction changed during the follow-up period. The exact descriptions of each indicator used are given in Appendixe 5.

### *4.5.4 Weighting and scaling of the IC-indicators*

To build up the IC monitor, the IC indicators were weighted and scaled to obtain a universal and sensitive scale of one to ten for each indicator. In this phase, weighting would mean to set each indicator a functional lower and upper limit (compare Sa´enz 2005). For example, in typical feedback indicators, where the scale is given from 1 to 5, this would mean setting a new scale from 3,5 to 4,5 (if all the given feedback values are usually in a range of 3,7 to 4,2). Weighting would thus make the indicators operate more sensitively, scaling them would put all indicators in the same line. In the weighting procedure, company-based data was used. Based on the indicator's average (±2SD), a calculation was made to set the indicator's lower (average – 2SD) and upper (average + 2SD) limit. This range would usually cover 90% of individual values of indicators, and in most indicators the year to year changes were relatively small. When no SDs were available, the researcher estimated lower and upper limits according to his best knowledge from the literature.

The scaling procedure was a purely mathematical matter. In each of the indicators, the lower limit was given a value of one and the upper limit a value of ten. To give an example, the project feedback in case company A had an average of 3,84 on customer feedback (range 1 to 5) and an SD of 0,24. Instead of using the range of one to five, an effective scale of 3,37 to 4,32 was utilized. Thus 3,37 equalled 1,0 and 4,32 10,0, and, for example, an original value of 4,00 gave a scaled value of 7,0 and 3,6 a scaled value of 3,2.

To give an example of weighting procedure, the indicators of case company A are presented in Table 6 over the period in original figures, lower and upper limits, and weighted and scaled figures respectively.

Table 6. The indicators of IC in case company B over the period 2001-2004 in original figures, lower and upper limits, and weighted and scaled figures.

| **Case B.** | **Human Capital** | | | | **Structural Capital** | | | **Relational Capital** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Original indicator values | JC | CPM | CMW | ST | TSP | PSW | CW | CB | PF | MF |
| y. 2001 | 11,0 | 198 | 386 | 7,0 | 101 | 4,5 | 61,0 | 3,7 | 3,5 | 4,0 |
| y. 2002 | 11,8 | 152 | 354 | 5,2 | 101 | 5,2 | 60,0 | 3,7 | 3,7 | 3,9 |
| y. 2003 | 11,2 | 150 | 369 | 4,2 | 104 | 6,2 | 64,7 | 3,9 | 3,6 | 3,9 |
| y. 2004 | 11,6 | 158 | 376 | 4,3 | 100 | 9,1 | 66,6 | 4,1 | 3,8 | 4,1 |
| min. value | 11,0 | 150 | 354 | 4,2 | 100 | 4,5 | 60,0 | 3,7 | 3,5 | 3,9 |
| max. value | 11,8 | 198 | 386 | 7,0 | 104 | 9,1 | 66,6 | 4,1 | 3,8 | 4,1 |
| average | 11,4 | 164,5 | 371,3 | 5,2 | 101,5 | 6,3 | 63,1 | 3,85 | 3,65 | 3,98 |
| SD | 0,4 | 22,6 | 13,5 | 1,3 | 1,7 | 2 | 3,1 | 0,19 | 0,13 | 0,1 |
| given min. | 10,7 | 119,3 | 344,3 | 2,6 | 105 | 10,3 | 56,9 | 3,47 | 3,39 | 3,78 |
| given max. | 12,1 | 209,7 | 398,2 | 7,8 | 98 | 2,3 | 69,3 | 4,23 | 3,91 | 4,17 |
| | | | | | | | | | | |
| Scaled indicator values | JC | CPM | CMW | ST | TSP | PSW | CW | CB | PF | MF |
| y. 2001 | 3,0 | 8,8 | 8,0 | 8,7 | 6,1 | 7,5 | 4,0 | 3,7 | 2,9 | 6,1 |
| y. 2002 | 7,9 | 4,3 | 2,6 | 5,5 | 6,1 | 6,7 | 3,3 | 3,7 | 6,4 | 3,7 |
| y. 2003 | 4,2 | 4,1 | 5,1 | 3,8 | 2,3 | 5,4 | 6,7 | 6,1 | 4,6 | 3,7 |
| y. 2004 | 6,8 | 4,9 | 6,3 | 4,0 | 7,4 | 2,4 | 8,1 | 8,4 | 8,1 | 8,4 |

The abbreviations in Table 6 are; JC = job career, CPM = competence in project management, CMW = competence in maintaining work, ST = staff training, TSP = time spent in projects, HRC = HR-capital, PSW = productivity of system work, CB = customer benefit index, PF = project feedback, MF = maintaining feedback.

*4.5.5 Constructing the IC-measure*

The IC measure was constructed based on the qualitative assessment of the fractions of the components of IC (HC, SC and RC) and on the weighted and scaled figures of chosen indicators. The IC measure's maximum value was chosen to be 30 units, composed of three summed pieces of 10 units in the event that all IC components are of equal importance. For non-equal situations, a formula value = fraction/33.3*100 was utilized, where the fraction was the assessed fraction of a particular IC component. Table 7 presents some examples of the procedure.

Table 7. Example of IC-components values in different priorities of components.

| | fractions | value | | fractions | value | | fractions | value |
|---|---|---|---|---|---|---|---|---|
| HC | 33,3 | 10 | | 40 | 12 | | 30 | 9 |
| SC | 33,3 | 10 | | 35 | 10,5 | | 50 | 15 |
| RC | 33,3 | 10 | | 25 | 7,5 | | 20 | 6 |
| IC | 100 | 30 | | 100 | 30 | | 100 | 30 |

In our example, case company A, the component had the following values: HC 43,4% (value between 1,3 – 13,0), SC 32,7% (value between 0,95 – 9,5) and RC 24,9% (value between 0,75 – 7,5).

To obtain a value for each IC component, an average of individual indicators was calculated for each year. This average was weighted according to the principle described in the previous chapter. For example, if in Case A the average of HC indicators were 10,0 in some year, the final value for HC would be 13,0. Correspondingly, a value of 10,0 for RC would have produced a final value of 7,5. Table 8 presents the averages of weighted and scaled indicators on the left and the final IC monitor on the right.

Table 8. Averages of IC-components (on left) and weighted and scaled components (on right) in Case A.

| Averages of indicators in IC-components | | | | | Weighted average of indicators in IC-components | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | HC | SC | RC | IC | | HC | SC | RC | IC |
| y. 1999 | 4,9 | 4,8 | 3,6 | 13,4 | y. 1999 | 6,4 | 4,6 | 2,7 | 13,8 |
| y. 2000 | 6,1 | 5,0 | 4,8 | 15,9 | y. 2000 | 7,9 | 4,7 | 3,6 | 16,2 |
| y. 2001 | 5,4 | 4,9 | 5,9 | 16,2 | y. 2001 | 7,0 | 4,7 | 4,4 | 16,1 |
| y. 2002 | 4,6 | 7,9 | 3,8 | 16,2 | y. 2002 | 5,9 | 7,6 | 2,8 | 16,3 |
| y. 2003 | 5,4 | 6,1 | 7,0 | 18,5 | y. 2003 | 7,0 | 5,8 | 5,2 | 18,1 |
| y. 2004 | 6,6 | 5,3 | 7,9 | 19,8 | y. 2004 | 8,6 | 5,1 | 5,9 | 19,5 |

*4.5.6 Reporting of the IC measure*

The IC measure was reported to the CEO (or head) of each case company. In some cases, a presentation was also provided for other managers.

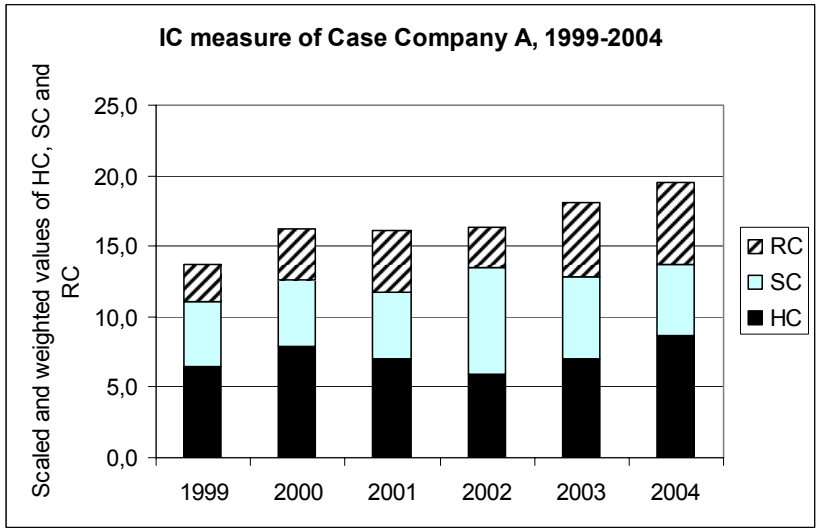


Figure 16. The IC-measure in case company A.

### *4.6 Qualitative methods used in the study*

Qualitative methods were used in this study to more deeply explore certain phenomena, such as the nature and contents of Intellectual Capital in the case companies, and interviewees' opinions and attitudes toward physical activity in general and WFP in particular. To achieve these goals, semi-structured interviews were utilized (Bryman & Bell 2003, Silverman 2005). In some aspects, more profound discourse analysis was used (Alvesson & Kärreman 2000, Potter 2004). In addition, wider material and researchers' conclusions were sources for analysing the case companies' WFP in frameworks of behavioural modification (Bandura 1969, McAlister *et al.* 1982) and social cognitive theory (Bandura 1986).

Interviews

Semi-structured interviews of 45 to 60 minutes (see Appendix 2 for details) were used to analyse certain phenomena, such as the nature and contents of Intellectual Capital in case companies, interviewees' opinions and attitudes toward physical activity WFP, and interviewees' interpretation of the results gained at the end of the follow-up periods in the case companies. All interviewees received beforehand a little (half page of A4) information on the study and the purpose of the interview. Interviews were carried out in privacy with the researcher in the case companies' meeting rooms. All speech was audio-taped and later transcribed for further analysis. The researcher also made notes during the interviews to help future analysis.

Transcripts were analysed partly through analytic induction and selective coding, and partly by coding into concepts and creating categories of the concepts (Bryman & Bell 2003). The results were presented in a descriptive manner to show interviewees' motives or opinions. All essential quotations were included in the text of the thesis. In interviews, the validity was increased by first doing two pilot interviews with managers M3 from Case A and M2 from Case B. In the pilot interviews, the semi-structured questionnaire was carefully examined and certain clarifying changes were made afterwards. Secondly, validity was increased by interviewing a relatively large number of people (nine to thirteen interviews per case company). In addition, summary tables were constructed to present the key findings from each subject. The tables were also a good way to avoid 'anecdotalism' (Silverman 2005) in the interview's conclusions. In validity discussion, double-hermeneutics (Giddens 1984) have to be taken into consideration in my study. This kind of double hermeneutic circle during the interview had been possible in the interviews concerning motives and the effects of physical activity. All transcripts were analysed carefully and objectively to ensure the reliability of the analysis.

Discourse analysis

To explain in more detail the management's role in WFP, a discourse analysis was carried out in cases A and B. The principles and methods presented by Alvesson & Kärreman (2000) and Potter (2004) were utilized. The analyses of the transcripts of the interviews of managers in case companies A and B were the basic sources for analysis as

described above; in addition, the researcher's notes and the companies' internal communication material was used.

Case study setting

To research the associations between WFP policy and IC a follow-up case study with companies A, B and C was planned, whereas in case D a traditional experimental setup was designed. During the study, case D was revealed to be a case study as well, because of the failures in data collection. In case D, the results of the Test-1 work unit were utilized for case study purposes; the rather independent role of the work units made that possible. In addition to the case study setting, all data gathered from case D's Test-2, Control-1, and Control-2 work units were utilized for cross-sectional analysis purposes. In that respect, the first fitness test results from each employee were utilized.

Analyses of company specific WFP and IC

In analysing the case companies' WFP as a whole, the framework of behavioural modification (BM), and social cognitive theory (SCT) were used. In analysing BM, a structured questionnaire with some numerical estimations was utilized in the employee interviews (see Table 3). In addition, the researcher used all information received and his knowledge of each case company's WFP to complete the analysis. In the framework of SCT, the main emphasis was to clarify the environmental aspects for the employees' change of physical activity habits. In this analysis, transcripts of interviews of managers and occupational health care experts were utilized, as well as notes made by the researcher during the study.

In constructing the IC measure, qualitative methods were utilized to assess the fractions (or weights) of different IC components as well as the essential elements of HC, SC and RC. In these phases, transcripts of interviews with management and owners were analysed based on analytic induction and selective coding (Bryman & Bell 2003). In choosing indicators for the assessed essential elements of HC, SC and RC, wider interpretative conclusions were made by the researcher. In that phase, the measurement tools the case companies utilized had a great impact.

### *4.7 Validity and reliability of the methods used*

The validity of the physical activity questionnaire was confirmed in several expert focus group discussions in companies before the questionnaires were delivered to the employees. This took place during the preliminary study in 1996-1998. In those expert meetings (managers responsible of work ability and WFP, occupational health physicians and physiotherapists), all questions were analysed carefully to ensure their validity. Some of the questions were already scientifically validated (see Tuomi *et al.* 1998).

The reliability of the physical activity questionnaire was examined in case company D, where fitness testing protocol and psycho-social questionnaires were used over the same time period in 2005. In the physical testing protocol, 239 employees took part and in the psycho-social questionnaire, 290 employees answered. No differences in physical activity patterns were found: the PAI in the psycho-social questionnaire setting was 34,9%,

and in the fitness testing setting it was 33,8% (Z-value in Mann-Whitney U test Z=-0,53, p=ns).

In the fitness testing (bicycle ergometer test, Lange Andersen 1971), the reliability has been evaluated by Greiwe *et al.* (1995), who found that the correlation coefficient between repeated submaximal bicycle ergometer test is r=0,863. On the other hand, the validity of the bicycle submaximal ergometer test used has been studied, and it seems that the test will give results sufficiently close to those by more accurate methods (Louhevaara *et al.* 1980, Takalo 2001).

# 5 RESULTS OF THE PRELIMINARY STUDY

## *5.1 Background for the preliminary study*

The background for the preliminary study lies in the practical, physical-activity-promoting work carried out in the Finnish Sport for All Association. In 1997, a co-operative process ("Fitness network") began with 15 large companies to develop and to unify sport for all and health-enhancing physical activity events at worksites. To change the management and promotion of physical activity in companies, top management and human resource functions were invited to join the process. Earlier in the 1970's-80's WFPs were governed mainly by voluntary sport for all bodies in companies, and in the early 1990's, occupational health took the prominent role in developing WFP in a framework of maintaining work ability (MWA).

### *5.1.1 Physical activity and fitness in a framework of Human Resource Accounting*

The Fitness Network process included two main areas, developing health-enhancing physical activity services throughout the country and developing the management of physical activity by creating measurement and indication systems. The framework for the latter was Human Resource Accounting (HRA), which at that time (early 1998) was the focus of much interest. The model presented by Ahonen (1998, p. 53) was taken as a guideline for the work.

The developmental process of measurement, indicators and thus basics for management in the field of physical activity was named the "Physical activity – Human Resource Accounting" (PA-HRA) project. After 18 months, principles for measuring and managing physical activity could be drawn up.

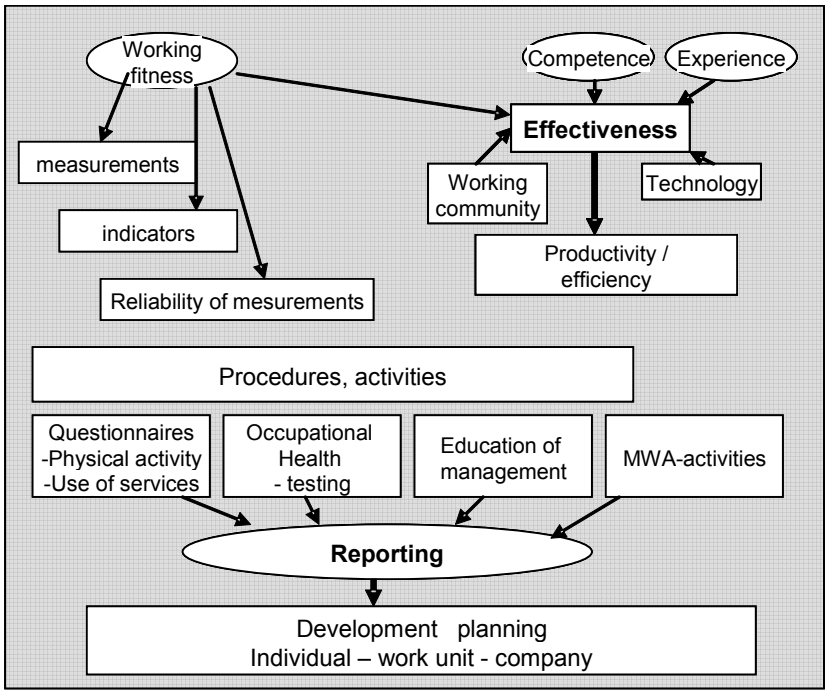


Figure 17. Principles in developing measurement and management system in Worksite Fitness Programs (from the PA-HRA-project's report 4th October 1999).

*5.1.2 Basics for the indicators of physical activity and physical fitness in a Human Resource Management and Human Resource Accounting framework*

According to the guidelines presented in Figure 17., the following indicators were determined.

**Worksite Fitness Program Indicator (WFPI)**: indicates the fraction of employees taking part regularly in worksite fitness programs. WFPI will be determined by a standardized questionnaire. Worksite Fitness Program Indicator is thus a percentage number of the personnel.
**Worksite Fitness Program Event Indicator (WFPE)**: indicates the fraction of employees taking part in worksite fitness program events. WFPE will be determined by a standardized questionnaire. WFPE is thus a percentage number of the personnel.
**Physical Activity Indicator (PAI)**: indicates the fraction of employees who are physically active enough in response to enhance their health. PAI will be determined by a standardized questionnaire. Physical Activity Indicator is thus a percentage number of the personnel.
**Physical Fitness Indicator (PFI)**: indicates the fraction of employees who are fit enough with a certain criteria. PFI will be determined by a standardized fitness testing protocol. Physical Fitness Indicator is thus a percentage number of the personnel.

In collecting data for indicators described above, great care has been taken to ensure the reliability of the data collection.

## *5.2 Surveys on Physical Activity patterns*

### *5.2.1 Material*

Physical activity questionnaires were collected from 33 companies over the period 1996-2004. The questionnaires were part of a business co-operation between the companies and the Finnish Sport for All Association, so the companies paid for the questionnaires.

The physical activity questionnaires were responded by 14420 persons of the sample total of 24410 employees. Basic characteristics will be presented in Table 9. Standardized questionnaires were mailed to the employees' home address and the questionnaires were returned in closed envelopes to Finnish Sport for All Association. All the questionnaires were anonymous. All the data was coded with highest possible exactness in Excel-worksheets for descriptive analysis and later imported to SPSS for further statistical analysis.

### *5.2.2 The physical activity patterns*

#### 5.2.2.1 The amount and intensity of physical activity

The purpose of analysing physical activity patterns in this study was twofold; first the collected data was used to create Physical Activity Indicator for company level measure of physical activity. Second purpose was to examine more closely the effects or associations between physical activity patterns and selected wellness parameters like perceived health, sick leave and self-assessed work ability estimations. For the first purpose a general overview of the results is given in Table 9. The second aspect is written in chapter 5.3.

Table 9. The material for physical activity questionnaires in 33 companies.

| | mean | SD | | **company-level statistics** | mean | SD |
|---|---|---|---|---|---|---|
| personnel | 1548 | 3019 | | PA-frequency | 2,55 | 0,3 |
| sample | 740 | 649 | | PA minutes/week | 131 | 13,5 |
| answerers | 437 | 376 | | Comm.PA-frequency | 1,3 | 0,8 |
| response rate | 64 | 11 | | Comm.PA minutes/week | 42,6 | 28,8 |
| male % | 59 | 17 | | Total PA frequency | 3,82 | 0,9 |
| female % | 41 | 17 | | Total Amount of PA | 171,9 | 31,5 |
| under 30 years | 15 | 11 | | Intensity of PA | | |
| 30-39 years | 28 | 7 | | no activity | 3,0 | 2,0 |
| 40-49 years | 34 | 8 | | light | 15,0 | 4,5 |
| 50-59 years | 21 | 11 | | moderate | 62,0 | 5,7 |
| over 60 years | 1 | 3 | | vigorous | 19,0 | 5,6 |

In Table 9 mean (±SD) figures of the data (amount of personnel, sample size, answerers and response rates, distribution between male and female, distribution between different age groups), and mean (±SD) results of the basic characteristics of physical activity (leisure time physical activity frequency [PA-frequency] and total amount of leisure time physical activity [PA minutes/week], commuting activity frequency [Comm.PA-frequency] and total amount of commuting activity [Comm.PA minutes/week], and distribution of answers in the intensity of leisure time physical activity [no activity, light, moderate and vigorous intensity]).

Table 9. shows, that the average frequency for leisure time physical activity was 2,55 times a week and the total duration 131 minutes a week. Differences between companies were 2,03 – 3,15 times a week and 101-157minutes per week, respectively. Describing the results in more detail, one can say that women engage in leisure time physical activity slightly more often than men. That said, the duration of activity is slightly longer for men. The total amount of leisure time physical activity did not differ between males and females (independent t-test, t=-0,96, p=ns)

In commuting activity relatively large differences between companies and age groups were found. Women are slightly more active in commuting activity compared to men (43,8±5,5 minutes/week vs. 36,2±7,7 minutes/week; difference in total amount of commuting activity in week t=-5,96, p<0,001, independent t-test).

Besides gender, activity in WFP, age group and nature of work influenced on the total amount of physical activity.

Formula 3.

APA = 44,29*WFPI-4,89*AG+8,73*NW-6,35*gender+166,18, where
APA=total amount of physical activity (minutes/week)
WFPI=activity in WFP, t=19,10, p<0,001
AG=age group, t=-4,74, p<0,001
NW=nature of work (1=white collar, 0=blue collar), t=4,59, p<0,001
gender (1=male, 0=female), t=-2,80, p<0,01

Respondees were asked to determine the intensity of their physical activity using one of four alternatives. Table 9. shows that 62% of all subjects carried out leisure time physical activity at a moderate intensity, while 19% at a vigorous intensity The intensity of commuting physical activity was clearly lower. The results are in good agreement with earlier findings in Finland (Suomen Kuntourheiluliitto 2002, Suomen Kuntoliikuntaliitto 2006). The difference between male and female subjects was statistically significant (Pearsson Chi-square test, chi-square value=366,1, p<0,001), men having higher intensity. Regarding age groups, higher intensities dominated in younger age groups; the differences were statistically significant (Pearsson Chi-square test, chi-square value for male 468,6, p<0,001 and for female 158,1, p<0,001).

As a whole the intensity of physical activity was mostly based on leisure time physical activity. In this data leisure time physical activity's intensity was higher than commuting physical activity's intensity in 75,7% of subjects. 21,1% of respondents had the same intensity both in leisure time physical activity and commuting activity, and only 3,2% of employees had higher intensity in commuting physical activity.

In determining the physical activity groups and hence the Physical Activity Indicator, the dominant intensity was used for each individual. As described in the section on methods above, the dominance was based upon quantitative analysis. In most cases (97%) the fitness activity was dominant (usually moderate or vigorous).

#### 5.2.2.2 Physical activity groups and Physical Activity Indicator

Physical activity groups were determined based on the frequency and intensity of physical activity. Furthermore, the Physical Activity Indicator (PAI) was calculated as a sum of health-related physical activity groups and fitness-sports groups.

Table 10. Distribution of physical activity groups and the Physical Activity Indicator (PAI) in companies.

| | P | AL | PH | FS | PAI | | P | AL | PH | FS | PAI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| co-1 | 32,4 | 28,8 | 16,2 | 22,5 | 38,7 | co-19 | 15,2 | 35,5 | 30,0 | 19,3 | 49,2 |
| co-2 | 25,1 | 35,2 | 26,3 | 13,4 | 39,7 | co-20 | 15,7 | 37,6 | 36,2 | 10,5 | 46,7 |
| co-3 | 25,2 | 41,2 | 13,4 | 20,1 | 33,6 | co-21 | 10,3 | 37,5 | 34,2 | 17,9 | 52,2 |
| co-4 | 21,9 | 48,9 | 16,4 | 12,8 | 29,2 | co-22 | 22,0 | 37,0 | 28,5 | 12,5 | 41,0 |
| co-5 | 19,7 | 35,0 | 31,4 | 13,9 | 45,3 | co-23 | 16,9 | 35,6 | 26,3 | 21,1 | 47,5 |
| co-6 | 35,0 | 35,6 | 13,9 | 15,5 | 29,4 | co-24 | 19,0 | 37,9 | 32,8 | 10,3 | 43,1 |
| co-7 | 18,1 | 30,6 | 37,5 | 13,9 | 51,4 | co-25 | 35,5 | 31,6 | 27,6 | 5,3 | 32,9 |
| co-8 | 42,1 | 42,1 | 6,8 | 9,1 | 15,8 | co-26 | 5,8 | 34,1 | 46,4 | 13,7 | 60,1 |
| co-9 | 5,2 | 30,3 | 46,4 | 18,1 | 64,5 | co-27 | 9,3 | 58,1 | 23,3 | 9,3 | 32,6 |
| co-10 | 16,0 | 32,4 | 38,4 | 13,2 | 51,6 | co-28 | 12,0 | 44,2 | 32,7 | 11,1 | 43,8 |
| co-11 | 17,3 | 42,9 | 16,5 | 23,3 | 39,8 | co-29 | 12,9 | 43,2 | 32,0 | 11,9 | 43,9 |
| co-12 | 20,2 | 30,9 | 30,2 | 18,6 | 48,8 | co-30 | 16,7 | 37,2 | 32,2 | 13,9 | 46,2 |
| co-13 | 9,2 | 37,8 | 42,2 | 10,8 | 53,0 | co-31 | 24,7 | 44,8 | 15,2 | 15,3 | 30,5 |
| co-14 | 20,8 | 37,7 | 26,8 | 14,7 | 41,6 | co-32 | 11,0 | 60,4 | 16,5 | 12,1 | 28,6 |
| co-15 | 15,3 | 26,3 | 44,9 | 13,6 | 58,5 | co-33 | 22,2 | 50,8 | 19,6 | 7,4 | 27,0 |
| co-16 | 15,0 | 26,3 | 37,5 | 21,3 | 58,8 | average | 19,0 | 38,2 | 28,1 | 14,8 | 42,8 |
| co-17 | 17,6 | 40,7 | 24,9 | 16,7 | 41,6 | SD | 8,4 | 8,0 | 10,2 | 4,7 | 10,9 |
| co-18 | 21,3 | 31,1 | 23,2 | 24,3 | 47,6 | | | | | | |

The abbreviations in Table 10 are P=passive, AL=active lifestyle, PH=physical activity for health, FS=fitness sports

In Figure 18, the distribution of PAI values of different companies is given.

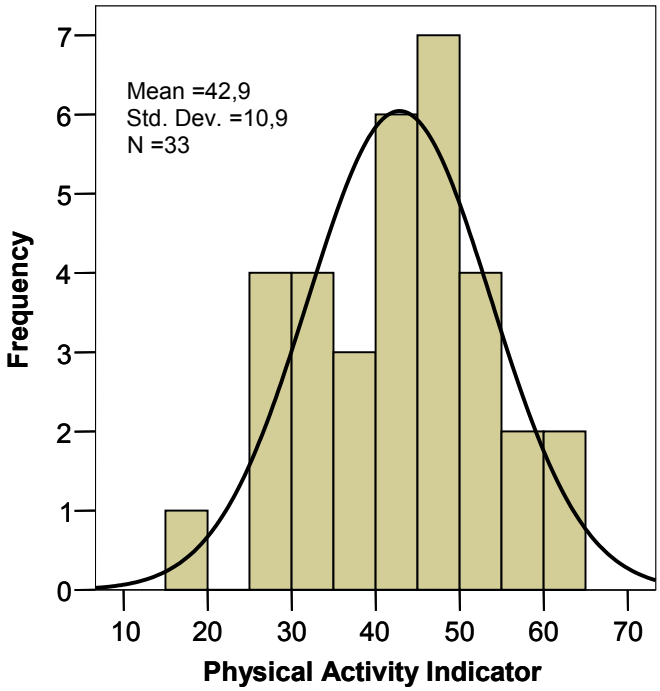


Figure 18. Distribution of Physical Activity Indicator values in 33 companies.

The average (and standard deviation) for Physical Activity Indicator was 42,9% (±10,8%) in the 33 companies in the sample. As a result of that, a criterion for company's PAI was created.

Table 11. Criteria for Physical Activity Indicator

| | PAI |
|---|---|
| poor (x – 2SD) | 21,3 |
| fair (x – SD) | 32,1 |
| average (X) | 42,9 |
| good (x + SD) | 53,7 |
| excellent (x + 2SD) | 64,5 |

The criteria shown in Table 11. were some of the main results of the preliminary study and formed the basis for evaluation of each company's WFP policy. Principally, one of the main goals in WFP was enhancing the level of physical activity of the employees.

Table 12. Distribution of physical activity groups and the Physical Activity Indicator by different age groups and in male (m) and female (f) subjects.

| | | active | phys.act. | fitness- | |
|---|---|---|---|---|---|
| | passive | lifestyle | for health | sports | PAI |
| m under 30y | 20,3 | 27,1 | 21,6 | 31,1 | 52,7 |
| m 30-39y | 24,1 | 33,4 | 19,6 | 22,8 | 42,4 |
| m 40-49y | 24 | 39,6 | 21,7 | 14,7 | 36,4 |
| m 50-59y | 23,6 | 44,4 | 22,6 | 9,5 | 32,1 |
| m over 60y | 23,6 | 46,7 | 20 | 9,7 | 29,7 |
| **male** | **23,5** | **37,5** | **21,3** | **17,7** | **39,0** |
| f under 30y | 12,5 | 36,1 | 32,6 | 18,8 | 51,4 |
| f 30-39y | 18,1 | 36,5 | 33,2 | 12,2 | 45,4 |
| f 40-49y | 16,5 | 42,1 | 32,6 | 8,8 | 41,4 |
| f 50-59y | 16,1 | 46 | 32,7 | 5,3 | 38,0 |
| f over 60y | 17,5 | 38,3 | 41,7 | 2,5 | 44,2 |
| **female** | **16,2** | **40,6** | **33** | **10,2** | **43,2** |
| **all** | **20,9** | **38,6** | **25,4** | **15,1** | **40,5** |

The PAI was significantly higher for women (43,2%) compared to men (39,0%) (Pearsson Chi-square test, chi-square value=23,6, p<0,001). In further analysis, the PAI was dependent on age and nature of work. Figure 19 summarizes the findings. The blue collar workers in the age group over 60 years were so few, that the results were excluded.

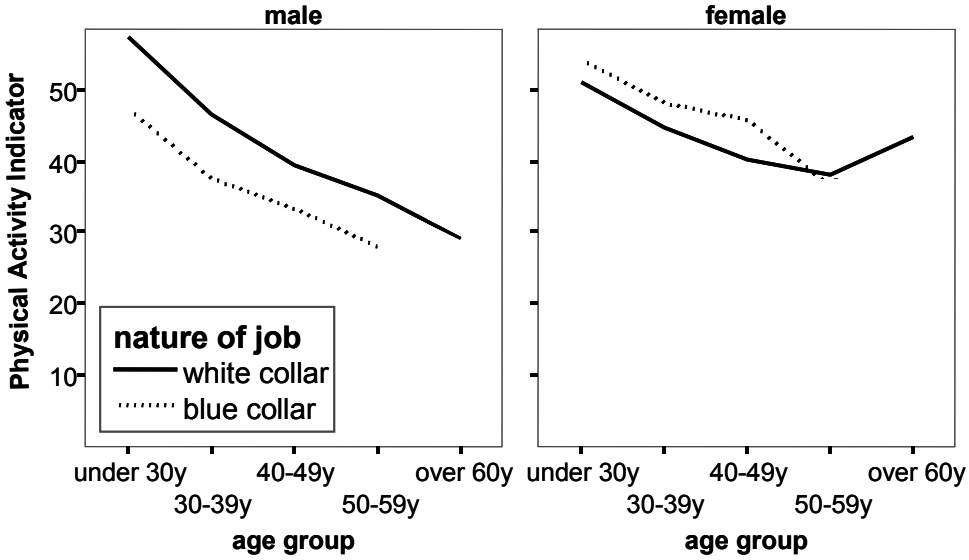


Figure 19. Physical Activity Indicators in different age groups according to gender and nature of job.

The PAI was higher in younger age groups both in male and female subjects (Pearsson Chi-square test, chi-square value for male =162,4, p<0,001 and for female = 40,9, p<0,001). In men the white collar workers (42,1%) had a significantly higher PAI than blue collar (35,2%) (Pearsson Chi-square test, chi-square value=45,3, p<0,001), while in women the situation was opposite (44,9% for blue collar and 42,7% for white collar), but not statistically significant.

5.2.2.3 Specific sports and forms of physical activity

Specific sports (sport events) were of some interest in the study. Generally, in Finland the most popular sports have been walking, cross-county skiing, bicycling, jogging and swimming (Suomen Kuntoliikuntaliitto 2006). In this study, the sports events were asked in the questionnaire and the results are presented as percentage fractions of exercisers in different subgroups in major sports as well as in certain groups. The major events were walking, bicycling, gym exercise, jogging, cross-county skiing, swimming, gymnastics, Nordic walking and roller skating. Groups were gathered into team sports (ball games like floorball, volleyball. football, basketball, ice-hockey, etc), racquet sports (tennis, badminton, squash, table tennis) and music and martial sports (aerobics, bailatino, tai chi, karate, Pilates, spinning, etc). In worksite fitness programs, the most popular events were gym exercise, swimming, gymnastics, music and martial sports, team sports and racquet sports. For still compact the results, all sport events were divided into three main groups by their nature:

- sports for basic physical activity (walking, bicycling, jogging, cross-county skiing, Nordic walking and roller skating
- sports for musculo-skeletal fitness (gym exercise, swimming, gymnastics, and music and martial sports)
- ball games (team and racquet sports)

Table 13., which summarizes the results, shows that nearly 70% of employees were active in sports for basic physical activity, 45% were active in improving musculo-skeletal fitness and 22% were playing some kind of ball games.

Table 13. Sport specific physical activity of all subjects: by gender and age group.

| | | gender | | male, age groups | | | | | female, age groups | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| spesific sport | all | male | female | under 30y | 30-39y | 40-49y | 50-59y | over 60 y | under 30y | 30-39y | 40-49y | 50-59y | over 60 y |
| walking | 46,4 | 41,2 | 56,6 | 24,4 | 33,8 | 44,0 | 53,6 | 56,7 | 48,4 | 53,2 | 58,5 | 62,5 | 61,4 |
| bicycling | 22,7 | 22,0 | 24,0 | 19,6 | 19,6 | 23,2 | 24,5 | 21,0 | 17,0 | 22,8 | 25,3 | 28,2 | 26,3 |
| gym exercise | 20,2 | 19,2 | 22,0 | 32,6 | 22,8 | 15,5 | 13,9 | 14,0 | 30,6 | 24,7 | 18,8 | 18,4 | 19,3 |
| jogging | 19,1 | 20,5 | 16,5 | 20,7 | 21,8 | 21,3 | 17,7 | 16,6 | 21,6 | 19,0 | 15,3 | 12,7 | 10,5 |
| cross country | 18,7 | 20,2 | 15,8 | 7,3 | 16,1 | 22,9 | 27,1 | 33,1 | 5,3 | 13,4 | 17,7 | 23,0 | 13,2 |
| swimming | 15,7 | 14,2 | 18,5 | 12,6 | 14,3 | 13,9 | 15,4 | 16,6 | 17,0 | 19,2 | 17,2 | 19,5 | 27,2 |
| team sports | 15,2 | 19,5 | 6,9 | 31,9 | 26,8 | 16,6 | 9,7 | 5,1 | 9,0 | 8,8 | 6,2 | 4,5 | 5,3 |
| music and martial sports | 13,0 | 7,9 | 23,1 | 9,9 | 6,7 | 7,6 | 8,8 | 5,7 | 30,7 | 23,4 | 19,5 | 22,1 | 28,9 |
| gymnastics | 11,9 | 6,5 | 22,5 | 3,6 | 5,6 | 6,6 | 8,7 | 11,5 | 15,4 | 20,5 | 24,4 | 25,5 | 36,0 |
| racquet sports | 9,7 | 10,8 | 7,5 | 13,0 | 13,2 | 10,2 | 7,6 | 15,9 | 9,1 | 7,2 | 7,3 | 7,4 | 4,4 |
| nordic walking | 4,7 | 3,0 | 7,9 | 0,3 | 1,3 | 3,3 | 6,1 | 5,7 | 1,5 | 4,7 | 8,3 | 14,0 | 17,5 |
| roller skating | 2,6 | 2,8 | 2,2 | 4,4 | 3,0 | 2,9 | 1,9 | 1,9 | 2,5 | 2,9 | 1,8 | 1,9 | 0,0 |
| | | | | | | | | | | | | | |
| Basic sports | 69,6 | 65,9 | 76,7 | 50,0 | 60,1 | 70,1 | 74,7 | 74,5 | 67,3 | 74,8 | 78,4 | 82,7 | 78,9 |
| MSC-sports | 44,9 | 37,2 | 59,9 | 44,6 | 38,9 | 33,7 | 37,0 | 34,4 | 64,9 | 60,2 | 58,1 | 58,1 | 69,3 |
| Ball games | 22,1 | 26,7 | 13,1 | 39,4 | 34,2 | 24,0 | 15,6 | 19,7 | 16,5 | 14,2 | 12,9 | 10,5 | 8,8 |

Besides the general features discussed above, Table 13. shows certain age- and gender-related differences in sport-specific physical activity. According to the age groups, younger employees are more active in ball games and less active in basic physical activity than older age groups. Inside the basic physical activity sports, the phenomenon occurs from more intensive sports towards less intensive sports as employees get older. Also, some trends and Finnish sports traditions can be seen in the results, for instance activity in cross-country skiing is much higher in older age groups than younger, although the intensity trend demonstrated earlier would lead one to expect skiing to be a sport for younger people.

Differences between genders are obvious; women are more interested in gymnastics and music sports and men, on the other hand, in ball games. In basic physical activity, women are also more active in walking compared to men.

The findings are to a great extent in line with information found from Finland in population sample studies (Suomen Kuntourheiluliitto 2002, Suomen Kuntoliikuntaliitto 2006). The sports-specific results in WFP will be discussed later in section 5.2.3.2.

### *5.2.3 Activity in Worksite Fitness Program*

#### 5.2.3.1 Worksite Fitness Program Indicator

The Worksite Fitness Program Indicator (WFPI) was determined to be the fraction (%) of employees who regularly took part in WFP activities supported by employer.

Table 14. The Worksite Fitness Program Indicator (WFPI) and the average frequency WFP activity of those active in companies.

| | | WFP-act | | | WFP-act | | | WFP-ac |
|---|---|---|---|---|---|---|---|---|
| | WFPI | times/week | | WFPI | times/week | | WFPI | times/week |
| co-1 | 50 | 1,2 | co-12 | 27 | 1,7 | co-23 | 39 | 1,7 |
| co-2 | 46 | 2,2 | co-13 | 50 | 1,8 | co-24 | 43 | 1,9 |
| co-3 | 53 | 1,8 | co-14 | 37 | 2,2 | co-25 | 15 | 1,1 |
| co-4 | 39 | 1,8 | co-15 | 42 | 1,3 | co-26 | 55 | 1,4 |
| co-5 | 30 | 3,9 | co-16 | 16 | 2 | co-27 | 40 | 1,8 |
| co-6 | 32 | 0,7 | co-17 | 38 | 1,7 | co-28 | 44 | 1,3 |
| co-7 | 47 | 1,4 | co-18 | 33 | 1,7 | co-29 | 47 | 1,5 |
| co-8 | 9 | 1,4 | co-19 | 44 | 2,6 | co-30 | 38 | 1,7 |
| co-9 | 28 | 1,7 | co-20 | 48 | 1,5 | co-31 | 43 | 0,7 |
| co-10 | 32 | 2 | co-21 | 18 | 1,5 | co-32 | 52 | 1,4 |
| co-11 | 63 | 2,1 | co-22 | 33 | 1,4 | co-33 | 52 | 1,1 |
| | | | | | | | | |
| **average** | **38,9** | | | | | | | |
| **SD** | **12,5** | | | | | | | |

In the companies involved the WFPI was on the average 38,9%, which is in the same range that employers estimated (34-39%) in Worksite Fitness Program Barometer in 2002, 2003 and 2005 in Finland (Työpaikkaliikunnan barometri 2005). The result on an individual basis concluded that 30,1% of employees were active in WFP. The difference with the company based finding was because of one large company had relatively low WFP activity (nr 8).

WFPI was significantly higher for women (31,9%) compared to men (29,1%) (Pearsson Chi-square test, chi-square value = 11,9, $p<0,001$). The nature of work had even higher impact as demonstrated in Figure 20. The WFPI for white collar workers was 34,5% and for blue collar 22,5%, chi-square value for all respondents =215,1, $p<0,001$. With male subjects WFPI was for blue collar workers 21,8% and for white collar 34,8% (chi-square value = 185,8, $p<0,001$); for female the respective values were for blue collar workers 25,3% and for white collar workers 33,6% (chi-square value = 26,3, $p<0,001$). WFPI differed between age groups with male subjects; younger age groups were more active in WFP than older age groups (Pearsson Chi-square test, chi-square value = 80,6, $p<0,001$). With female subjects no differences between age groups were found. These findings are summarized in Figure 20, where the blue collar workers in the age group over 60 years were excluded because of their few number.

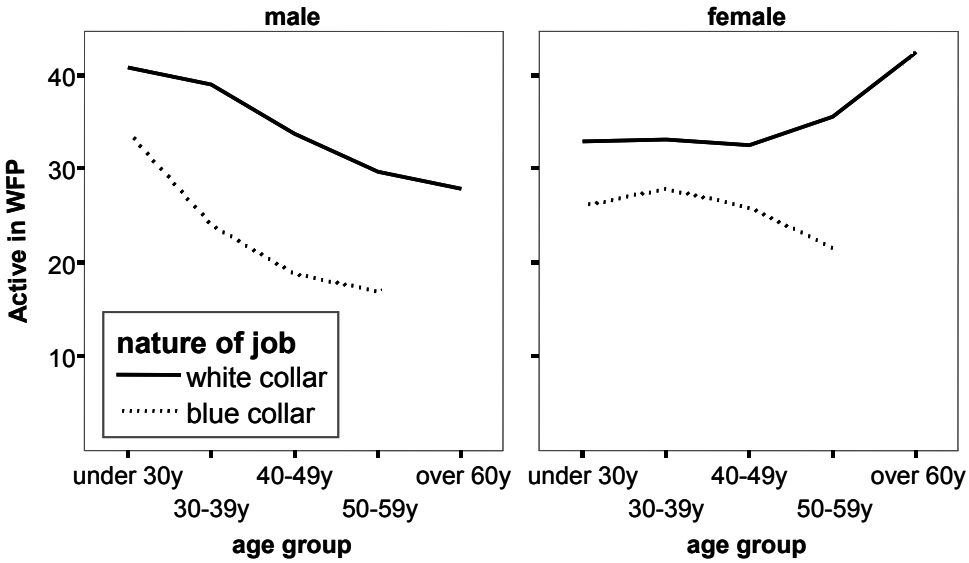


Figure 20. WFPI according to age group and nature of job in male and female employees.

Further analysis of the WFPI reveals a slight negative correlation ($r=0{,}351$, $p<0{,}05$) between WFPI and company size, which in this case was referred to as the number of those who responded. This finding indicates that management of WFP would be more effective in smaller companies. That would indicate in favour of smaller unit management in large companies as well.

#### 5.2.3.2 Specific sports in Worksite Fitness Programs

Employer support in WFP in Finnish enterprises is focused mainly on swimming, gym exercise, gymnastics and other music sports and ball games (Työpaikkaliikunnan barometri marraskuu 2005). In the material of this preliminary study, practically all employers were supporting gym activities and swimming and most were also supporting ball games. In some nationwide companies, exercise in all supported sports was not possible because of, for example, the lack of a swimming hall. As a whole, it was estimated that at least 90% of the respondents had the possibility to exercise at supported gym activities (including gymnastics and music and martial sports) and swimming, while the percentage was 70% in ball games supported.

Table 15. Sport-specific physical activity in employer-supported sports (WFP) of all subjects, male and female, and by different age groups.

| | gender | | | male, age groups | | | | | female, age groups | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sports in WFP | all | male | female | under 30y | 30-39y | 40-49y | 50-59y | over 60 y | under 30y | 30-39y | 40-49y | 50-59y | over 60 y |
| gym exercise | 11,9 | 11,3 | 13,0 | 17,4 | 13,4 | 9,6 | 8,2 | 9,6 | 15,6 | 14,5 | 11,5 | 12,1 | 12,3 |
| swimming | 8,6 | 7,9 | 9,9 | 7,4 | 8,9 | 7,3 | 7,9 | 8,3 | 8,6 | 11,4 | 9,0 | 10,2 | 13,2 |
| team sports | 6,6 | 8,4 | 3,3 | 15,1 | 11,6 | 6,7 | 3,7 | 2,5 | 4,8 | 3,8 | 2,8 | 2,5 | 2,6 |
| gymnastics | 4,5 | 2,7 | 7,9 | 1,9 | 3,0 | 2,5 | 3,1 | 3,8 | 4,9 | 7,5 | 8,8 | 9,0 | 11,4 |
| racquet sports | 4,2 | 4,6 | 3,4 | 5,6 | 5,1 | 4,6 | 3,6 | 5,7 | 4,1 | 3,0 | 3,4 | 3,6 | 0,9 |
| music and martial sports | 3,8 | 2,4 | 6,7 | 2,8 | 1,8 | 2,7 | 2,4 | 4,5 | 8,4 | 5,2 | 5,9 | 8,0 | 8,8 |

According to Table 15 gym exercise (with weights and weight training device) was the most popular sport in WFP. Besides that gymnastics and other music and martial sports are exercised in gyms, which makes gyms the most important facility in WFP. Differences between gender and age groups are similar than presented earlier in connection with general exercise of specific sports. Women exercise more gymnastics and other music sports, while men are more active in team sports.

5.2.3.3 Worksite Fitness Program cluster

In the preliminary study, a cluster analysis was made to group those 33 companies with respect to worksite fitness programs and their effectiveness. The cluster analysis produced four clusters, which were characterized by certain average values and are presented in Table 16.

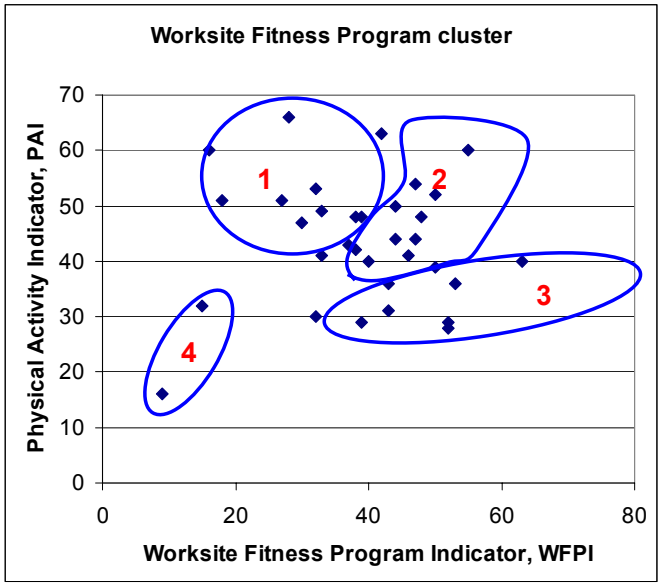


Figure 21. Worksite fitness program cluster.

The clusters can be characterized as follows:

Cluster 1. Low activity in WFP, good general physical activity (PAI)
Cluster 2. High activity in WFP and high general physical activity (PAI)
Cluster 3. High activity in WFP but quite low general physical activity (PAI)
Cluster 4. Low activity in WFP and low general physical activity (PAI)

In principal, cluster 1 would be the most effective in terms of financial investment, low input to WFP but still high output (PAI). The average results of other parameters presented in Table 16. will, however, show a different view. In cluster 2, where the output (PAI) is as high as in cluster 1, the other important parameters (health-factor, estimation of work ability) are statistically significantly higher than in cluster 1. The quality of WFP, which is seen as a higher WFPI, is one possible explanation. The high proportion of white collar workers in cluster 2 is probably the most important explanation. The quality of WFP gains still more support in cluster 3, where WFPI is relatively high, but PAI low. In this cluster, the health-factor and assessment of work ability are significantly higher than in cluster 1, although the proportions of white and blue collar workers are relatively similar.

There remains one difference between the clusters, and a possible explanation is the nature of the company. In cluster 1, most companies (all but one) are public or basic industry worksites. Cluster 3, in contrast, constitutes companies from different areas, such as service and knowledge intensive companies, also in addition to one public and three industry worksites.

Table 16. Average figures of certain parameters in four WFP Clusters.

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 |
|---|---|---|---|---|
| physical activity average, amount/week | 4,6 | 4,1 | 2,8 | 2,1 |
| health factor | 9,9 | 10,2 | 10,1 | 9,7 |
| sick leave days | 7,2 | 6,5 | 6,4 | 6,7 |
| work ability estimation | 8 | 8,2 | 8,2 | 7,9 |
| worksite fitness program indicator | 23,3 | 39,8 | 28,5 | 8,2 |
| physical activity indicator | 53,8 | 47 | 31 | 16,4 |
| men (%) | 69,3 | 54,5 | 71 | 84,1 |
| women (%) | 30,7 | 45,5 | 29 | 15,9 |
| under 40 years (%) | 55 | 38,7 | 32,9 | 33,5 |
| over 40 years (%) | 45 | 61,3 | 67,1 | 66,5 |
| white collar, office work | 51,2 | 81,1 | 57,2 | 36,4 |
| blue collar, physical work | 48,8 | 18,9 | 42,8 | 63,6 |
| public worksite | 4 / 7 | 5 / 15 | 1 / 9 | 1 / 2 |
| basic industry and construction | 2 / 7 | 2 / 15 | 3 / 9 | 1 / 2 |
| services | 1 / 7 | 4 / 15 | 3 / 9 | 0 / 2 |
| knowledge intensive worksite | 0 / 7 | 4 / 15 | 2 / 9 | 0 / 2 |

Statistical differences between clusters were dependent on physical activity patterns and nature of work. Health Factor was significantly lower in clusters 1 and 4 compared to clusters 2 and 3. Self-assessed work ability estimations were lower in cluster 1 compared to clusters 2 and 3. In sick leave days no differences were seen.

## *5.3 Physical Fitness Indicator*

### *5.3.1 Material*

The data was gathered according to a standardized fitness test protocol. A height, weight, 12 min $VO_2$ ergometer test (Lange Andersen *et al*. 1971) and abdominal muscle strength test (Viljanen *et al.* 1991) were used to gather data on physical fitness from 87 companies and 4 424 persons during the period 1998-2002. The fitness test protocols were part of the business co-operation between the companies and Finnish Sport for All Association, so the companies paid for the testing.

In the fitness test protocol in worksites, the fitness testing was accomplished on a voluntary basis. The test sessions were usually performed campaign after intensive internal marketing. All the employees tested were asked for permission to keep the results for further group level analysis. In the analysis, all personal identification was excluded, leaving in the final database just gender and age besides the measured fitness parameters.

Table 17. Participant and physical fitness characteristics in fitness testing procedures in first preliminary phase 1998-2002 and in second phase 2003-04.

| **PFI-material 1998-2002 (87 companies)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | n | male | female | age | VO2 est | Abd. Est. | TFV | PFI |
| mean | 50,9 | 27,1 | 23,7 | 39,8 | 3,0 | 3,4 | 3,2 | 55,4 |
| SD | 47,7 | 27,1 | 26,9 | 3,9 | 0,3 | 0,7 | 0,4 | 15,9 |
| **Further material 2003-04 (49 companies)** | | | | | | | | |
| | n | male | female | age | VO2 est | Abd. Est. | TFV | PFI |
| mean | 31,8 | 16,3 | 15,4 | 42,0 | 2,6 | 4,3 | 3,4 | 59,9 |
| SD | 21,3 | 13,1 | 12,5 | 3,4 | 0,6 | 0,6 | 0,6 | 17,0 |
| diff | 3,2 | 3,1 | 2,4 | -3,3 | 4,5 | -8,0 | -1,8 | (121,5) |
| sign | ** | ** | * | *** | *** | *** | ns | ns |

In Table 17 mean (±SD) figures of amount of participants, age, estimations of cardiorespiratory (VO2 est) and muscle fitness (Abd. Est.), Total Fitness Value (TFV) and Physical Fitness Indicator (PFI) are prsented. Table 17 indicates that the material was presumably collected from large and medium size companies. Based on voluntary participation, the exact participation rates are difficult to evaluate. As a whole, the material did match the Finnish employees' age distribution very closely, being slightly younger than Finnish labour in general.

Cardiorespiratory fitness ($VO_2$) and abdominal tests were used to determine Total Fitness Values. To evaluate the parameters, basic statistical feature analyses were computed (SPSS 12.0). In the cardiorespiratory fitness test, the average was 37.8 $ml^{-1}*kg^{-1}*min^{-1}$ and the standard deviation was 8.4 $ml^{-1}*kg^{-1}*min^{-1}$, kurtosis in the sample was 0,53 and skewness 0,60. In the abdominal muscle test, the respective figures were 16.3, 6.4 (SD), 0,11 for kurtosis and 0,33 for skewness.

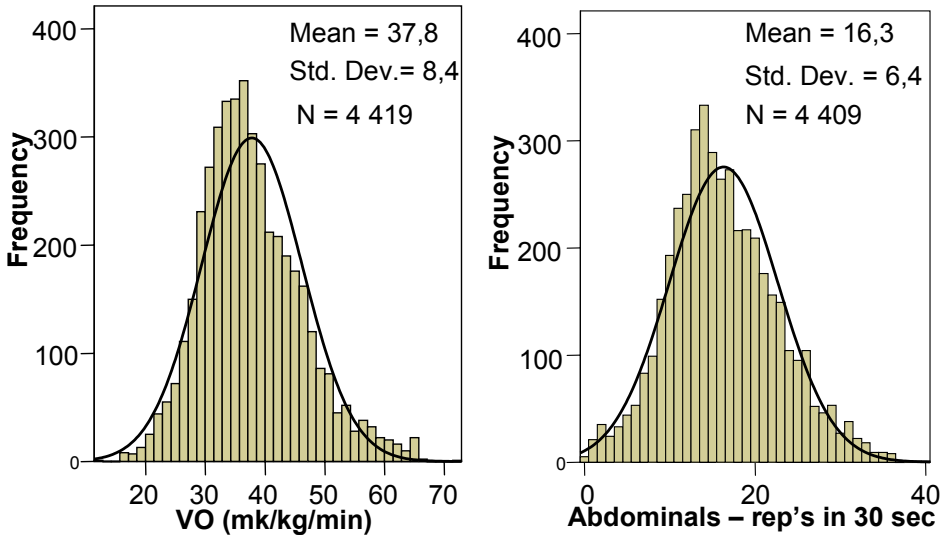


Figure 22. Distributions of the results of the cardiorespiratory ($VO_2$ ml/kg/min, left) and abdominal muscle test (repetitions in 30 seconds, right).

*5.3.2 Results on the company level*

The results on the company level of the fitness test protocol to determine Physical Fitness Indicator is presented in Figure 23 and Table 18.

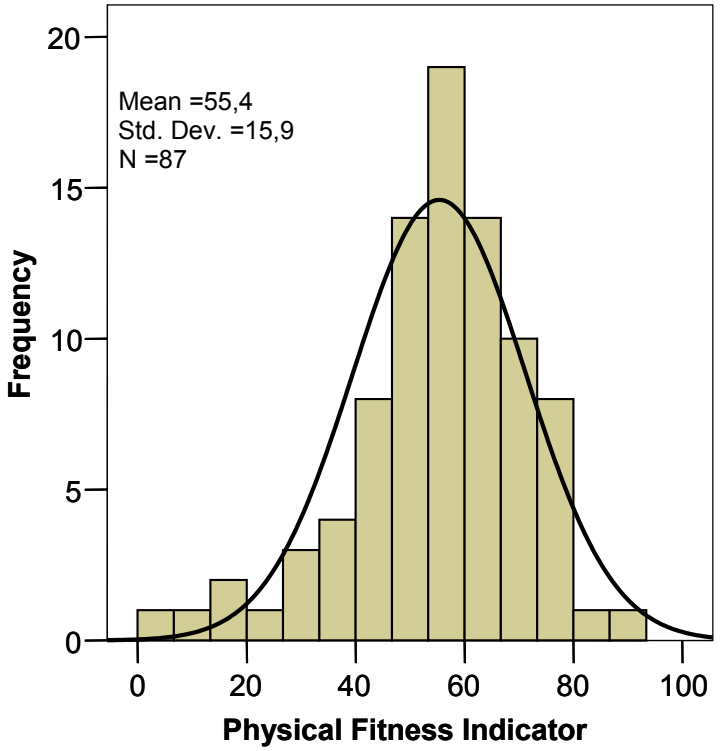


Figure 23. Distribution of Physical Fitness Indicator

Table 18. The criteria for Physical Fitness Indicator.

| | PFI |
|---|---|
| poor (x – 2SD) | 23,8 |
| fair (x – SD) | 39,6 |
| average (x) | 55,4 |
| good (x + SD) | 71,2 |
| excellent (x + 2SD) | 87,0 |

The criteria shown in Table 18. were one of the main results of the preliminary study and formed the basis for evaluation of company's WFP-policy. Principally one of the main goals in WFP was enhancing the level of physical fitness of the employees.

To further study the PFI, a comparison was made between the Total Fitness Values and the Physical Fitness Indicators. As both were based on the same material, it was obvious that they would correlate on a highly significant level as demonstrated in Figure 24.

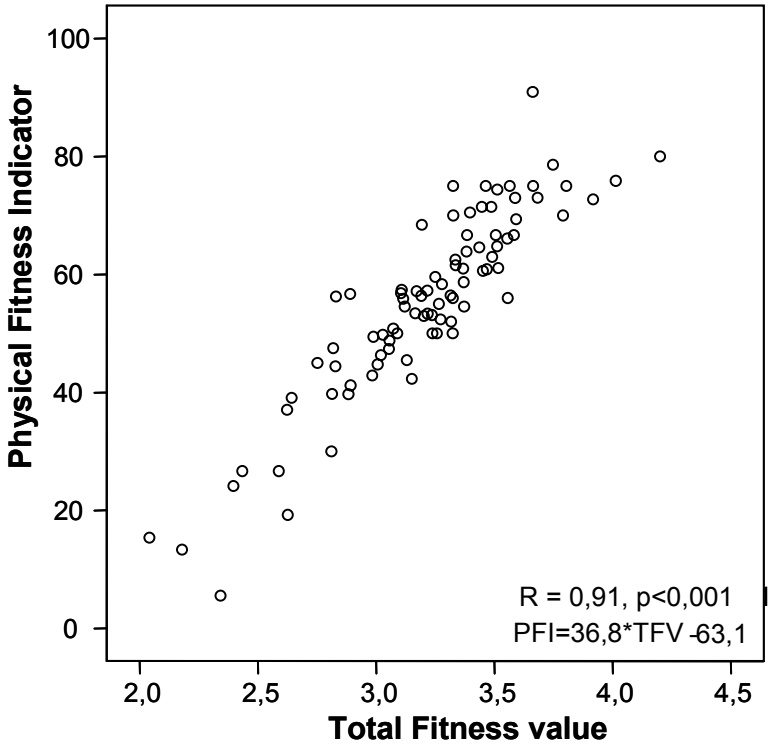


Figure 24. Correlation between averages of Total Fitness value and Physical Fitness Indicator in 87 companies.

Figure 24 shows that both parameters (Total Fitness Value and Physical Fitness Indicator) would be as good for predicting a company's fitness level. According to the practical goal-setting of the framework of Human Resource Management, the Physical Fitness Indicator was chosen. In one phase of the preliminary study, both parameters were tested by the researcher in feedback lectures for corporate management, and the PFI was found to be a clear and easily understandable parameter for managers. The sentence "60% of your employees are fit enough" is more concrete than the sentence "your employees' Total Fitness value is 3,35" – although both sentences mean the same.

*5.3.3 Effects of age and physical activity on physical fitness*

To find differences between men and women, and between age groups, analyses were made. The results of tests and estimations in cardiorespiratoty fitness (VO2) and abdominal muscle fitness; averages of Total Fitness Values and Physical Fitness Indicators in different age groups are presented in Table 19.

Table 19. Average results in fitness testing in different gender and age groups.

| | | VO2 | Est.VO2 | Abd's | Est. Abd' | TFV | **PFI** |
|---|---|---|---|---|---|---|---|
| **male** | under 30y | 44,2 | 3,0 | 23,9 | 3,5 | 3,2 | **54,8** |
| | 30-39y | 41,6 | 3,0 | 20,6 | 3,3 | 3,1 | **51,4** |
| | 40-49y | 39,5 | 3,2 | 16,8 | 3,1 | 3,1 | **51,6** |
| | 50-59y | 36,2 | 3,2 | 14,6 | 3,3 | 3,3 | **56,5** |
| | all male | 40,4 | 3,1 | 18,9 | 3,3 | 3,2 | **52,8** |
| **female** | under 30y | 38,1 | 3,2 | 17,5 | 3,7 | 3,5 | **64,5** |
| | 30-39y | 35,9 | 3,2 | 14,3 | 3,5 | 3,3 | **60,7** |
| | 40-49y | 33,7 | 3,1 | 11,9 | 3,6 | 3,3 | **60,7** |
| | 50-59y | 30,8 | 2,9 | 9,4 | 3,5 | 3,3 | **59,1** |
| | all female | 34,8 | 3,1 | 13,3 | 3,6 | 3,3 | **61,2** |

Concerning gender, females had a statistically significantly higher TFV than men, Chi-square value in Pearssons Chi-square test was 31,59, $p<0,001$. As a whole age didn't affect on the TFV as can be seen in Formula 3.

In collecting the fitness test data, only a rough questionnaire was applied concerning physical activity. Most interest was focused upon the health safety of the procedure. In the questionnaire, however, the frequency and duration of leisure time physical activity was asked (but not the intensity of physical activity). On the database, the product of these two questions was saved. The material from the years 1998-2002 allowed a general overview of the phenomenon of links between between physical activity and fitness to be carried out.

The total amount of physical activity and Total Fitness Value were correlated on a statistically significant level, $r=0,363$, $p<0,01$. A regression analysis with TFV as a dependent variable and the amount of physical activity, age and gender as independent variables was performed. This resulted in Formula 4.

Formula 4.

TFV=0,0042*PA-0,166*gender+2,962, where
PA = leisure time physical activity in minutes / week, t=22,65, $p<0,001$
gender 0=female, 1=male, t=-4,49, $p<0,001$
F-value = 266,4, $p<0,001$
$R^2$ = 13,7%

## *5.4 Motives for physical activity*

Motives were studied to be able to develop each company's Worksite Fitness Program. The analysis of the motives is done to further encourage that goal.

### *5.4.1 Importance of different motives for physical activity*

The most important motive for physical activity was the health benefits of physical activity; nearly 90% of respondents rated it as extremely important or important.

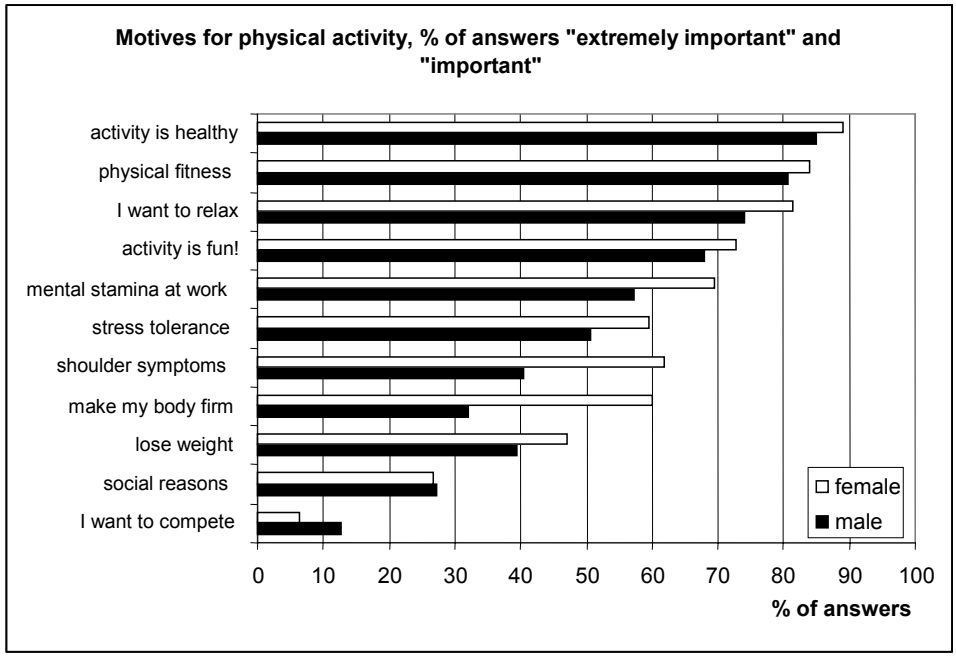


Figure 25. Reasons by percentage of answers "extremely important" and "important" in male and female respondents.

All the differences between motives were statistically significant, except between "I want to make my body firm" and "I want to lose weight". Also, the differences between males and females were statistically significant, except in the case of the response "I practice physical activity for social reasons", where no difference was found.

### *5.4.2 The effects of different motive factors on physical activity*

As presented in the previous chapter, the motives for physical activity were tightly connected to the level of physical activity. The more you are motivated by improving your physical fitness, the more you exercise. In this chapter, an attempt is made to identify the reasons for physical activity.

To further analyse the role of different motive factors, a series of regression analyses were performed. Different dependent variables were chosen while motive factors (basic motives, specific health motives, social motives and weight control motives), age group, gender and activity in WFP served as independent variables. Dependent variables were Total amount of physical activity (APA), frequency of physical activity, intensity of physical activity (IPA) and physical activity group (1=passive, 2=active lifestyle, 3=physical activity for health and 4=fitness-sport). Table 20 presents the results.

Table 20. The regression analyses of motive factors.

| Model – variables | Constant | Coeffi-cients | t-values | signifi-gance | F-value | signifi-gance | $R^2$ |
|---|---|---|---|---|---|---|---|
| **Total amount of physical activity** | -24,72 | | -2,81 | p<0,01 | 231,72 | p<0,001 | 9,40 % |
| basic motives | | 13,55 | 21,73 | p<0,001 | | | |
| WFP activity | | 26,06 | 8,51 | p<0,001 | | | |
| specific health motives | | -2,36 | -3,78 | p<0,001 | | | |
| | | | | | | | |
| **Frequency of physical activity** | 0,78 | | 4,24 | p<0,001 | 116,78 | p<0,001 | 6,50 % |
| basic motives | | 0,21 | 17,86 | p<0,001 | | | |
| WFP activity | | 0,44 | 7,09 | p<0,001 | | | |
| gender | | -0,22 | -3,46 | p<0,001 | | | |
| social motives | | -0,04 | -2,63 | p<0,01 | | | |
| | | | | | | | |
| **Intensity of physical activity** | 2,00 | | 41,67 | p<0,001 | 312,87 | p<0,001 | 15,70 % |
| basic motives | | 0,06 | 22,09 | p<0,001 | | | |
| WFP activity | | 0,18 | 11,81 | p<0,001 | | | |
| age group | | -0,07 | -10,36 | p<0,001 | | | |
| social motives | | 0,04 | 9,82 | p<0,001 | | | |
| | | | | | | | |
| **Physical activity group** | 0,78 | | 10,87 | p<0,001 | 248,17 | p<0,001 | 12,90 % |
| basic motives | | 0,10 | 23,49 | p<0,001 | | | |
| WFP activity | | 0,23 | 9,85 | p<0,001 | | | |
| age group | | -0,07 | -6,15 | p<0,001 | | | |
| social motives | | 0,03 | 4,98 | p<0,001 | | | |

In Table 20 the constants and coefficients in stepwise regression analyses with different dependent variables and motive factors (basic motives, specific health motives, social motives and weight control motives), age group, gender and activity in WFP serving as independent variables. T- and F-values and $R^2$ values are given.

The results in Table 20. indicate that the basic motives found by factor analysis (health, physical fitness, relaxation, fun) are the key motives to activate employees. This finding should encourage practitioners to build simple, knowledge intensive Worksite Fitness Programs to strengthen basic motives.

To look still closer at basic motives and WFP, an analysis of basic motives in different physical activity groups and activity in WFP was carried out. As shown in Figure 26, employees active in WFP had overall higher basic motives compared to those not active in WFP.

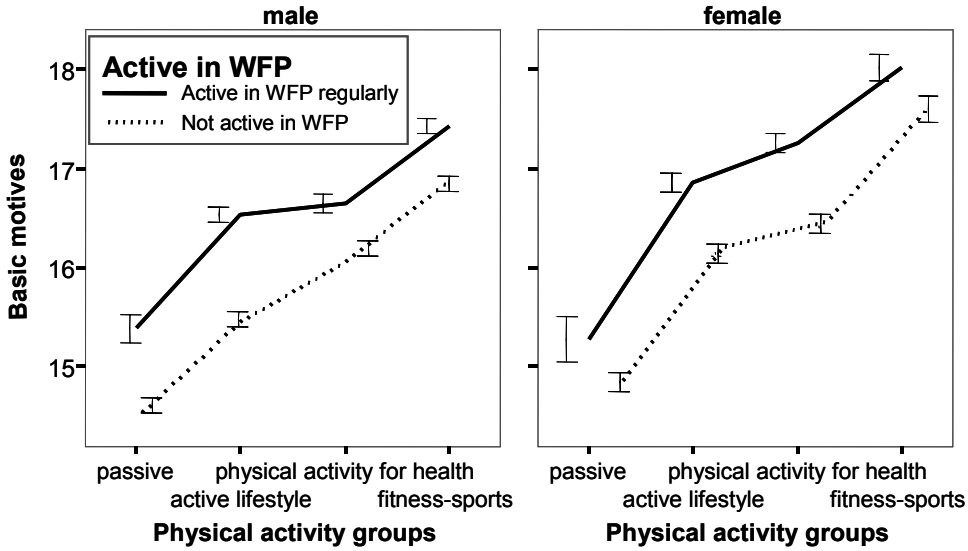


Figure 26. Averages of basic motive factors in different physical activity groups with respect to activity in Worksite Fitness Programs by male and female subjects.

The differences between WFP active and non-active men and women presented in Figure 26 were statistically highly significant. In an independent T-test, the t-value for men was t=17,0 (p<0,001) and for women t=9,6 (p<0,001). With this kind of data, the causal relationships are difficult to interpret, but at least a part of the difference shown in Figure 26 can be explained by the contents of WFP:

## *5.5 The associations between physical activity patterns and sick leave, perceived health and work ability*

### *5.5.1 The association between physical activity patterns and sick leave*

The association (and possible effect) between physical activity patterns and sick leave has been the main motivator for employers to promote WFP. Research in the field has also been focused on that matter. The material of this study provided some basic results for the discussion.

On a group level analysis (independent variable T-test) difference between white- and blue collar is distinct, averages for males are 4,89 d/y (white collar) and 8,56 d/y (blue collar), whilst for the T-test, the t-value -9,24 (p<0,001), averages for females are 6,17 d/y (white collar) and 9,78 d/y (blue collar), and in the T-test the t-value was -5,64 (p<0,001). No significant difference between male and female was found (averages 6,54 and 6,85 d/y respectively, p=ns).

The association between age and sick leave was slightly significant. The regression analysis on sick leave days with gender, age group and nature of work as independent variables created a Formula 5.

Formula 5. SLD=0,463*AG-1,27*gender-3,64*NW+8,54, where
AG=age group, t-value=3,03, p<0,01
gender 1=male, 0=female, t-value=-3,72, p<0,001
NW=nature of work, 0=blue, 1=white collar, t-value=-10,8, p<0,001
F-value = 42,0, p<0,001, $R^2$=1,1%

To estimate the associations of physical activity patterns and sick leave multiple statistical analyses were performed. In analysing single parameters, only the intensity of physical activity had a significant effect on sick leave days.

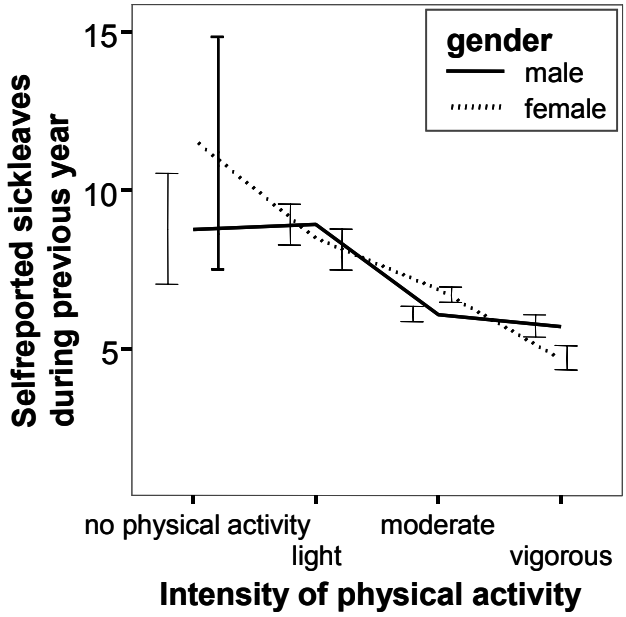


Figure 27. Average (±SE) sick leave days by different intensity levels of physical activity and by gender.

In a regression analysis (sick leave days as dependent variable), gender, age group, nature of job, intensity of physical activity and total amount of physical activity were used as independent variables. The result found two statistically significant coefficients: nature of job and intensity of physical activity. Formula 6 could therefore be written as:

Formula 6.
SLD=-3,38*NW-1,29*IPA-1,14*gender+13,4, were
NW=nature of work (0=blue collar, 1=white collar), t-value -9,98, p<0,001
IPA= intensity of physical activity (2=no activity, 4=light, 6=moderate, 8=vigorous), t-value=-5,63, p<0,001
gender male=1 and female=0, gender t-value -3,33, p<0,01
F-value=49,6, p<0,001, $R^2$=1,3%

To look closer the results of above mentioned regression analysis, the results indicate strongly, in this kind of survey type research set up, the importance of the intensity of physical activity in sick leave. The amount of physical activity, on the contrary, hadn't a statistically significant relation to sick leave.

These results can be expressed more practically on the basis of physical activity groups, where both the intensity and the amount of physical activity are taken into consideration.

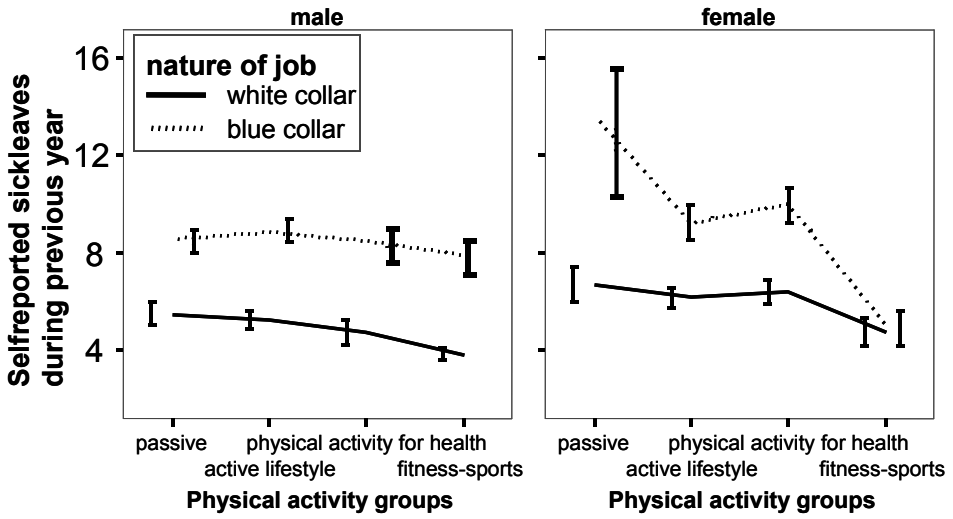


Figure 28. Average sick leave days in different physical activity groups in white and blue collar males and females.

Figure 28 demonstrates the results already presented in Formula 6. The role of physical activity was highest in female blue collar and lowest, although statistically significant in white collar. No statistically significant association was found between the activity in WFP and sick leave.

*5.5.2 The association between physical activity patterns and perceived health*

A factor analysis on the perceived health questionnaire produced four factors, as described in methods, section 4.1.3. A further analysis was carried out to see the effects of physical activity on those factors. The increase in the amount and intensity of physical activity will increase all the factor values, the effect being largest in Health Factor, which is composed of parameters of the respondents' general health status.

A positive association between regular activity in WFP and the Health Factor was found. In a regression analysis, the Health Factor as a dependent variable and gender, nature of work, age group, total amount and intensity of physical activity and WFP activity as independent variables produced Formula 7.

Formula 7.

HF=0,229*IPA+0,003*APA+0,247*WFP+0,097*NW-0,046*AG+8,23,
where
IPA=intensity of physical activity, t-value 14,77, p<0,001
APA=total amount of physical activity, t-value 15,19, p<0,001
WFP=activity in WFP, 1=active, 0=not active, t-value 5,56, p<0,001
NW= nature of work, 1=white collar, 0=blue collar, t-value 2,49, p<0,05
AG=age group, 1=under 30 years, 2=30-39y, 3=40-49y, 4=50-59y
5=over 60 years, t-value -2,41, p<0,05
F-value = 198,1, p<0,001, $R^2$=11,7%

Figure 29 presents the result on a basis of physical activity groups in male and female.

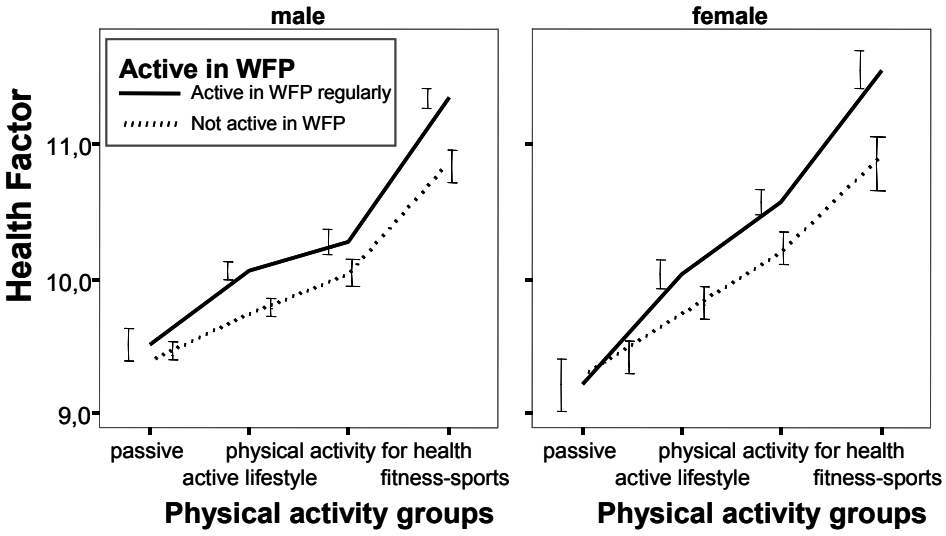


Figure 29. Average Health Factor Values by gender and different physical activity groups with respect to WFP activity.

To enable us to look more closely at the Health Factor, it was divided into five subgroups according to the average and SD values. The physical activity characteristics in these subgroups are presented in Figure 30.

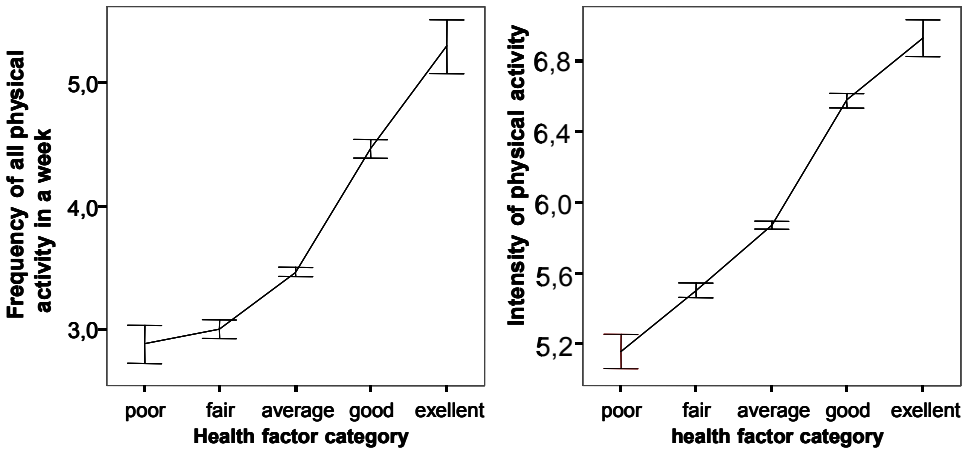


Figure 30. The average frequencies and intensities of physical activity in different Health Factor subgroups.

Evaluating the physical activity patterns on a general level, one can say that you should exercise physical activity 4,5 times a week at a mostly moderate, but sometimes vigorous, intensity to be sure to have a "good" Health Factor. For an "average" Health Factor, 3.5 times a week at a moderate intensity would be sufficient.

*5.5.3 The associations between physical activity patterns and self-assessed work ability*

In this study the work ability was self-assessed on a scale of zero to ten according to Work Ability Index (see Tuomi *et al* 1998). The WAE-values found were in good agreement with recent Finnish survey study (Peltoniemi 2005). The difference between white and blue collar workers was statistically significant both in males and females. The averages for males are 8,24 (white collar) and 7,94 (blue collar), whilst for the T-test, the t-value was 7,20 ($p<0,001$); the averages for females are 8,25 (white collar) and 8,06 (blue collar), and in the T-test the t-value was 3,20 ($p<0,001$).

To analyse the effects of physical activity characteristics, a regression analysis with WAE as a dependent variable and gender, age group, nature of work, total amount and intensity of physical activity and WFP activity as independent variables was performed. The result indicated a prominent association of intensity of physical activity on work ability estimation. As shown in Formula 8. also age (age group) had significant role in WAE.

Formula 8.

WAE=0,149*IPA-0,180*AG+0,253*NW+0,001*APA+0,077*WFP+7,39,
where
IPA=intensity of physical activity, t-value 12,52, p<0,001
AG=age group, 1=under 30 years, 2=30-39y, 3=40-49y, 4=50-59y
5=over 60 years, t-value -12,97, p<0,001
NW=nature of work, 1=white collar, 0=blue collar, t-value 7,81, p<0,001
APA=total amount of physical activity, t-value 7,12, p<0,001
WFP=activity in WFP, 1=active, 0=not active, t-value 2,46, p<0,05
F-value = 131,6, p<0,001, $R^2$=6,8%

In Formula 8 the coefficient of activity on WFP was statistically significant. Figure 31 illustrates the effects in more detail. The role of active WFP participation was highest in less active blue collar employees. This is a promising finding since these groups have been judged to be the most difficult to activate. Physical activity regimens in WFPs, even in limited amounts, seemed to have a positive association with estimations of work ability.

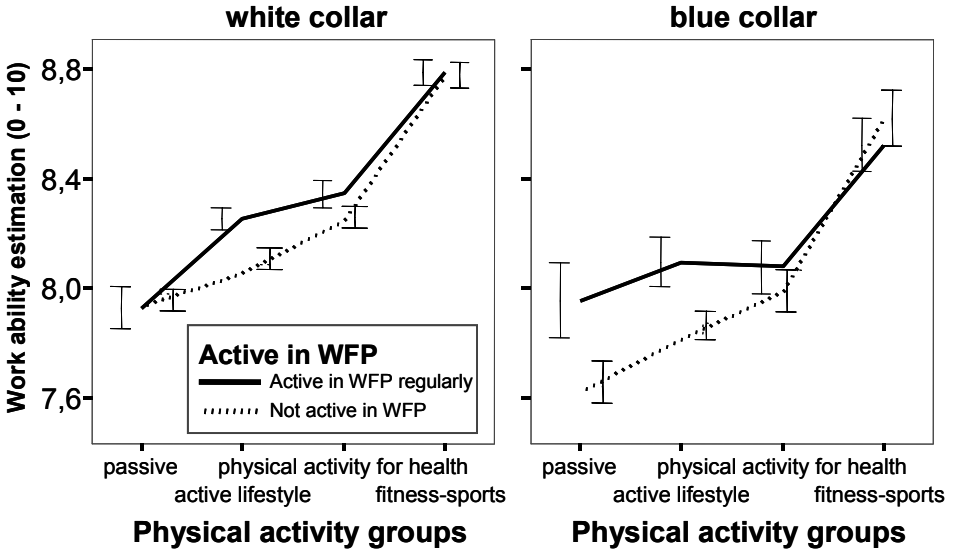


Figure 31. Averages of work ability estimations in different physical activity groups in respect to activity in Worksite Fitness Programs in white and blue collar employees.

The effects of exercising via specific sports was analysed on a sport-specific group level. According to earlier results (e.g. Formula 8), the intensity of physical activity played an essential role in predicting work ability estimations. Based on given values of the intensity of physical activity in specific sport exercisers, a group level intensity factor was calculated for each sport (taken from the US Department of Health and Human Services, 1996). Based on the energy consumption figures of different intensity levels, intensity factors were calculated using relative values:

These numbers were then summed to get a Sport Specific Intensity Factor (SSIF). In the calculation the option "no activity" was left out, while in exercising some sport that should be impossible. As all respondent's answers represented the base line, a Sport Specific Relative Intensity Values could be calculated, Formula 9.

Formula 9.

SSIF = (%-light*4,0+%-moderate*6,0+%-vigorous*8,0)/587,1*100
where, %-light = % of people exercising in light intensity in a specific sport
%-moderate = % of people exercising in moderate intensity in a specific sport
%-vigorous = % of people exercising in vigorous intensity in a specific sport

As presented in Table 21. team sports as a sport received the highest relative intensity value, other high intensive sports were roller skating, racquet sports, jogging and gym exercise. Walking and Nordic walking received lowest intensity values.

Table 21. Intensity characteristics of sport specific exercisers groups.

| **sport** | no activity | light | mode-rate | vigo-rous | intensity factor | **relative intensity** | mean WAE | mean HF |
|---|---|---|---|---|---|---|---|---|
| walking | 0,5 | 15,4 | 74,2 | 10,0 | 586,2 | **99,8** | 8,12 | 9,96 |
| all | 3,9 | 14,6 | 61,8 | 19,7 | 587,1 | **100,0** | 8,17 | 10,00 |
| nordic walking | 0,2 | 5,8 | 84,8 | 9,2 | 605,8 | **103,2** | 8,19 | 10,33 |
| swimming | 1,0 | 10,0 | 69,0 | 20,0 | 614,3 | **104,6** | 8,19 | 10,32 |
| gymnastics | 0,2 | 7,4 | 75,0 | 17,5 | 619,0 | **105,4** | 8,37 | 10,43 |
| cycling | 0,4 | 9,4 | 70,6 | 19,6 | 618,3 | **105,3** | 8,23 | 10,34 |
| cross-country skiing | 0,2 | 7,0 | 69,5 | 23,4 | 631,9 | **107,6** | 8,33 | 10,51 |
| music and martial sports | 0,1 | 5,4 | 68,7 | 25,7 | 639,9 | **109,0** | 8,42 | 10,78 |
| gym exercise | 0,4 | 4,7 | 57,9 | 37,1 | 662,6 | **112,8** | 8,39 | 10,83 |
| jogging | 0,1 | 2,8 | 59,6 | 37,4 | 668,5 | **113,9** | 8,50 | 10,95 |
| racquet sports | 0,5 | 3,1 | 55,2 | 41,2 | 672,9 | **114,6** | 8,39 | 10,66 |
| roller skating | 0,6 | 3,5 | 53,5 | 42,5 | 674,6 | **114,9** | 8,54 | 11,21 |
| team sports | 0,2 | 3,5 | 49,6 | 46,7 | 684,8 | **116,6** | 8,41 | 10,61 |

In Table 21 the Sport Specific Intensity Factors; Relative Intensity Values and average age-standardized self-assessed work ability estimation (WAE) and Health Factor (HF) are given.

In the data in Table 21 the correlation coefficient between relative intensity of a sport and age-standardized work ability estimation was 0,887 ($p<0,001$). Corresponding correlation between intensity of sport and Health Factor was $r=0,870$, $p<0,001$. Results indicate further the importance of the intensity of physical activity in respect to perceived health and work ability.

*5.5.4 Associations between physical fitness and sick leave and work ability*

After the preliminary study, during the years 2003 and 2004 further material was collected with the same principals described in section 4.2. Further, in 49 companies, a fitness test protocol was completed with more detailed background questionnaires of sick leave and self-assessments of work ability. The average number for the test group was 31,8±21,1 persons and the average age was 42,4±9,8 years.

The results showed, at first, an average PFI of 58,2 (±16,2), which was reasonable close to the findings gained in the preliminary study (55,4±15,9). Subsequently, correlations between the Physical Fitness Indicator and sick leave, as well as self-assessed work ability, were analysed.

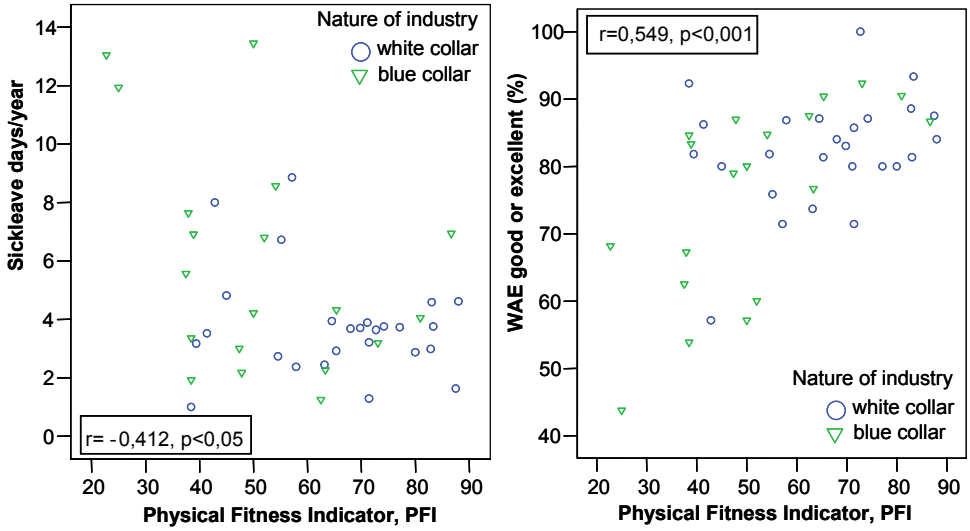


Figure 32. Relations between Physical Fitness Indicator and sick leave (left) and Physical Fitness Indicator and self-assessments of work ability (% on estimations 8-10) (right).

The results demonstrated fair, but statistically significant, correlations between PFI and sick leave and work ability estimations. In the case of sick leave, the result is greatly influenced by the company's business area, as companies employing primarily blue collar workers had higher sick leave levels than white collar companies. From the Figure 32, it can also be seen that the correlation was caused mainly by three blue collar companyies. In the case of self-assessed work ability, the effect of the nature of the job was also obvious, although the trends between PFI and WAE were similar both in blue and white collar companies. Results from the individual level confirmed the results in both sick leave (correlation between sick leave and Total Fitness Value r=-0,056, p<0,05) and self-assessed work ability (correlation between WAE and TFV r=0,103, p<0,01).

*5.5.5 Summary of the associations between physical activity patterns and sick leave, perceived health and work ability in white and blue collar workers*

The main findings of the preliminary study are summarized in this chapter. regarding sick leave, the intensity of physical activity had important role (Formula 5.). Table 22. presents the results concerning sick leave, where the main differences were seen between white and blue collar workers. Among male passive white collar employees, those employees active in WFP had less sick leave than employees not active in WFP. In the case of the female fitness-sports group, for blue collar employees the situation was reversed: employees active in WFP had more sick leave than non-active employees.

Regarding the Health Factor, the associations between the intensity and total amount of physical activity, WFP activity and nature of work were demonstrated in Formula 7. In Table 22, these associations are clearly presented as results and the statistical differences between different subgroups are given.

Self-assessed work ability (WAE) was seen to be influenced by intensity of physical activity, total amount of physical activity, WFP activity and nature of work as presented in Formula 12 and Figure 31. Table 22 emphasizes the importance of WFP activity, especially in passive and active lifestyle physical activity groups.

Table 22. Summary wellness parameters in different employee groups.

| | | male | | | | female | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Sick leaves** | passive | active lifestyle | physical activity for health | fitness-sports | passive | active lifestyle | physical activity for health | fitness-sports |
| *white collar* | *Active in WFP regularly* | *3,65* | *5,31* | *4,53* | *4,07* | *5,36* | *5,56* | *7,29* | *4,81* |
| | *Not active in WFP* | *5,95* | *5,20* | *4,88* | *3,57* | *7,03* | *6,45* | *5,81* | *4,69* |
| blue collar | Active in WFP regularly | 8,62 | 9,20 | 7,89 | 8,68 | 6,09 | 8,75 | 12,49 | 7,48 |
| | Not active in WFP | 8,55 | 8,77 | 8,69 | 7,50 | 14,47 | 9,32 | 8,93 | 3,62 |
| | **diff white-blue collar** | **0,001** | **0,001** | **0,001** | **0,001** | **0,05** | **0,01** | **0,01** | **ns** |
| | **diff WFP-act in white collar** | **0,01** | **ns** | **ns** | **ns** | **ns** | **ns** | **ns** | **ns** |
| | **diff WFP-act in blue collar** | **ns** | **ns** | **ns** | **ns** | **ns** | **ns** | **ns** | **0,05** |
| | **Health factor** | passive | active lifestyle | physical activity for health | fitness-sports | passive | active lifestyle | physical activity for health | fitness-sports |
| *white collar* | *Active in WFP regularly* | *9,80* | *10,14* | *10,45* | *11,50* | *9,23* | *10,05* | *10,60* | *11,55* |
| | *Not active in WFP* | *9,38* | *9,78* | *10,04* | *11,30* | *9,35* | *9,70* | *10,22* | *11,10* |
| blue collar | Active in WFP regularly | 9,30 | 9,99 | 10,12 | 11,10 | 9,00 | 10,00 | 10,46 | 11,63 |
| | Not active in WFP | 9,37 | 9,70 | 10,03 | 10,57 | 9,04 | 9,86 | 10,12 | 10,40 |
| | **diff white-blue collar** | **ns** | **ns** | **ns** | **0,001** | **ns** | **ns** | **ns** | **ns** |
| | **diff WFP-act in white collar** | **0,05** | **0,01** | **0,05** | **ns** | **ns** | **0,01** | **0,01** | **ns** |
| | **diff WFP-act in blue collar** | **ns** | **0,01** | **ns** | **0,01** | **ns** | **ns** | **ns** | **0,01** |
| | **WAE** | passive | active lifestyle | physical activity for health | fitness-sports | passive | active lifestyle | physical activity for health | fitness-sports |
| *white collar* | *Active in WFP regularly* | *7,90* | *8,20* | *8,38* | *8,80* | *7,97* | *8,32* | *8,31* | *8,78* |
| | *Not active in WFP* | *7,86* | *7,99* | *8,26* | *8,80* | *8,03* | *8,12* | *8,24* | *8,74* |
| blue collar | Active in WFP regularly | 8,05 | 8,12 | 7,92 | 8,50 | 7,09 | 8,03 | 8,42 | 8,71 |
| | Not active in WFP | 7,65 | 7,78 | 7,81 | 8,61 | 7,45 | 7,91 | 8,27 | 8,64 |
| | **diff white-blue collar** | **ns** | **0,05** | **0,001** | **0,01** | **0,01** | **0,05** | **ns** | **ns** |
| | **diff WFP-act in white collar** | **ns** | **0,01** | **ns** | **ns** | **ns** | **0,05** | **ns** | **ns** |
| | **diff WFP-act in blue collar** | **0,01** | **0,01** | **ns** | **ns** | **ns** | **ns** | **ns** | **ns** |

# 6 CASE STUDIES

## *6.1 Description of case companies*

### *6.1.1 Description of case company A*

Case company A (later Case A) is operating in the IT services sector as a part of large conglomerate. Case A is owned jointly with the main customer, with which Case A operates in tight partnership. Case A is situated in South Finland in one location, and has 220 employees (222,5±11,4 in years 1999-2004).

Case A and its predecessors have been operating for over 30 years, with the present ownership for the last decade. The organization of Case A is based on five business units and a light supportive team, which works in co-operation with conglomerate supportive functions.

The values of Case A are customer benefit and human growth, which lead to Case A's guiding principles: "We recognise customer needs and build long-term solutions, we react to customer feedback immediately and learn from it, we continuously measure and develop our business, we reward outstanding performances, personal target-driven development is encouraged and we co-operate closely with all our corporate associates".

Management in Case A is based on the Balanced Score Card (BSC) method (Kaplan & Norton 1996). The indicators of BSC changed over the years, but were relatively constant from 2001.

**Customer**
-Customer benefit index
-Project feedback
-Maintenance feedback
-Customer work distribution
-Internal atmosphere

**Personnel**
-Full-time employees
-Competence index
-Development review
-Physical condition

**Processes**
-On schedule
-Within workload estimate
-Number of errors
-Failure work

**Finance**
-Turnover
-Operating profit
-Invoicing level

The mean age of the personnel was 42.5 years during 1999-2004, moving between 41,4 and 43,3 in different years. 58% of the employees were women.

*6.1.2 Description of case company B*

Case company B (later Case B) is operating in the IT services sector as a part of large conglomerate. Case B is owned jointly with the main customers, with whom Case B operates in tight partnership. Case B is situated in South Finland in one location with 180 employees (176,8±5,8 in the years 2001-2005).

Case B and its predecessors have been operating for over 40 years, with the present ownership for the last decade. The organization of Case B is based on four business units and a light supportive team, which works in co-operation with conglomerate supportive functions.

The values of Case B are customer benefit and human growth, which lead to Case B's guiding principles: "We recognise customer needs and build long-term solutions, we react to customer feedback immediately and learn from it, we continuously measure and develop our business, we reward outstanding performances, personal target-driven development is encouraged and we co-operate closely with all our corporate associates".

Management in Case B has been based on the BSC method since 1999. The indicators of the BSC changed over the years, but were relatively constant from 2002.

Customer
- Customer benefit index
- Project feedback
- Maintenance feedback
- R&D expenses
- Market share
- Number of partnership customers

Personnel
- Competence index
- Employee satisfaction
- Turnover
- Employee-superior discussions

Processes
- On schedule
- Within workload estimate
- Efficiency of system work
- Failure work expenses
- Work time distribution

Finance
- Turnover
- Operating profit
- Value added

The mean age of the personnel was 44,7 years during 2001-05. 10% of employees were under 30 years, 25% 30-39 years, 35% 40-49 years and 30% over 50 years. 59% of employees were women.

*6.1.3 Description of case company C*

Case company C (later Case C) is operating in the paper industry sector as a part of the special product group of a large conglomerate. Case C is situated in Central Finland in one location with 350 employees (355,2±16,4 in years 1999-2004).

Case C and its predecessors have been operating for over 30 years, with the present ownership for the last decade. The organization of Case C is based on three business units and a light supportive team, which works in co-operation with conglomerate supportive functions.

The values of Case C are customer care, openness, readiness for change and continuous development. Above all is profitable business, and the basis is competent personnel.

The mean age of the personnel was 42,5 years during 1999-2004, moving between 41,4 and 43,3 in different years. 35-40% of the employees were women.

#### *6.1.4 Description of case company D*

Case company D (later Case D) is a public sector employer operating all over Finland. In this study, four regional work units took part with a total of 430 employees. Case D is financed from public funds. The organization of Case D is based on a central head office with several supportive functions, five territorial units, tens of regional units and over 200 local offices.

The values of Case D are human respect, regeneration, competence and co-operation. In its vision, Case D states: "Our customers will have the best public sector service through out all country."

The mean age of the personnel was 47 years at the end of 2004, and the distribution by age category was: 6,0% under 30 years, 19,6% aged 30-39 years, 27,7% aged 40-49 years, 38,2% aged 50-59 years and 8,6% aged over 60 years. 83% of the employees were women.

### *6.2 Case study set-up, maintaining of work ability and WFP in case companies*

#### *6.2.1 Operations in the case study in case A.*

Case A had already actively taken part in the preliminary study of this PhD thesis. The research project was presented to the CEO and manager responsible for HR on the 2nd December 1998. After the first meeting, the board of directors made the decision to be involved in the research. A work group was also founded to evaluate and develop the methods for promoting and measuring work ability and physical fitness used in Case A.

After four meetings during the period February – May 1999, the work group suggested a model in which fitness testing would be connected to the regular occupational health care examination. The examination will be carried out when an employee is 35, 40, 45, 50, 53, 56, 59, 62 and 65 years old. For the needs of this study, some younger employees than 35 years old would attend the fitness tests yearly. The first fitness tests were carried out in November 1999.

The results of the fitness testing were presented yearly in the board of directors' meeting, in the personnel development group, and in the maintaining of work ability group. The report could be also seen by all employees via the intranet of Case A.

Chronological set of events in the study in Case A.

| | |
|---|---|
| 1998 | Presentation of the research project to CEO on 2nd December<br>Personnel club activities |
| 1999 | Preliminary research. Evaluation of physical activity and worksite fitness program with respect to management and human resource activities, occupational health services, and voluntary WFP activities. Conclusion of the preliminary study: Fitness testing as a part of medical examination. HEPA campaign "Ready for the millennium". Personnel club activities. First set of measurements (n=31). |
| 2000 | Beginning of special wellbeing processes on voluntary basis. Personnel club activities. Second set of measurements (n=34). |
| 2001 | Wellbeing processes continued. Personnel club activities. Third set of measurements (n=32). |
| 2002 | Wellbeing co-ordinating team established; four meetings. Wellbeing processes continued. Personnel club activities. Fourth set of measurements (n=41). |
| 2003 | Wellbeing activities implemented more tightly in the work of business units, wellbeing co-ordinating team continues its work (two meetings). Wellbeing processes continued. Personnel club activities. Fifth set of measurements (n=29). Psycho-social questionnaire for measured employees. First interviews of Intellectual Capital etc, (management, personnel, owner/customer). |
| 2004 | Wellbeing activities implemented more tightly in the work of business units, wellbeing co-ordinating team continues its work (two meetings). Wellbeing processes continued. Personnel club activities. Sixth set of measurements (n=38). Psycho-social questionnaire for measured employees. |
| 2005 | Interpretative interviews (management, personnel). |

*6.2.2 Operations in the case study in case B.*

The study was presented to manager M2 (responsible for Human Resources and maintaining of work ability functions) in March 2001 and a research agreement was signed on 5th May 2001. The study was launched as a research project ("IC as a part of Physical Activity and Fitness") for four years and a special test group of one third of staff was

selected in a randomised order. The test group was complemented yearly to maintain the size of the group at the required level.

The results of fitness testing were presented yearly in the board of directors' meeting, in the personnel development group, and in the maintaining of work ability group. The report could be also seen by all employees via the intranet of Case B.

The role of occupational health care in the study was twofold; in the beginning phase, the Occupational Health Care (OHC) provider refused any co-operation, and only after the appointment of a new OHC provider did positive co-operation begin. From Case B's point of view, the problem was the tacit (and only tacit) knowledge the former OHC had about employee's fitness and physical activity. In discussions, the (former) company nurse and physiotherapist spoke about employees' fitness level and some work-related symptoms, but no written documents were available.

Chronological set of events in the study in Case B.

2001 Presentation of the research project to the CEO in April 2001. Research agreement on 5th May 2001. Personnel club activities (conglomerate's and own Club). Own gym and sporting facilities. No (explicit) co-operation with Occupational Health Care. First set of measurements in November (n=62).

2002 Personnel club activities (conglomerate's and own Club). Own gym and sporting facilities. Second set of measurements in November (n=52).

2003 Personnel club activities (conglomerate's and own Club). Own gym and sporting facilities up to the end of March. On 1st April, Occupational Health Care provider changes and co-operation begins. Health-related fitness WFP activities by OHC. First interviews of Intellectual Capital etc, (management, personnel). Third set of measurements in November (n=45). Psycho-social questionnaire for measured employees.

2004 Personnel club activities (conglomerate's and own Club). Health-related fitness WFP activities by OHC. First interviews of Intellectual Capital etc, (owner/customer). Fourth set of measurements in December (n=42). Psycho-social questionnaire for measured employees.

2005 Interpretative interviews (management, personnel)

*6.2.3 Operations in the case study in case C.*

The researcher has been collaborating with Case C from 1994. In 1995, the first physical activity questionnaire was created to evaluate the employees' physical activity level and wishes for future services in WFP. During the period 1994-2000, the researcher's work with Case C could be described as "action research", while co-operation included much consulting and education of WFP activators. A second physical activity question-

naire was performed in 1999 to see the changes in employee's physical activity patterns and to create more ideas for further develop the WFP.

In 2000, Case C made the decision to be involved in this study and from that point the researcher's role has been more distant. Physical activity questionnaires have been carried out on a yearly basis since 2001 and the researcher has made the results and interpretations available to Case C's experts and WFP activators.

Chronological set of events in the study in Case C.

| | |
|---|---|
| 1995 | First physical activity questionnaire. WFP activator network was founded. |
| 1995-98 | Action research, development of WFP by consulting and educating WFP activators. WFP services extended towards health-enhancing physical activity. Personnel club activities continued. Fitness campaigns (Fitness Passport) twice a year (January to June and July to December). |
| 1999 | 'Physical activity for productivity' campaign implemented to enhance co-operation between WFP activators and superiors. At the same time, the number of WFP activators was reduced to 10-12 from the original 20-25. A Full-time post created for the WFP co-ordinator (later called the 'well-being consultant'). Health-enhancing physical activity services in WFP continued. Physical activity for productivity campaign begins. Personnel club activities continued. Fitness campaigns continued twice a year. Second physical activity questionnaire. |
| 2001 | Wellbeing processes begun to motivate passive employees regarding physical activity. Health-enhancing physical activity services in WFP continued. Personnel club activities continued. Fitness campaigns continued twice a year. Third physical activity questionnaire. |
| 2002 | Wellbeing processes continued. Health-enhancing physical activity services in WFP continued. Personnel club activities continued. Fitness campaigns continued twice a year. Fourth physical activity questionnaire. |
| 2003 | Wellbeing processes continued. Health-enhancing physical activity services in WFP continued. Personnel club activities continued. Fitness campaigns continued twice a year. Fifth physical activity questionnaire, including psycho-social questionnaire. First interviews of Intellectual Capital etc, (management, personnel). |
| 2004 | Wellbeing processes continued. Health-enhancing physical activity services in WFP continued. Personnel club activities continued. Fitness campaigns continued twice a year. Sixth physical activity questionnaire, including psycho-social questionnaire. |
| 2005 | Interpretative interviews (management, personnel). Interview of owner (IC assessment). |

*6.2.4 Operations in the case study in case D.*

The study was presented to the co-ordinating team in May 2002. Subsequently, a project plan was drawn up and the management of Case D formally approved the plan in December 2002. In the project plan, regional work units were recruited into the study and the responsibilities of the different actors were agreed. A traditional experimental setting with two experimental (test) and two control groups were planned, but in the event a case study with one work unit was completed. The reasons and implications of these changes are discussed later in the text. Physical fitness testing was carried out by local occupational health care with the help of a WFP expert from the central office.

Chronological set of events in the study in Case D.

2002 Study presented, co-ordinating team established, four meetings. Project plan made and accepted by management. WFP club activities.

2003 Co-ordinating team continues its work (four meetings). Test and control work units recruited. WFP club activities. First set of measurements in test- and control work units (196 tests). First interviews of Intellectual Capital etc, (management, personnel).

2004 Co-ordinating team continues its work (two meetings). WFP club activities. Second set of measurements in test units (71 tests).

2005 Co-ordinating team continues its work (two meetings). WFP club activities. Third set of measurements in test units (122 tests). Psycho-social questionnaire for employees in test and control units (290 responses). Interpretative interviews (management, personnel). First interviews of Intellectual Capital etc, (owners).

*6.2.5 Maintaining of work ability*

Maintaining of Work Ability (MWA) began in Case A as a result of the preliminary study. An MWA group was established in early 1999 to co-ordinate MWA activities in Case A. MWA activities were implemented through an applied quality circle.

The scope of MWA activities is always a matter of definition at the company level. In Case A, MWA activities were outlined as including health, rehabilitation, health-enhancing physical activity and company climate aspects. Expenses incurred through MWA activities rose during the years of the study: 1999 4677€ (23€/employee), 2000 11077€ (52€/employee), 2001 13252€ (59€/employee), 2002 16854€ (72€/employee), 2003 16435€ (71€/employee) and 2004 20057€ (88€/employee). An intensive educational training programme was not included in MWA, which is the case in some companies. The expenses of Case A's educational training programme were 2000-

3000€/employee yearly, which puts the investments in MWA (and later WFP) in a proper perspective.

In Case B, maintaining of work ability (MWA) had began in the early 1990's. A representative MWA group (management, employees, occupational health care) co-ordinates MWA activities in Case B. MWA activities were implemented through an applied quality circle.

The scope of MWA activities is always a matter of definition at the company level. In Case B, MWA activities were outlined as including health, rehabilitation, health-enhancing physical activity and company climate aspects. Expenses incurred through MWA activities rose during the years of the study: 2001 68€/employee, 2002 48€/employee, 2003 68€/employee, 2004 67€/employee and in 2005 102€/employee. An intensive educational training programme was not included in MWA, which is the case in some companies. The expenses of Case B's educational training programme were 1,500-3,000€/employee yearly, which puts the investments in MWA (and later WFP) in a proper perspective. The expenses of occupational health care ranged yearly from 380€ to 480€/employee, with a mean of 170€ for nursing and 230€ for preventive activities yearly.

In Case C, MWA actions had begun already in the late 1970's and early 1980's. At that time, the role of occupational health care was essential and the actions carried out ranged from occupational health care examinations to development of working postures. With regard to physical wellbeing, MWA activities began in the early 1990's when a special "Fitness team" was founded to develop and implement a thorough physical activity programme in Case C. The Fitness team, which is operating still, consists of multi-professional experts and representatives of labour units.

The scope of MWA activities is always a matter of definition in each company. In Case C, MWA activities were outlined as including job satisfaction and working climate, control of absenteeism, rehabilitation, utilisation of experience in work, health-enhancing physical activity and WFP activities. The focus in these activities is to underline each employee's own responsibility for his/her own work ability.

The expenses of MWA activities were rather constant during the closing years of the follow up (2001-2005). Costs were divided into costs of occupational health care (230-270 €/employee/year), general MWA activities (55-65 €/employee/year), costs of staff training (850-900 €/employee/year) and for expenses of WFP, which were in the range of 230-270 €/employee/year.

Maintaining of work ability (MWA) has a long tradition in Case D. Different actions began as early as the 1980's. Today, MWA activities consist of occupational health care (preventive and nursing services), rehabilitative services, lunch benefit, the worksite fitness program (WFP) services and some recreational services, such as support for holiday activities and personnel events. Proper management skills and competence (training) of employees are seen also as a part of MWA but they are not budgeted as MWA activities. MWA activities are guided by territorial, regional and local MWA groups which are composed of the representatives of management, occupational health

care and employers. Each group makes a yearly MWA plan according to the central guidelines agreed at Case D's MWA group and management level. In 2003 and 2004, some WFP activities were part of MWA activities but in 2005 all WFP activities were moved to the WFP club's responsibility.

Expenses of MWA activities were in the range of 620-720€/employee yearly, which consisted of 500-600€/employee for occupational health care, 60€/employee for MWA activities, 50-60€/employee for WFP. The expenses of Case D's educational training programme were 800-900€/employee yearly.

Table 23. MWA activities in case companies.

| | **Focus of MWA activities** | **MWA** | **OHC** | **staff training** | **WFP** |
|---|---|---|---|---|---|
| **Case A** | health, rehabilitation, health enhancing physical activity and company climate | 50-90€ | 370-520€ | 2000-3000€ | 125-145€ |
| **Case B** | health, rehabilitation, health enhancing physical activity and company climate | 50-100€ | 380-480€ | 1500-3000€ | 122-165€ |
| **Case C** | job satisfaction and working climate, control of absenteeism, rehabilitation, utilization of experience in work, health enhancing physical activity and WFP-activities | 55-65€ | 230-270€ | 850-900€ | 230-270€ |
| **Case D** | occupational health care, rehabilitative services, lunch benefit, WFP services and some recreational services | 60 € | 500-600€ | 800-900€ | 50-60€ |

In Table 23 the summary of the focus of Maintaining of Work Ability (MWA) activities and investments on MWA, Occupational Health Care (OHC), staff training and WFP in case companies. The range of investments during follow-up periods are given.

### *6.2.6 Worksite Fitness Program activities in case companies*

#### 6.2.6.1 Worksite Fitness Program activities in Case A

In Case A, the Worksite Fitness Program had some established traditions before this study. Personnel Club activities were (and are still) carried out by conglomerate's HR functions. Personnel Club activities include several sport clubs, which all employees can take part with no fee or with formal fee. The sports possible in the club range from bridge to ball game sports and from gym to swimming, the total number being 25 to 30 sports. The Personnel Club has a contact person in Case A and in addition the activities are presented via the intranet. Case A's financial input into Personnel Club activities has been 95-105 euros per year per employee.

Recreational sporting days have been held irregularly over the years either for all staff or on a unit basis. The themes of these days (held outside working hours) have been related to walking and nature. Participation in these days has been quite low and this may be the main reason that these days have not been arranged in recent years.

"Ready for the millennium" was a physical activity campaign held in 1999 to remind the employees of the importance of physical activity during tough working periods. That communicative campaign was a starting point for the special wellbeing processes, which began in 2000. These voluntary wellbeing processes included different themes from weight control to stress control and from shoulder gymnastics to Pilates. Special wellbeing processes are based on employees' needs and are implemented on a weekly schedule or more of a project system, based on the theme. Case A provides financial support for the instructors of the processes. The idea of wellbeing processes with respect to traditional Personnel Club activities was to offer activities for beginners. From the year 2000, four to six wellbeing processes have been implemented yearly and around 25 to 50 employees have taken part in these processes annually. The role of occupational health care has been prominent in WFP.

#### 6.2.6.2 Worksite Fitness Program activities in Case B

In Case B, the Worksite Fitness Program had some established traditions before this study. Personnel Club activities are carried out by both conglomerate's HR functions and Case B's own Club. Some health-related fitness activities are arranged by occupational health care.

Conglomerate Personnel Club activities include several sport clubs, which all employees can take part in either at no cost or for a nominal fee. The sports possible in the club range from bridge to ball game sports and from gym to swimming, the total number being 25 to 30 sports. The Personnel Club has a contact person in Case B and in addition the activities are presented via the intranet. Case B's own Personnel Club provides some ball games and gymnastics services regularly and arranges sporting days and instructional activities.

Case B had its own gym and sporting facilities until the end of March 2003. In those facilities, the Club arranged gymnastics and ball games several times a week. After 1st April, Case B moved to a new office building with no WFP facilities. Subsequently, the same opportunities were offered to employees in nearby commercial gyms and a sports centre.

Recreational sporting days have been held irregularly during the years, either for all staff or on a unit basis. The themes of these days (held outside working hours) have changed from walking to curling. Participation in these days has been quite low. Investments in WFP varied between 122 and 165€/employee annually.

The role of occupational health care was twofold: in the initial phase, OHC refused to co-operate at all and only after the OHC provider was changed to a more modern one was positive co-operation possible. From the autumn of 2003, OHC arranged one to two weekly gymnastics sessions for beginners with particular symptoms in the back or shoulder region.

6.2.6.3 Worksite Fitness Program activities in Case C

The Worksite Fitness Program in Case C can be divided administratively into two parts: health-enhancing physical activity within the framework of MWA and fitness-sports within the framework of Personnel Club activities. In practice, all activities are marketed and implemented as a single unity.

The development of Case C's WFP began in 1994, when the WFP "Team in Shape" programme was launched. Before that time, mainly competitive sports services were supported, such as volleyball and ice-hockey tournaments. The basic elements of Case C's WFP are the internal marketing network (WFP activators), qualitative sports services from beginner's courses to competitive tournaments, and communication material (posters, leaflets, Fitness Passport). The communication material was created by a professional media agency from the very beginning of the Team in Shape programme.

A WFP activator network was founded in 1995 to implement more effective internal marketing of WFP for employees. At that point, 20-25 employees from all units were selected to act as voluntary WFP activators. The main roles of WFP activators were to inform people of WFP services, to encourage people to participate and to gather feedback from people to develop WFP. WFP activators were trained twice a year in one-day sessions to raise their level of knowledge and motivation. After several years, in 1999 the number of WFP activators was reduced to 10-12 to strengthen the effects of their work. At the same time, a new approach for WFP, "Physical activity for productivity" was launched. In this, WFP was marketed for superiors as a possibility to increase work unit productivity. After several joint meetings, the superiors' support for WFP activators was secured.

WFP sport services have been included in Personnel Club activities every year, and consist of almost 20 different sports and activities. Many ball games, gymnastics, jogging and bowling are typical Personnel Club activities. In addition, there are also motorcycling, travelling, hunting and even curling available. Each activity has a contact person who is responsible for the activities. In parallel with Personnel Club activities, recreational activities, such as holiday visits are also supported.

Health-enhancing physical activity opportunities are offered either regularly or on a campaign basis. Regular activities include different modes of gymnastics, recreational ball games, amongst others. Activities such as swimming (two months in the spring), cross-country skiing (winter), and commuting physical activity (summer) are implemented on a campaign basis. Some activities are special events, such as a recreational run for women and a cross-country skiing event. Sport-specific courses and instruction have also been arranged on a yearly basis.

One trademark of Case C's WFP has been the large "WFP festival" events carried out in the autumn and in some years, winter time too. These WFP festivals are events for the whole family, containing activities such as pony-riding, games, recreational sports, entertainment and refreshments. The WFP festivals have been very popular, usually 40-

60% of employees have attended these festivals, which usually take place on Friday evenings. The effects of the WFP festivals on company spirit cannot be underestimated. The role of occupational health care has been active in planning and developing WFP. The company nurse has been member of the Fitness Team since its founding. Physical activity has also been a matter of discussion in occupational health care examinations. The purpose of these discussions has been twofold: to activate employees and thus encourage activity, and to give advice for proper physical activity.

6.2.6.4 Worksite Fitness Program activities in Case D

In Case D, the Worksite Fitness Program is organised through the WFP club. The WFP club is a registered society which receives its budgeting from Case D. All employees are members of the WFP club. The club is organised through central and territorial committees, which plan and perform WFP activities in Case D. At the regional and local level, the WFP club has WFP activators, who are responsible for marketing, and to some extent carrying out, WFP services. Four (regional) work units participating in this study were thus guided in their WFP activities by territorial WFP club committees, and operationally served by local WFP activators. To some extent, the role of local management was left unclear to the researcher.

WFP activities consist of national events and campaigns, territorial events and local events and regular sporting services. National events activated 5% of employees and consisted of a summer festival weekend and different competitive tournaments. The year-round Fitness Card campaign activated 17% of employers, while the one-week Fitness Week attracted 46% of employees. 14% of employees took part in territorial WFP days.

The main focus in WFP is on local WFP activities. Local events activated 20% of employees and 46% took part in regular WFP activities. Local events can be described as "collective wide range physical activity". This means that WFP events can consist of sport-specific instructional courses, trekking or picking mushrooms in the forest, or simply ordinary physical activity, such as walking or cycling. The main focus in local events is on collective activity and raising community spirit. Regular WFP activities vary from office to office. The most common activities are gymnastics, gym exercise and swimming. A number of ball games are also organised.

## *6.3 Methods in case studies*

### *6.3.1 Samples in case studies*

In Case A, the fitness testing sample was gathered in connection with the occupational health care medical examination, which was carried out regularly for employees in the years they were 35, 40, 45,50, 53, 56, 59, 62 and 65 years old. 35 to 45 employees were in those age groups each year and only three to six employees were not involved in the fitness testing. In addition to the ages mentioned above, some younger employees were asked to take part in the testing in order to ensure the age distribution's correspondence to the real age structure of Case A. Based on the five year interval, 16 employees who were tested in 1999 attended the tests again in 2004.

In Case B, a representative sample (70 employees, 40% of personnel) was randomly chosen for the study in 2001. In subsequent years, the sample was supplemented (also randomly) to ensure the sample size remained within the range of 25-30% of personnel yearly.

In Case C, the physical activity questionnaires were delivered around the worksite by the WFP activators during one week in November in 1995, 1999, 2001, 2002, 2003 and 2004. In 1995, 1999, 2003 and 2004, the entire personnel were the target group; employees absent from the worksite during that week were excluded. Reasons for not being in worksite were sick leave, holidays, business trips or rehabilitative courses. The number of employees that were not present during the questionnaire was 55 to 90 employees in different years.

Case D, has several tens of regional working units. Two units (Test-1 and Test-2) were chosen as test units and two for control units (Control-1 and Control-2). All units had about 100 employees and were situated around Finland. Fitness testing and questionnaires were applied during one-day sessions in May 2003, 2004 and 2005 for the test units, and May 2003 and 2005 for the control units. Muscle strength tests and questionnaire completion were performed during the working day and a walking test in the afternoon after the day's work. This arrangement may have had an impact upon the relatively low participation percentage of the fitness testing protocol. For the final sample in Case D, for follow-up purposes only Test-1 was chosen; Test-2, Control-1 and Control-2 were removed simply because of the very low participation percentage in the fitness testing protocol. In the cross-sectional analysis, however, all the data gathered in the first test round and the "new people" tested in rounds 2 or 3 were utilised.

A psycho-social questionnaire (Dallner *et al*. 2000) was implemented in all four case companies during 2003-05. In cases A and B, 54 and 58 employee, respectively, responded to the questionnaire during the fitness testing protocol in 2003 and 2004. In Case C, the psycho-social questionnaire was integrated as a part of physical activity questionnaires in 2003 and 2004, when 191 and 222 employees responded to the questionnaire. In Case D, the psycho-social questionnaire was implemented in all four work units in May 2005. 290 employees responded to the questionnaire, which was 65.3% of the employees of those work units at that time.

Table 24. Data collection in case companies during follow-up periods.

| | description | 1995 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|
| Case A | questionnaire and fitness testing in line with occupational health care examination | | 31 (85%) | 34 (87%) | 32 (84%) | 41 (93%) | 29 (78%) | 38 (86%) | |
| Case B | questionnaire and fitness testing as a research project with a random sample | | | | 62 (89%) | 52 (74%) | 45 (64%) | 42 (60%) | |
| Case C | questionnaire as a part of WFP-development with all employees or random samples | 96 (45%) | 220 (77%) | | sample 60 (77%) | sample 68 (85%) | 193 (74%) | 224 (80%) | |
| Case D | questionnaire and fitness testing as a research project with all employees | | | | | | 56 (51%) | 42 (38%) | 52 (43%) |

In Table 24 the summary of the principles in data collection and amount of employees actively participating in research during follow-up periods. Percentages in parentheses indicate the activity of employees in line with the made research settings in each of the case companies.

### *6.3.2 Physical activity and physical fitness*

In determining physical activity, a "shorter" version of questionnaire was utilised in cases A, B and D compared to the protocol presented in Chapter 4.1. The question was presented as 'How often are you physically active? (Practise fitness-sport, commuting activity, housework, etc) _____ times/week, _____ minutes/session.' Thus, the leisure time and commuting physical activity were not researched separately, but the test supervisor asked these to be taken into consideration. This difference to the questionnaire implemented in the preliminary study may reflect in the slightly lower results in the Physical Activity Indicator. Perceived health, sick leave and assessment of work ability were asked in a routine way (see appendix 1 for details).

The methods used in measuring physical fitness were those presented in chapter 4.2. In Case D, the method used in measuring cardio-respiratory fitness was the two-kilometre walking test (Laukkanen *et al.* 1992) instead of the bicycle ergometer test presented in Chapter 4.2.2.

The motives behind, importance of, and individual role of physical activity and fitness were examined in interviews with both the management and employees. For methodological observation, see Chapter 4.6 for details.

### *6.3.3 Psycho-social factors at work and at the worksite*

A Psycho-social questionnaire (according to Dallner *et al*. 2000) was implemented in all four case companies during 2003-05. See chapter 4.3 for details.

### *6.3.4 Worksite Fitness Program evaluation*

To evaluate the quality of WFP in each case company, Behaviour Modification (McAlister *et al*. 1982) and Social Cognitive Theory (Bandura 1986) protocols were utilised. The data for analysis were gathered in interviews with management and employees. See Chapter 4.4 for details.

### *6.3.5 Assessment and measurement of Intellectual Capital*

The assessment of the components of Intellectual Capital, essential elements of IC and indicators of IC were analysed according to Chapter 4.5. The data for analysis were gathered in interviews with management and owners and, in Cases A and B, also with representatives of customers.

## *6.4 Results in case studies*

### *6.4.1 Evaluation of Worksite the Fitness Program in the case companies*

Evaluation of the case companies' WFP was carried out in three phases. First, in the first and second interviews, respondents were asked to estimate the importance of WFP investments in the Human Resource framework in the company. This question was complemented with further questions on the role of physical activity and WFP at the worksite level. Secondly, the employees in the second interviews were asked to evaluate the company's WFP in a framework of Behaviour Modification. Finally, WFP was evaluated with the help of the WFP cluster created in the preliminary study.

#### 6.4.1.1 Importance of WFP investments and WFP in general

The importance of WFP investment in the Human Resource framework was observed in interviews. The respondents were asked to estimate the importance of WFP investment on a scale of five to one, where 5=extremely important, 4=very important, 3=relatively important, 2=slightly important and1=not at all important. Average (±SD) results are given in Table 25 The difference between the answers of managers and employees were tested with an independent sample T-test.

Table 25. Estimations of employees and managers of the importance of WFP investments in Human Resource framework in case companies.

| | Case A | Case B | Case C | Case D |
|---|---|---|---|---|
| employees | 4,00±0,32 | 4,00±0,00 | 4,30±0,54 | 3,80±0,84 |
| managers | 3,17±0,29 | 3,13±0,25 | 3,50±0,71 | 3,43±0,53 |
| difference | t=-3,82, p<0,01 | t=-7,00, p<0,001 | ns | ns |

The role played by physical activity and fitness in work and the worksite were researched through several questions. In addition to answering these questions, the role of physical activity (and the Worksite Fitness Program) was commented on spontaneously during the interview.

In responding to the general role of physical activity at the worksite, the interviewees focused only on the "mental" effects of physical activity compared to the "physical" effects. Many of the interpretations were in line with the "official" expressions in Finland that time. After many governmental projects it is easy (and justified!) to say "Physical activity is essential for stamina at work" or "Physical activity is good for work ability". Although these aspects influenced the answers, most interviewees gave their personal responses in this matter.

Table 26 summarises the role of physical activity (and WFP) at work and at the worksite in the case companies. When estimating the role of physical activity at the worksite and WFP, some differences could be found between employees and managers. First, many respondents emphasised the positive effects of physical activity and WFP (fresh-

ness, strength for work), while some people formulated the same thing in a more negative or maintaining manner (stamina at work, maintaining work ability). The positive expressions are the more common among employees (for example, an employee in Case A, E1, said: *"If a person is physically active, I presume that this is true also for other people besides myself, he/she is perkier at work, makes fewer mistakes and gets more work done compared to if he/she were tired. In this respect, the employer should support the worksite fitness program even more than it does nowadays"* and an employee in Case B said, *"Yes its (physical activity) as important for whole company as for every individual. If you are active, it will improve your freshness and health."*

Managers tended to express the same positive phenomenon in a "maintaining" way. For example, a manager in Case B said, *"In my unit I, see some problems with stamina and sick leave and I suppose physical activity would be one solution for solving these problems. It is a challenge to create the kind of atmosphere where exercising (and WFP) would be natural part of people's life, not a 'must'. It is not right just to deliver tickets (for WFP activities), it is essential to build up the whole system to activate employees."*

The third aspect in the answers was collective (community spirit or climate), which was seen as quite important by both employees and managers. An employee in Case C responded: *"Worksite sports are important for the spirit and co-operation between people. A good example was our local "Tour de France", where eight people cycled round the great lakes (180 kilometres) and another eight to ten guys served as assistants to those enthusiasts. That was real company spirit!"* The CEO of the same company emphasised that *"For me personally, company sports are actually the only way of getting to know our people, it is a value in itself for me as a manager to be with our employees. In this industry, you can't underestimate the importance of the picture the employees are getting from you. And further*, *"In corporate sports, it is important that people do things together, they plan and sport together. That's essential for our company spirit."* In addition, an employee from Case B stated: *"The role of WFP is that you get to know people better."*

The fourth aspect, the role of physical activity in stress control, was equally important with both employees and managers, although the managers viewed stress control as having an important role in physical activity at the individual level while employees brought that to a more collective level.

In the interviews, the role of physical activity and fitness from the individual point of view was discussed. These answers brought up the role of physical activity; wellbeing, health and work related aspects (stamina at work, relaxation from work, stress control) were regarded as being of greatest importance. Social aspects were connected to the forms of physical activity; tennis, volleyball, ice-hockey or floorball players found the social aspects more important for themselves than people who exercised sports alone.

The role of physical fitness was seen as very much the same as the role of physical activity. Most of the interviewees could not differentiate these two things. Some answers emphasised the more concrete role of physical fitness compared to physical activity, *"in a good state of fitness, you are able to work harder without pain in the shoulder and so on*" (employee in Case A), or *"good fitness is like an investment in the future"* (a man-

ager in Case B), and *"I exercise for fitness – that's an investment for the future"* by an employee in Case B. Many answers were "*fitness gives you (mental) energy (or freshness)"* or similar. In addition, comparisons of "good" versus "bad" fitness were made from the perspective of being sick: *"you do not realise the meaning of good fitness until you have been really sick for days."* (an employee in Case C); a manager in Case D said, *"in good shape, you are able to stand the hurry and haste you have in your job*".

Table 26. The role of physical activity and WFP in work and at the worksite concerning given priorities by employees and managers in case companies.

| **Case A.** | **1st priority** | **2nd priority** | **3rd priority** |
|---|---|---|---|
| F, e, al | if you are physically active, you have more energy | when fit you make fewer mistakes | when fit you have fewer sick leave |
| F, e, p | staying in good health | | |
| F, ma, pah | better stress control | better work activity | |
| M, e, al | social role through team sports | fit shoulders enables effective work | |
| M, e, al | WFP will increase company (and work unit) spirit | sports takes your thoughts away from work | |
| M, e, fs | WFP strengthens collectivity in worksite | physical activity keeps your body alive (refreshment from static working | |
| M, ma, al | maintaining of work ability although staff is ageing | good fitness equals good mental stamina | |
| M, ma, fs | fitness is getting more important in ageing | physical activity is background for mental well-being | WFP is "trademark" for active organisation |
| M, ma, pah | good fitness is background for mental stamina | relaxation through physical activity | time control in your life – life ain't just work! |
| M, occ, pah | better time control through physical activity | in stress control physical activity is important | |
| **Case B** | | | |
| F, e, al | freshness | health | activates peolple! |
| F, e, al | stamina at work | company climate | |
| F, e, pah | good to support active people | PR-thing if taken care of properly | |
| F, ma, pah | counterbalance to work | stamina at work | activate passive |
| M, e, fs | getting know peolple | company climate | |
| M, e, pah | stamina at work | interest | that they care! |
| M, ma, fs | general vitality | | |
| M, ma, p | exercise | | |
| M, ma, pah | without physical activity people don't stand the work pressure | activate passive employees | |
| **Case C** | | | |
| f, e, al | stamina at work | work ability | |
| f, e, fs | stamina at work | health of employees | company spirit |
| f, e, pah | freshness | stamina at work | |
| f, Ex, pah | joy of work | sleep is important also | |
| m, e, fs | counterbalancing work | weight control | revival |
| m, e, fs | company spirit | stamina at work | |
| m, e, fs | co-operation between people | company spirit | |
| m, e, pah | freshness | quality of sleep | keep your muscles in shape |
| m, e, pah | stamina at work | freshness | |
| m, Ex, pah | stamina at work | mental freshness | important to support WFP |
| m, m, fs | stamina at work | good feeling | company spirit |
| m, m, pah | relaxation | company spirit | |

Table 26. continues.

| Case D | | | |
|---|---|---|---|
| F, e, al | community spirit | stress control | back health |
| F, e, pah | freshness | mental freshness | |
| F, e, pah | stamina at work | stress control | community spirit |
| F, e, pah | community spirit | stamina at work | stress control |
| F, ma, al | freshness | more receptive to new things | |
| M, e, al | stamina at work | stress control | health |
| M, Ex, p | get the work done | work efficiency | no early retirements |
| M, ma, al | get the work done | community climate | no early retirements |
| M, ma, al | community climate | work ability | employer reputation |
| M, ma, al | strengthen employees | stamina at work | community spirit |
| M, ma, pah | get the work done | social importance | WFP is a value itself |
| M, ma, pah | stamina at work | stress control | work efficiency |

In Table 26 in first column the abbreviations are: F=female, M=male, e=employee, ma=manager, occ=occupational physician, ex=expert in WFP, p=passive, al=active life-style, pah=physical activity for health, fs=fitness-sports.

In further questions (see Appendix 2), special interest was focused on the effects of physical activity on work effectiveness and innovativeness. In the case of effectiveness, the answers were positive; people saw that physical activity had a positive effect on effectiveness. Several mechanisms were offered: first, physical activity will increase general activity which is closely connected to effectiveness. Secondly, physical activity helps in stress control which then helps in optimising work loads and effectiveness. Behind the stress control was seen also the positive effect of physical activity on the quality of sleep and the effects of WFP on corporate climate. Thirdly, physical activity will improve the general quality of life, which will affect motivation level, which is a key factor behind work efficiency. The importance of WFP on team-work abilities cannot be underestimated either.

In the case companies, innovativeness was seen as a natural part of the development of systematic work or work practices, which means that innovativeness was not seen as a separate phenomenon. Both managers and employees found physical activity essential for innovativeness, although basic know-how, education and similar concepts were considered the most important. The mechanism of physical activity's effect was seen as being the same as in the case of effectiveness: physical activity will improve general activity at work and reduce stress and thus create better opportunities for innovative thinking. Some respondents emphasised "fresh thinking", as E2 said: *"Physical activity keeps your brains in positive shape."* In addition, the importance of physical activity on general stamina was emphasised, too. A worthy opinion was also that *"physically active people are open minded for new things."*

In the interview, several questions were directed towards the interviewees' evaluations of WFP on working climate, fluency of work, exchange of information and commitment of employee in different levels of activity (see Appendix 2). Interviewees estimated the role of WFP based on their own experiences. The smallest unit of analysis was the team or work unit, in which there had been physical activity connected to yearly planning sessions or kick offs and similar. These events were seen as very positive with respect

to working climate; the responses varied between "very important" and "important" and also with respect to the commitment to the employer.

At the company level, WFP activities were considered very important with regard to working climate in all case companies, important in regard to commitment to employees (in Case A and D) and less or not important with regard to fluency of work and exchange of information. WFP was seen also as a part of employer pride by E6, who said *"It's important to see that the employer takes care of us employees – although I'm not personally active in this respect."*

At the company level, it was seen as especially important to get to know better other people than those in your own team. Through this "knowing people", it was estimated that WFP is a key to networking inside the company, which then indirectly would facilitate work processes.

The stakeholders of Case A, B and C were described as being mainly managers in other units of the conglomerate. In this respect, WFP activities were directed at all the personnel of the conglomerate and estimations of the value of WFP were thus quite general – WFP events were seen to be important in getting to know people better across the conglomerate.

At the customer level, WFP activities were evaluated in Case A and B by each respondent from his/her own perspective. WFP activities were mainly pleasant activities during the launching of larger projects. Managers found WFP activities essential (important) in building a co-operative climate and commitment to co-operation. The employees' views were the same regarding a co-operative climate, but less important in commitment to co-operation. Managers did not see WFP activities as having any role in the exchanging information, whereas employees considered WFP activities quite important in that respect. This difference may be explained by the different roles held people, employees met their closest partners in WFP events, whereas managers had more general roles in there.

From the customer's point of view, the vice-chair of the board answered the question, "WFP with customer – do you have co-operation with Case A (besides work meetings)?" as follows: *"We have had all the time – not so much but regularly. Case A has been active in organising events in the final phases of certain projects. Usually, some outdoor activities and a dinner in a relaxed atmosphere, feedback from our (customer's) side has been very positive. These joint events will increase contacts between people and trust between people and thus help the co-operation and partnership on the level of personnel also."* Furthermore, a customer of Case B stated: *"When I compare the time when I was younger and was involved in sports with them (Case B), we made friendships through free-time sports, we exercised together. Today, there are no joint activities in sports. Well, everybody knows that physical activity is good for you, it keeps you in good shape and gives you energy as well. At that time, you got to know people better; communication is easier if you know each other and you have shared experiences, that's what it (WFP) helps.*

Manager M2 pointed out in this phase the importance of Case C's WFP as the local PR function. He stated: *"We are active within the local "Fitness Network", it is good to know other people working in the field of WFP and that is also important for our reputation. Besides this co-operation with other companies, the role of our WFP has risen in importance in the recruitment sector; all people who are applying for a job from us know that we have a good WFP system – and that is why they all seem to be physically very active. Maybe they think that active people are in the front line when we select our staff – and they are not so wrong in that!"*

The stakeholders of Case D were described as being mainly other public offices. In this respect, WFP activities were very rare and thus the role of WFP could not be evaluated. Some managers thought that WFP with stakeholders would be a good idea.

#### 6.4.1.2 Evaluation of each company's WFP in a framework of Behaviour Modification and Social Cognitive Theory

In the second interview, employees were asked to evaluate the case cmpanies' WFP according to application of the Behaviour Modification process. The interviewees were asked to describe the actions case companies had carried out in different parts of the Behaviour Modification model. To get more accurate evaluations, the interviewees were asked to give numbers to each action, the scale of evaluation was: 1=excellent, 2=good, 3=average, 4=fair and 5=poor.

The results of the evaluation of each case company's WFP according to the Behaviour Modification model are presented in Tables 27 and 28.

In interpreting the evaluations presented in Table 27 (see next page), the conclusion can be drawn that the facilities are excellent for active people, but the systematic everyday motivating of employees is missing. The knowledge is mainly information about services, unless you yourself actively take part in a special wellbeing process (Case A). The active role of occupational health care (in Case A) in fitness testing as a part of regular health examination is a strong input to individual knowledge and motivation, although it takes place only every five years for each employee. Persuasion is given by active sport club leaders and in one case as a common positive discussion in work unit. This also reflects the evaluations of social support. The interviewees in Case B saw the organisation of WFP as being quite complex and in fact nobody knew the exact roles and duties of the two clubs and occupational health care.

E5 in Case B stated: *"We have a lot of good services; it is up to your activity if you utilise them."* E7 (activator in own Club) said: *"We have some activation goals in the Club, but do we have resources to do that – that is the question!"*

Table 27. Evaluations of WFP in Case A. and B. given by employees.

| **Element of BM** | **Action in Case A** | **Evaluation by employees** |
|---|---|---|
| Knowledge | Maintaining of work ability actions (general knowledge available in intranet). | 2 |
| | WFP activities are presented in intranet, special wellbeing processes. | 2 |
| | WFP activities are presented in intranet. | 3 |
| Persuasion | Frequent talk about fitness testing. | 4 |
| | Not much personal persuasion. | 4 |
| | Sport clubs persuade you to join the activities | 4 |
| Teaching skills | Some special courses on sport events. | -, |
| | Basic courses by personnel clubs, for example yoga. | 3 |
| | No teaching of skills | 5 |
| Social support | At the work unit level support in OK. | -, |
| | Sport club activators support and encourage to take part. | 2 |
| | No support from management. | 4 |
| Environment, facilities | Facilities for sports are excellent. | 1 |
| | Facilities for sports are OK | 1 |
| | Sport clubs are OK | 1 |
| Organising WFP | Organising is OK. | -, |
| | Organising not tightly managed by management. | 3 |
| | Organising too much on a voluntary (club) basis. Should be part of superior-employee discussion. | 4 |
| **Element of BM** | **Action in Case B** | **Evaluation by employees** |
| Knowledge | Information of activities on the intranet and via e-mail. | 3 |
| | Information of activities on the intranet. | 3 |
| | Information of activities on the intranet. | 3 |
| Persuasion | No active persuasion. | 5 |
| | No active persuasion. | 5 |
| | Nothing official, can be part of employee-superior discussion | 3 |
| Teaching skills | Sport specific courses. | 2 |
| | Nothing. | 5 |
| | Sport specific courses. | 2 |
| Social support | Social support for course such as weight control, nothing else. | 3 |
| | Support of colleagues | 3 |
| | Nothing official. | 4 |
| Environment, facilities | Good facilities. | 1 |
| | Good facilities, no company gym anymore. | 3 |
| | Good services, no company sport facilities any more | 2 |
| Organising WFP | Complex unity (conglomerate club, own Club, OHC), still OK. | 2 |
| | Is not able to comment. | ?, |
| | Co-operation between clubs is OK, role of OHC is unknown | 3 |

The scale of evaluation was: 1=excellent, 2=good, 3=average, 4=fair and 5=poor.

Table 28. Evaluations of WFP in Case C. and D. given by employees.

| Element of BM | Action in Case C | Evaluation by employees |
|---|---|---|
| Knowledge | We have plenty of knowledge, if people want to read! | 1-2 |
| | Good materials for employees | 2 |
| Persuasion | Persuasions for games is all right, otherwise roles between different experts are confusing | 3 |
| | No persuasion, activity is one's own responsibility | 4 |
| Teaching skills | Sport clubs mainly for active people | 3 |
| | Some sports courses have been excellent! | 1 |
| Social support | WFP activator system is good! | 2 |
| | People interested in same sport support each other. Special wellbeing courses are supportive. | 2 |
| Environment, facilities | Excellent facilities, clubs are too competitive | 1-2 |
| | Facilities for different sports is good | 2 |
| Organising WFP | Organizing is all right! | 1 |
| | Organizing is good | 1 |
| **Element of BM** | **Action in Case D** | **Evaluation by employees** |
| Knowledge | Only WFP club's leaflets about events | 5 |
| | Information of WFP events is good, | 2 |
| | no knowledge of the health benefits of physical activity | 5 |
| Persuasion | Persuasion for games and other WFP activities has been active by WFP activators | 2 |
| | No persuasion from occupational health care. | 5 |
| | Persuasion by WFP activators, | 1 |
| | Responsibility on persuasion is shifted merely to WFP activator. | 4 |
| | Occupational health care activates people only to rehabilitative courses. | 5 |
| Teaching skills | Sports-specific instructional courses. | 3 |
| | No teaching, services are meant for active people. | 5 |
| Social support | Support from superiors is not very active, WFP activators are active | 3 (2) |
| | Generally supportive climate. | 2 |
| Environment, facilities | Problems in community activity (storage of bicycles, showers) | 4 |
| | Sport specific facilities are good | 2 |
| | Problems in storing place for bicycles, | 5 |
| | WFP services are good | 2 |
| Organising WFP | New organisation in MWA begun in 2005, good start! | 3 |
| | Organizing is well done, challenge is to activate passive employees | 2 |

The scale of evaluation was: 1=excellent, 2=good, 3=average, 4=fair and 5=poor.

In interpreting the evaluations presented in Table 28, the conclusion can be drawn that the facilities are excellent for active people, but that the systematic management and thus motivation of employees are missing. The knowledge is mainly information about services, unless you yourself actively take part in a special wellbeing process (Case C). *"They presume that we all know!"* said employee E7 in Case D. Persuasion is done by active sport club leaders and in one case as a common positive discussion in the work unit. This also reflects the evaluations of social support. In Case D, persuasion is dele-

gated to active WFP club leaders, who have that voluntary task in addition to their job. In Case D, the role of occupational health care was seen as being passive with respect to physical activity or motivating people to increase their physical activity.

In Case D, an interesting organisational aspect was the new organisation of WFP and MWA in the beginning of 2005, where they two were separated from each other. From then, the voluntary WFP club has had responsibility for all WFP activities and the MWA group with manager M7 in its lead has taken care of other MWA activities. This will most probably clarify the roles of WFP and MWA but will maybe also disengage WFP activities from the community development framework – for which it serves a good tool as described in the results of the psycho-social questionnaire.

In Case C, in the physical activity questionnaires in 1999-2004, a feedback question was posed to evaluate the employees' opinions about WFP's success, "How successful do you think WFP has been?" The scale of answers was from 'very successful' (5) to 'completely unsuccessful' (1). For further analysis, the two most positive answers were combined to gain a positive feedback index for each year for WFP:

As demonstrated in Table 29, the positive feedback index was quite high, reaching 67% in 2004. Positive feedback was correlated with WFPI ($r=0,91$, $p<0,05$) and activity in WFP events ($r=0,87$, p=ns). This emphasises the importance of the quality of services in the activities included in WFP.

Table 29. Positive feedback index of WFP, WFPI and activity on WFP-events in Case C during 1995-2004.

| year | Positive feedback index | WFPI | Participation in WFP events |
|---|---|---|---|
| 1995 | | 26 | 31 |
| 1999 | 49 | 38 | 44 |
| 2001 | 56 | 44 | 47 |
| 2002 | 54 | 45 | 52 |
| 2003 | 56 | 47 | 55 |
| 2004 | 67 | 51 | 62 |

In the framework of Social Cognitive Theory, the environmental factors were good in all case companies with minor difficulties in commuting physical activity in Case D.

In Case A, from the perspective of physical activity and health, the positive attitude of the CEO and other managers had a positive effect on employees' self-efficacy. The active role played by occupational health care enhances that phenomenon. In Case B, in contrast, the neutral attitude of the CEO and other managers probably has only a minor effect on employees' self-efficacy. The passive, even negative attitude of occupational health care in the first years of the follow-up had caused even negative effects on employees' self-efficacy in Case B. The role of occupational health care in WFP was active after April 2003 when Case B changed its health care provider. From autumn 2003, OHC arranged one to two weekly gymnastics sessions for beginners with certain symp-

toms in the back or shoulder region. The company nurse is a member of Case B's MWA group and the OHC procedure actively guides people to WFP activities. An active WFP club activator has a positive influence in that respect; his resources were only very limited.

In Case C, the internal communication supports employees' self-efficacy behind physical activity patterns. From the perspective of physical activity and health the positive attitude of CEO and other managers probably has a positive effect on employees' self-efficacy. Active WFP club activators, on the contrary presumably had a positive influence in that respect. The neutral and somewhat uncertain position of occupational health care in the WFP context could not possibly have major effects on employees' self-efficacy. The occupational health care (OHC) nurse had been a member in the Fitness Team in planning and developing the WFP. At the practical level, the role of OHC has, however, been slightly confusing. In the framework of MWA (and for the purposes of this study), OHC's responsibility was to make fitness tests for employees in connection with OHC examinations. This was not achieved, except in 1999 when nearly 100 employees were tested. On the other hand, the company nurse felt that her expertise was not taken into consideration in developing WFP. She said: *"Our WFP is marching like an army! We have always the same ball games and too competitive sports, golf especially is bad because it is not equal for everyone. We should listen to people and their needs and then decide what to do. WFP activities should take individual needs more carefully into consideration."*

In Case C, in the physical activity questionnaire in 2004, employees were asked the influence different actors had had in their physical activity. 1% of people responded that OHC had influenced them "very much", 5% "much". The respective numbers for WFP as a whole were 2% and 13%, whereas the influence of childhood experiences (34% and 25%, respectively) and sport club activity (20% and 17%, respectively) were high. The results indicate not the poor activity of OHC so much as the outstanding influence that experiences in childhood and youth have on our physical activity patterns at adulthood.

In Case D, from the perspective of physical activity and health, the quite neutral attitude of management probably has little, if any, effect on employees' self-efficacy. The neutral position of occupational health care in the WFP context could not possibly have major effects on employees' self-efficacy. Active WFP activators, on the other hand, had a presumably positive influence in that respect. The only problem in that sense is the voluntary role of WFP activators, their time for motivating actions is limited.

In Case D, in 2003 and 2004, occupational health care had a consultative role in WFP as a member of the local MWA group. In 2005, this connection was removed and as far as the researcher was informed, no collaboration between occupational health care and WFP exists. The same conclusions can be drawn from the second round interviews where employees E6 and E7 found no role for occupational health care in physical activity or motivating employees to participate in physical activity. Further, the heads of test work units (M4 and M6) did not receive any reports from occupational health care about employees' physical activity or fitness. As M4 stated in his e-mail to the researcher: *"Well, it is like that, I don't get any reports from occupational health care, they send them direct to the head office. Our company nurse would know better - or*

*then you have to call the company doctor in head office, they will know better than I know. In our follow-up files I can find some kind of sick leave percentage, but nothing else."*

6.4.1.3 Evaluation of the companies' WFP in the WFP cluster

The third method to evaluate the case companies' WFP was the WFP cluster, which was analysed in the preliminary study. The result is presented in Figure 33.

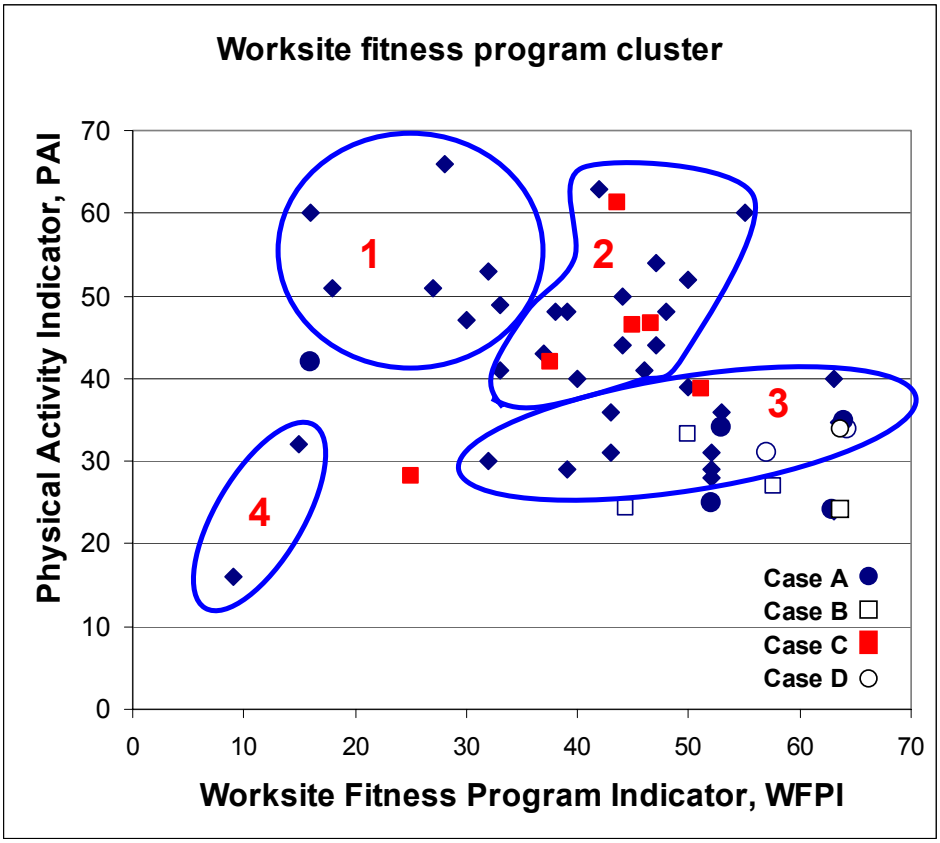


Figure 33. Case companies' positioning in the WFP cluster during years 1995-2005.

Figure 33 shows that the WFP of all case companies was quite effective in the sense of WFP indicators. On average, 40 - 65% of employees were regularly active in different WFP activities in the case companies. That would reflect the high quality and wide range of facilities, as was also expressed by employees in the second interview. The "productivity" of WFP as an overall level of physical activity was different in the case companies. In Case A, PAI reached the relatively low level of 32%, although employees active in WFP had on average a 5% higher PAI than employees not active in WFP. In Case B, the same difference was 3%, in Case C, 12%, and in Case D, 18%. Therefore, while WFP had a positive effect on physical activity, as a whole it was not high enough.

6.4.1.4 Sport specific activity in WFP in case companies during 1995-2005.

One of the main elements of an active WFP is having a proper selection of sports that employees are able to take part in with the employer's financial support. According to the results of the preliminary study (see Chapter 5.2.3.2. for details), gym exercise, swimming, gymnastics, music sports, team sports (ball games) and racquet sports formed a solid setting for a qualitative WFP with respect to the supported sports events. The activity of employees in those sports in the case companies is shown in Table 30.

Table 30. The percentages of active employees in different employer-supported WFP sports during the follow-up periods in the case companies.

| Year | 1995 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|
| **Case A** | | | | | | | | |
| gym exercise | | 0 | 36 | 18 | 15 | 10 | 11 | |
| swimming | | 0 | 6 | 9 | 10 | 7 | 3 | |
| gymnastics | | 3 | 15 | 6 | 22 | 17 | 18 | |
| music sports | | 6 | 6 | 9 | 10 | 7 | 8 | |
| team sports | | 0 | 6 | 0 | 5 | 0 | 0 | |
| racquet sports | | 13 | 18 | 21 | 15 | 14 | 21 | |
| **Case B** | | | | | | | | |
| gym exercise | | | | 21 | 17,3 | 13,3 | 11,9 | |
| swimming | | | | 8 | 4 | 7 | 10 | |
| gymnastics | | | | 21 | 21 | 18 | 19 | |
| music sports | | | | 16 | 17 | 16 | 19 | |
| team sports | | | | 7 | 8 | 7 | 5 | |
| racquet sports | | | | 5 | 6 | 2 | 7 | |
| **Case C** | | | | | | | | |
| gym exercise | 0 | 11 | | 15 | 16 | 7 | 8 | |
| swimming | 1 | 4 | | 8 | 4 | 12 | 11 | |
| gymnastics | 1 | 1 | | 8 | 7 | 1 | 2 | |
| music sports | 0 | 0 | | 3 | 6 | 7 | 2 | |
| team sports | 12 | 22 | | 8 | 12 | 17 | 17 | |
| racquet sports | 5 | 8 | | 8 | 3 | 6 | 5 | |
| **Case D** | | | | | | | | |
| gym exercise | | | | | | 32 | 29 | 33 |
| swimming | | | | | | 9 | 7 | 8 |
| gymnastics | | | | | | 9 | 10 | 10 |
| music sports | | | | | | 20 | 14 | 19 |
| team sports | | | | | | 7 | 7 | 6 |
| racquet sports | | | | | | 4 | 2 | 2 |

In Case A, activity in the WFP was high during the whole follow-up period, excluding 1999 when the WFP was not operated or marketed very efficiently. In Case B, activity in the WFP was high during the whole follow-up period. A slight, although not statisti-

cally significant (Pearsson's Chi-square test) decrease was seen in 2003, when Case B moved to a new office building with no in-house WFP facilities within it. The change in WFP practices caused a decrease in WFP activity in 2003, but in 2004 the level of WFPI rose to good level again.

In Case C, changes in WFP activities between the years were quite small. After the beginning of the more effective WFP programme in 1995, activity both in musculoskeletal sports and in ballgames increased. In MSC sports the change was from 14,7% to 41,2% (1995-1999); the difference was statistically significant (Pearson's Chi-square value 20,93, $p<0,001$). In ball games, the respective numbers were 16,8% to 33,5% (Pearson's Chi-square value 9,03, $p<0,01$). In Case D, activity in specific sport exercise between the years was relatively constant. In WFP, the most popular sports have been racquet sports, gym exercise and gymnastics.

*6.4.2 Follow-up results of physical activity and fitness patterns in case companies*

From the point of view of physical activity and fitness patterns, the changes in the Worksite Fitness Program Indicator (WFPI), Worksite Fitness Program Evenys Indicator (WFPE), Physical Activity Indicator (PAI) and Physical Fitness Indicator (PFI) formed the basis for the follow-up results in this study. The main results are presented in Table 31. Accurate results of each case are presented in Appendix 4.

Table 31. Changes in physical activity and fitness patterns in case companies during the follow-up periods.

| Year | 1995 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|
| **Case A** | | | | | | | | |
| WFPI | | 16 ◄***► 64 | | 52 | 63 | 52 | 53 | |
| PAI | | 42 | 35 | 25 | 24 | 31 | 34 | |
| PFI | | 65 | 41 | 38 | 44 | 41 | 58 | |
| **Case B** | | | | | | | | |
| WFPI | | | | 63 | 58 | 44 | 50 | |
| PAI | | | | 24 | 27 | 24 | 33 | |
| PFI | | | | 76 | 73 | 73 | 67 | |
| **Case C** | | | | | | | | |
| WFPI | 25 | 38 | | 44 | 45 | 47 | 51 | |
| WFPE | 31 ◄***► 44 | | | 47 | 52 | 55 | 62 | |
| PAI | 23 ◄***► 42 | ◄——— * ———► | | 61 | 46 | 47 | 39 | |
| **Case D** | | | | | | | | |
| WFPI | | | | | | 64 | 57 | 64 |
| PAI | | | | | | 34 | 31 | 35 |
| PFI | | | | | | 66 ◄***► 86 | | 71 |

In Table 31: WFPI=Worksite Fitness Program Indicator, WFPE=Worksite Fitness Program Event Indicator, PAI=Physical Activity Indicator and PFI=Physical Fitness Indi-

cator. Statistically significant differences between consecutive years were tested with Pearsson's Chi-square test and are presented with an asterisk (* $p<0,05$, *** $p<0,001$).

In Case A, physical activity had a V-shape pattern during 1999-2004. Activity as determined by PAI was at its highest in 1999 and at its lowest during 2001 and 2002, after which it rose once again. Changes in physical fitness had the same V-shape pattern as physical activity had during 1999-2004. Fitness as determined by PFI was at its highest in 1999 and at its lowest in 2001, after which it rose once again. In terms of Total Fitness Value, the pattern was identical. In PFI, no statistical differences were found (Pearson's Chi-square test). On the whole, physical fitness was at an average level in Case A during the follow-up period. The variation was quite large, the mean for TFV was 3,10 and SD 1,48. No differences between males and females could be discerned, but as will be clear from the chapter 6.4.4, age had a great impact on TFV. Older employees were generally in better shape than younger. Activity in the WFP was high during the whole follow-up period, excluding 1999 when the WFP was not operated and marketed very efficiently.

In Case B, for PAI, no statistical differences were found (Pearsson's Chi-square test), while as regards the total amount of physical activity, in 2004 it was significantly higher than in 2002 and 2003 (independent samples T-test, t-values $t=-2,10$, $p<0,05$ between 2002 and 2003. Activity in the WFP was high during the whole follow-up period. A slight, although not statistically significant (Pearsson's Chi-square test) decrease was seen in 2003 when Case B moved to a new office building with no in-house WFP facilities. The change in WFP practices caused a decrease in WFP activity in 2003, but in 2004 the level of WFPI rose to a good level again. Changes in physical fitness were relatively small (and statistically not significant) during 2001-2004. On the whole, physical fitness was at a good level in Case B during the follow-up period. The variation was quite large; the mean for TFV was 3,44 and SD 1,47. No differences between males and females could be discerned, but as will be clear from the chapter 6.4.4, age had great impact on TFV. Older employees were generally in better shape than younger.

In Case C, physical activity had an inverse V-shape pattern during 1995-2004. Activity as determined by PAI after the WFP started in 1995 was at its highest in 2001 and at its lowest in 2004. PAI increased from 1995 to 1999 (23,2% to 42,1%) statistically significantly (Pearsson's Chi-square test, Chi-square value = 100,28, $p<0,001$). The increase from 1999 to 2001 (42,1% to 61,3%) was also significant, Chi-square value = 6,01, $p<0,05$. Activity in the WFP was high during the whole follow-up period, excluding 1995 when the WFP was in its beginning phase as a health-enhancing worksite fitness programme. In 1995, WFP consisted mainly of competitive ball games and one gymnastics session a week. A quarter of the staff participated in the programme. After that, (as described in Table 32) the quality and quantity of WFP services increased. Activity in WFP events did increase from 1995 to 1999 (Pearsson Chi-square value = 1,95, $p<0,05$.

In Case C, the physical activity patterns in different age groups for both males and females were relatively similar. The PAI was changing in a similar way for both genders over the period 1995-2004. Only in 2003, did the females have a statistically significantly higher PAI than did the males (Pearsson's Chi-square value = 5,19, $p<0,05$). In

physical activity (PAI), the age groups showed relatively similar patterns. The female age group of 40-49 years had a higher PAI than other groups, the difference was not, however, statistically significant.

In WFP activity (WFPI), in the males, the two youngest age groups were more active than the age groups 40-49 years and 50-59 years; Pearsson's Chi square test under 30 years vs 40-49 years Chi-square value = 10,29, $p<0,001$, under 30 years vs 50-59 years Chi-square value = 3,88, $p<0,05$, 30-39 years vs 40-49 years Chi-square value = 12,80, $p<0,001$, 30-39 years vs 50-59 years Chi-square value = 4,46, $p<0,05$.

The differences in activity in WFP events for males were in the same range between the age group 30-39 years and older age groups; Pearsson's Chi square test 30-39 years vs 40-49 years Chi-square value = 11,58, $p<0,001$, 30-39 years vs 50-59 years Chi-square value = 7,77, $p<0,01$. In females, the youngest age groups were more active than the older ones; Pearsson's Chi-square values under 30 years vs 40-49 years Chi-square = 14,59, $p<0,001$, under 30 years vs 50-59 years Chi-square = 11,81, $p<0,001$, 30-39 years vs 40-49 years Chi-square = 10,30, $p<0,001$.

In Case D, the physical activity level was quite constant during 2003-05. In the Test-1 work unit, PAI was at a level of 30-35, which can be described as relatively low. The total amount of physical activity increased from three hours to 200-210 minutes a week during the follow-up. The activity in the WFP was very high in the Test-1 work unit in 2003-05; 57-64% of the employees participated in the WFP. Changes in physical fitness in the Test-1 work unit had a reverse V-shape pattern during 2003-05. The PFI rose from 66 in 2003 to 86 in 2004 and dropped again to 71 in 2005. The change from 2003 to 2004 was statistically significant (Pearsson Chi-Square test value 4,87, $p<0,05$). In terms of Total Fitness Value, the pattern was identical; the change from 2003 to 2004 was statistically significant (independent samples T-test, t-value $t=-3,45$, $p<0,001$). On the whole, physical fitness was at a good level in Case D's Test-1 work unit during the follow-up period. The distribution was quite normal, for the whole sample (four work units, n=239) mean (±SD) for TFV was 3,33±1,16. Estimations of abdominal muscle strength were higher than for the walking test (means of 3,94 and 2,64, respectively), but at the same time the variations were higher (the SD for estimation of abdominals was 1,67 and for the of walking test, 0,98). No differences between males and females could be discerned, but as will be seen from the chapter 6.4.4, age had some impact on TFV. Older employees were generally in better shape than younger.

Physical activity is sports-specific. In the case companies, activity in different sports was relatively constant and thus for the purposes of follow-up all sports were grouped into three groups. Basic sports were considered to be those such as walking, cycling, jogging, cross-county skiing, Nordic walking and roller skating. Ball games included team and racquet sports, while sports for musculo-skeletal conditioning (MSC) consisted of gym exercise, swimming, gymnastics, and music and martial sports. Table 32 presents the activity in those three groups in the case companies during follow-up periods.

Table 32. Percentages of active employees in different sports groups (basic sports, ball games and MSC sports) in the case companies during the follow-up periods.

| Year | 1995 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|
| **Case A** | | | | | | | | |
| Exercises basic sports | | 63 | 59 | 73 | 71 | 55 | 76 | |
| Active in ballgames | | 16 | 24 | 33 | 39 | 34 | 32 | |
| Active in MSC-sports | | 19 | 58 | 42 | 49 | 55 | 66 | |
| **Case B** | | | | | | | | |
| Exercises basic sports | | | | 73 | 71 | 69 | 71 | |
| Active in ballgames | | | | 26 | 25 | 20 | 21 | |
| Active in MSC-sports | | | | 60 | 65 | 67 | 71 | |
| **Case C** | | | | | | | | |
| Exercises basic sports | 60 | 68 | | 79 | 62 | 69 | 70 | |
| Active in ballgames | 17 | 34 | | 27 | 25 | 38 | 38 | |
| Active in MSC-sports | 15 | 41 | | 52 | 64 | 40 | 48 | |
| **Case D** | | | | | | | | |
| Exercises basic sports | | | | | | 75 | 76 | 75 |
| Active in ballgames | | | | | | 14 | 14 | 10 |
| Active in MSC-sports | | | | | | 64 | 60 | 65 |

Compared to the results of the preliminary study, the activity of the employees in Case A was slightly lower in basic sports, but slightly higher in ball games and musculo-skeletal sports. In Case B, the activity was at the same level in basic sports and ball games, but clearly higher in MSC sports. In Case C, sport-specific activity was the same in basic sports, slightly higher in musculo-skeletal sports and clearly higher in ball games, whereas in Case D the activity was slightly higher in basic sports, clearly higher in musculo-skeletal sports, but slightly lower in ballgames. These differences in Case D are at least partly gender-related and close to the activity patterns of females in general.

### *6.4.3 Interpretation of the follow-up results in physical activity and fitness patterns*

#### 6.4.3.1 Interpretation of the results in Case A during 1999-2004

In interpreting the results obtained from fitness testing and the physical activity questionnaire, a second set of interviews was carried out in April 2005. Two managers (M1 and M3) and three employees (E5, E6 and E7) took part in the interviews.

In the interviews, the results of the research into physical activity and fitness patterns during 1999-2004 were shown to the interviewees (data presented in Table 31) and the following questions were posed: "Do the results seem reasonable or real? What could be the reasons that caused first the decrease in results (in 2000-2002) and later the increase in years 2003-2004?"

All the interviewees had the same interpretation: work stress in Case A was quite heavy in 1999 because of the millennium and especially heavy in 2001-2002 because of the Euro change in their software products. Employee E5 said: *"The Euro-change was*

*really a tough job. The pressure was highest in 2001 and still high in 2002, we had to work overtime and I hadn't the strength to take part in sport after work, as I usually had. But in 2003, work returned to normal and also the maintaining of work ability programme became more active, that may be a second explanation. But the Euro was the biggest reason".*

M3 (responsible for MWA) stated: "The y*ears 2001 and 2002 were tough for us because of the Euro, we really worked hard at that time. And if you work hard, you don't have time or energy to be active in sports. This is a peculiar "chicken and egg" situation; you should be physically active to have stamina at work, but if you have to work really hard you don't have energy to do sport. That happened to us in 2001-02, and that is what the management should take into consideration: if you have hard work periods you have to have some lighter time after that. And now in 2003-04 we have had just the normal working pace. On the other hand, activities involving MWA began as early as in 1999, but to implement these things properly within the organisation takes five years. I presume that the good results in 2003-04 are, at least partly, because of the MWA work."*

The representative of the owner also confirmed this interpretation as he said: *"The years 2000 and Euro were tough phases in our co-operation, really hard work and commitment was needed. The year 2000 was hard, but the change to the Euro was even harder; it happened in two phases, first programming and then implementing. Successful work needed highly motivated and skilful personnel both in Case A and our (the customer's) side. The people in Case A worked hard, they had good working spirit, they had only three weeks of summer holiday (normally four weeks) and everything went well. We really appreciate their effort and expertise!"*

Based on the interviews, it can be concluded that there is an inverse relationship between intense work load and physical activity and fitness. On the company level, heavy work periods will effect people directly through longer work days (overtime working) and through greater stress at work. During such phases, great emphasis has to be placed upon relaxation and renewal, in which physical activity may well have an important role.

Differences in physical fitness between the age groups were confirmed by M1 (the CEO), who spontaneously said in the first interview (without yet having seen the results presented) that, *"Maintaining of work ability is very important in this business, but not only for the people over 50 years, as is usually indicated, but also for our younger people, who clearly are not in the same shape as we older people are."*

#### 6.4.3.2 Interpretation of the results during 2001-2004 in Case B

In interpreting the results obtained from fitness testing and the physical activity questionnaire, a second set of interviews was carried out in May 2005. Two managers (M1 and M2) and three employees (E5, E6 and E7) took part in the interviews.

In the interviews, the results of the physical activity and fitness patterns researched during 2001-2004 were shown to the interviewees (data presented in Table 31) and the fol-

lowing questions were posed: "Do the results seem reasonable or real? What could be the reasons that caused the increase in physical activity in 2004 and at the same time a decrease in fitness?" With the managers, the primarily results of the psycho-social questionnaire were also considered.

Manager M1 could not find any reason or explanation for the results of the physical activity and fitness patterns. M2 (responsible for MWA) was specifically asked why the difference between PAI (required physical activity at least four times a week) and PAI3 (requirement only three times a week) was so large in Case B. He stated spontaneously: *"Our people believe what they have been told. And during the ten last years everybody has been told that three times a week is enough. Our people do what is enough – and nothing more!" R*egarding the actual results, he commented as follows: *"The results seem obvious, I believe that so it went. In our work, I don't find anything so special that would have affected people's physical activity."*

Employees were more aware of the changes of work load during 2001-04. E5 stated: *"The workload has increased all the time, the years 2003 and 2004 have been the worst in that respect. In 2003, we lost our own gym and sports facilities and that has influenced people's fitness greatly, especially for those who are not very active. It is somehow more difficult to go to another place [the commercial gym a few hundred metres from Case B]. Also, when the workload is high, those 'not so active' people don't have time or energy to exercise and their fitness will drop. The challenging working pace had also affected fitness testing, people don't seem to have time to participate."*

E6 said: *"We'd been in a hurry during recent years, that's affecting the physical activity level of people. And the lost of our own gym affected some people's activity negatively, that's for sure!"*

E7 had to some extent an opposite opinion: *"Our WFP services have improved during recent years. People have many opportunities to exercise and that's had an influence on the rise in physical activity. IT people in general are very interested in sports, that's a good way to release yourself from the job for a while. But what the reason is for decrease in fitness in 2004, that I don't know!"*

Based on the interviews, it can be concluded that the perceived heavy work load would negatively affect physical activity of those people who are so involved in exercise. Really active people find the time and energy to exercise even if the work is hard.

#### 6.4.3.3 Interpretation of the results during 1995-2004 in Case C

In interpreting the results obtained from the physical activity questionnaire, a second set of interviews was carried out in May 2005. One manager (M2), one expert (Ex1) and two employees (E7 and E8) took part in the interviews.

In the interviews, the results of the physical activity patterns researched during 1994-2004 were shown to the interviewees (data presented in Table 31) and the following questions were posed: "Do the results seem reasonable or real? What could be the rea-

sons that caused first the rise in physical activity (in 1995-2001) and later the decline (over the years 2002-2004)?"

All the interviewees had the same basic interpretation: the services in WFP increased in quantity and quality from 1995 to 2001, after which they have settled at a rather good level. During the years 2002-2004, people were saturated with good services and some of them thought that activities in WFP were enough for them (and their health and work ability).

E7 stated: *"In 1995 some recreational sports besides competitive sports began and more people went along. Physical activity and the worksite fitness programme were discussed quite a lot – and in a positive atmosphere. People saw that investments in WFP were increasing and that was found to be a good thing. Also, the working shifts in shiftwork were such that there was quite a lot of free time after night shifts which made it possible to practise more sports. In 2001, the system in work shifts was changed such that no long free sessions were left and thus the opportunities for sports were diminished. One problem in some sports is also too high a level of competitiveness; whenever a new sport is launched it is always more recreational and everybody can participate, but little by little the game changes into a more serious competition and those not so eager, skilful or fit are left out."*

E8 said: "The WFP service was improving up to 2001 and people became more active. After that, people got bored with the same, although good, service and some kind of natural laziness won the day. In our job (office), there has not been any remarkable change, so that would not be the reason for the decreased activity. People just are getting lazy."

M2 and Ex1, who had both been building up the WFP and its services, saw the situation the same way as employees E7 and E8; the level of services had improved remarkably from 1995 to 2001 and after that a steady, good level has been maintained. But the reasons for the decline in the years 2002-04 were different according to M2 and Ex1. M2 stated: *"Between 1995 and 1999, WFP services were increased quite greatly, more sports were possible for employees and simply that caused the increase in physical activity. In the content of WFP, a great change occurred in 1999, when 'physical activity for health' was launched, and people's awareness of the role of physical activity was clarified. This produced good results in 2001; it takes some years before you get things through in an organisation. The decline between 2001 and 2004 is real! It is rather contradictory that while the WFP services have been at a very good level employees activity in the WFP has increased but general physical activity decreased. The reason behind this is that the WFP is experienced as an employer's activity and thus the employer should take responsibility for each employee's physical activity – the employee's own responsibility in that respect is partly forgotten by them. This seems to be the case especially in the younger age groups. The positive attitude towards work and the employer is decreasing, unfortunately! And I have to admit also that in some phases, the work of the trade unions have negatively effected the work on developing the WFP and employees' physical activity, health and work ability!"*

The same issue was commented on by Ex1, who had in this respect a more humane view, saying: *"The intensive work we carried out from 1995 produced the best results in 2001. WFP services were increased constantly; The WFP activator network was established in 1995. In 1999, the campaign "Physical activity for productivity" also started, which motivates superiors to support our WFP activators. But the decline after 2001 is real. The reason is partly that many active employees have retired after 2001, but that's only a minor explanation. Maybe the novelty value has worn off and the WFP activities have gained an ordinary 'everyday life' label. Many of the people think that one to two times a week (physical activity) is enough, and that's a wrong opinion! Especially younger people are challenging in this respect, those who are older and whose health has already got a little bit worse are easier to motivate to engage in physical activity. We have good internal marketing for our WFP, but still more personal motivation is needed."* When asked for more detail on working conditions, Ex1 responded: "*The changes in working shifts have probably influenced to some extent the level of physical activity. Up to 2001, we had workshift "37" in blue collar and that allowed quite long free time and thus the possibility to take part in physical activity. In 2002, that changed and physical activity went down."*

The conclusions from these four interviews are easy to draw. Building up a good WFP will increase employees' physical activity remarkably (from a level of 25% to the level of 50%, as measured by PAI). Extraordinary results (PAI 61 in 2001) can be achieved when all work and worksite-related issues are positive. In the case of Case C, this would mean steady production, no strikes, no major changes in working conditions, etc. The change in workshift at the beginning of 2002 influenced not only the opportunities for blue collar employees to exercise but also affected their earnings considerably, too. Although the earnings were returned to the earlier level relatively quickly, the struggle between the employees and employer was considerably prolonged.

#### 6.4.3.4 Interpretation of the results during 2003-05 in Case D

In interpreting the results obtained from the fitness testing and physical activity questionnaire, a second set of interviews was carried out in October 2005. Three managers (M4, M6 and M7) and two employees (E6 and E7) took part in the interviews.

In the interviews of M4, M7, E6 and E7 (from Test-1 work unit), the results of the physical activity and fitness patterns researched during 2003-05 were shown to the interviewees (data presented in Table 31) and questions were framed: "Do the results seem reasonable or real? What could be the reasons that caused first the increase in fitness results (in 2004) and later the decrease in 2005?"

In evaluating the whole study, all the interviewees from the Test-1 work unit had the same interpretation, the study did not have any effects on MWA or WFP routines in the Test-1 work unit. Both managers and employees thought that the WFP was seen to be operating relatively well. The study was introduced by the HR, MWA and WFP experts in the "headquarters" and no extra budgeting was available. As M4, the head of work unit Test-1 said: *"We didn't implement any extra, special activities, we tried to go on and develop our actions based on the results of the fitness tests and on the ideas (and needs) of our employees."* From the organisational point of view, the only change that

took place was in 2005 when the MWA and WFP activities were clearly separated (organisationally) from each other. In 2003 and 2004, some 'health enhancing physical activity'–type WFP activities were implemented under the MWA unit, whereas in 2005 all WFP activities were co-ordinated by WFP club.

The participation rate was seen as quite good; in the beginning in 2003, it was relatively high *("as it always is in the beginning phases"* stated employee E7). In 2004 and 2005, participation decreased to 40%, which was still considered "reasonable" by the interviewees. The assessment of the managers was that *"the active people are always involved in these kinds of things"* (M7) and *"it was nice to see that the older employees also took part in this study – not only the young ones!"* (M4). Employee E6 had her explanation: *"Fitness testing always took place in May when people are tired and are waiting for the summer holiday. This probably has diminished the participation rate in testing."* As a whole, the researcher concluded that the participation rate was at its minimum level of around 40%. It was much lower than in other case companies, where the implementation and set-up of the study were different. This will be discussed in more detail in chapter D-5.

In the Test-1 work unit, the changes in physical activity (PAI) and physical fitness (PFI) were seen as "natural" or "based on change". Actually the changes were so minor that no explanations were found for interpretation.

Based on the interviews (and results), it could be concluded that during the relatively short follow-up period of two years no changes in WFP activities nor in behaviour of the employees could be seen in the Test-1 work unit.

The interview of M5 (head of Test-2 work unit) focused on the participation rate. In the first year, 2003, participation was very high (83%) but dropped then to 35% and 30% in 2004 and 2005, respectively. M5 stated: *"In the beginning, there was a great enthusiasm, which caused those high figures in 2003. But why it dropped like that, that's the question. In 2004, we kind of were surprised by the measurements; we didn't expect them to come so soon. The last time, I tried to market and advertise it, but no, people didn't take part. I don't really know what the reason was for that. Fitness testing was done during working hours and some prizes were drawn for the participants, but still people were not active."* The researcher's conclusion was that the study was, from the point of view of both management and employees, some kind of nice campaign which was not seen as a part of development of work or employees in the wider range. Fitness testing was probably seen as separate from the Test-2 work unit's real daily life.

*6.4.4 The effects and relationship of physical activity and fitness patterns on perceived health, sick leave, work ability assessments and work related psycho-social factors in case companies*

6.4.4.1 Effects of physical activity patterns on physical fitness

Based on the principles of physical activity and fitness, the physical activity patterns are likely to have an effect on the level of physical activity. A cross-sectional analysis of the data confirmed this assumption. Data on all first-time tested employees in the case companies were utilised for the case specific analyses. In Case A, 189 employees took part in the fitness testing protocol during 1999-2004; this sample represents about 85% of Case A's personnel. In Case B, the comparable numbers were 91 employees (years 2001-04) and 50% of Case B's personnel. In Case D, during 2003-2005, 239 employees attended fitness testing and questionnaires. This sample represents about 56% of Case D's personnel concerning four regional work units.

Based on the samples described above, stepwise regression analyses were ran to evaluate the effects of physical activity patterns on Total Fitness Value (TFV), estimation of cardio-respiratory fitness ($VO_2$ and walking test) and estimation of abdominal strength. Age, gender, the total amount of physical activity, intensity of physical activity and activity in WFP were independent variables. The results of the Cases A, B and D are shown in Formulas 10, 11 and 12. The abbreviations and dummy variables used in the formulas are: APA=amount of physical activity, IPA=intensity of physical activity (2=no activity, 4=light activity, 6=moderate activity, 8=vigorous activity), gender (1=male, 0=female), WFPI = activity in WFP (1=active, 0=not active), gender (1=male, 0=female), WFPI = activity in WFP (1=active, 0=not active).

Formula 10. Case A.

TFV=0,003*APA+0,038*age+0,442*WFP+0,143*IPA-0,029,
t-values for APA=3,23 ($p<0,001$),age=3,15 ($p<0,01$),
WFP=2,19 ($p<0,05$) and IPA=2,01 ($p<0,05$)
F value = 9,03, $p<0,001$, $R^2$ = 16,6%

VO2 estimation=0,082*age+0,004*APA+0,182*IPA-2,5077,
t-values for age=5,49 ($p<0,001$),
APA=3,27 ($p<0,001$) and IPA=2,11 ($p<0,05$)
F value = 17,19, $p<0,001$, $R^2$ = 20,8%

Abd. estimation=0,733*WFP+0,003*APA+2,91,
t-value for WFPI=2,94, $p<0,05$ and APA=2,83, $p<0,05$
F value = 8,58, $p<0,001$, $R^2$ = 7,8%

Formula 11. Case B.

TFV=0,348*IPA+0,060*age+0,004*APA+0,61*WFPI -2,084,
t-values for IPA=3,24 ($p<0,01$), age=4,10 ($p<0,001$), APA=2,42 ($p<0,05$)
and WFPIt=2,22 ($p<0,05$), F-value=10,00, $p<0,001$, $R^2$=32,3%

VO2 estimation=0,072*age+0,005*APA+0,291*IPA+0,704*WFPI-3,15,
t-values for age=5,26, ($p<0,001$), APA=3,43 ($p<0,001$),IPA=2,89 ($p<0,01$)
and WFPI =2,74 ($p<0,01$), F-value=14,00, $p<0,001$, $R^2$=40,0%

Abd. estimation=0,437*IPA+0,046*age-0,349,
t-values for IPA=2,72 ($p<0,01$) and
age=2,09 ($p<0,05$), F-value=5,62, $p<0,01$, $R^2$=11,9%

Formula 12. Case D.

TFV=-0,788*gender+0,030*age+0,218*IPA+0,346*WFPI+0,827
t-values for gender=-3,96 $p<0,001$,age=4,71, $p<0,001$,
IPA=3,72, $p<0,001$ and WFPI=2,48, $p<0,05$
F-value = 14,76, $p<0,001$, $R^2$ = 20,1%

WT est =0,211*IPA-0,600*gender+0,015*age+0,001*APA+0,252*WFPI+0,629
t-values for IPA=3,92, $p<0,001$, gender t=-3,47, $p<0,001$
age =2,69, $p<0,01$, APA=2,13, $p<0,05$ and WFPI=2,04, $p<0,05$
F-value = 11,06, $p<0,001$, $R^2$ = 20,4%

Abd.est. =0,045*age+0,229*IPA-0,798*gender+0,447*WFPI+0,673,
t-value for age=4,75, $p<0,001$, IPA=2,62, $p<0,01$,
gender =-2,69, $p<0,01$ and WFPI=2,14, $p<0,05$
F-value = 10,4, $p<0,001$, $R^2$ = 15,1%

According to Formulas 10, 11 and 12, the measured fitness values were mainly influenced by the intensity of physical activity and less by the amount of physical activity. Activity in the WFP had a positive effect on the Total Fitness Value (TFV) and abdominal strength in Case A, whereas in Case B, activity in the WFP had a slightly positive effect on TFV and cardio-respiratory fitness (VO2 estimation). In Case D, activity in the WFP had a slight positive effect on all fitness parameters.

With respect to gender and age, gender had an effect on physical fitness only in Case D, where women were in better shape compared to men. Age, in contrast, had an effect on physical fitness characteristics in all three case companies. The effect of age was highest in cardio-respiratory fitness (VO2 and walking test estimation) in Cases A and B, while in Case D age was a more significant variable in abdominal strength. Altogether, age had a relatively strong effect on the Total Fitness Value (TFV); older employees were in relatively better shape than younger employees. Figure 34 presents the average values of TFV in different age groups in case companies A, B, and D.

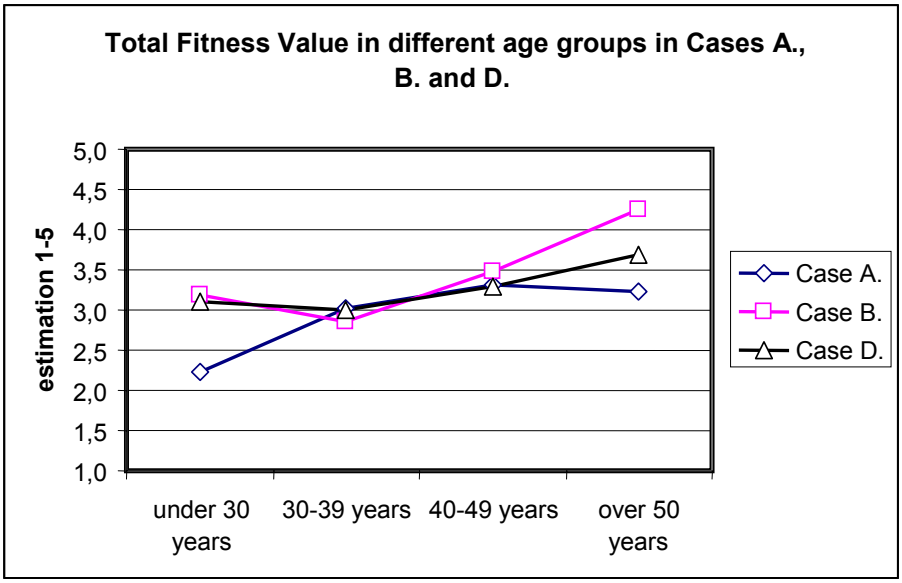


Figure 34. Average values of TFV in different age groups in case companies A, B and D.

6.4.4.2 Effects of physical activity patterns on perceived health

In the preliminary study, perceived health was seen to be a rather sensible variable with respect to physical activity patterns. In the case companies, perceived health was researched in Cases C and D.

In Case C, perceived health was examined by means of several questions in the physical activity questionnaire. Later, a Health Factor variable was constructed, as explained in Chapter 4.1.4. In the follow-up analysis, both the Health Factor and the "basic" health question methods were utilised. The basic health question was, "How would you describe your health?" and the alternatives were 5=good, 4=fairly good, 3=average, 2=fairly poor, 1=poor. The results of this basic question are given under the heading "perceived health".

In Case C, activity in the WFP was the first subject with respect to perceived health. The results provided no evidence of the effects of WFP activity in itself at the individual level. Male employees active in the WFP had a slightly higher Health Factor than the non active, but this was influenced by the younger age distribution of WFP-active employees.

During the follow-up (1995-2004), Worksite Fitness Program activity (WFPI) correlated highly positively with Health Factor at the company level ($r=0,828$, $p<0,05$).

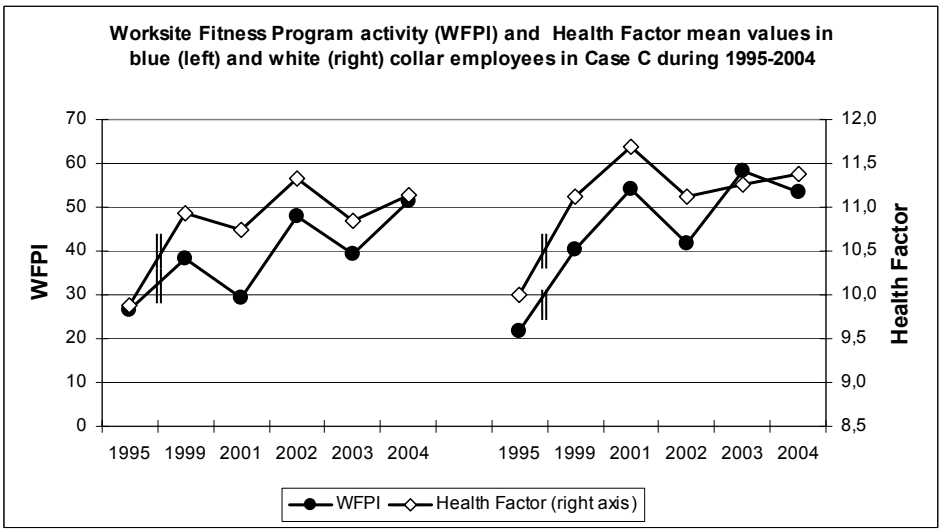


Figure 35. Worksite Fitness Program activity (WFPI) and mean values for Health Factor in blue (left) and white collar (right) in Case C during 1995-2004.

Figure 35 demonstrated the astonishing parallel changes between WFPI and Health Factor in Case C for both blue (correlation coefficient 0,847, $p<0,05$) and white collar (correlation coefficient 0,911, $p<0,01$). Two possible explanations could be put forward. First, activity in WFP will at the individual level raise the level and quality of physical activity which will then in turn improve the Health Factor (see Table 32). Second, the explanation receives support from the qualitative interviews of the employees (see Table 26). Participation in WFP activities will improve freshness, company spirit and stamina at work, which it can be assumed will affect employees' perceived health either directly or at least indirectly. In accordance with these explanations in psycho-social questionnaires, employees active in WFP had better estimations of the working climate, which would partly influence the feelings of health as well.

In Case C, general physical activity patterns were the second subject with respect to perceived health. At the individual level, regression analyses were carried out for the years 1999, 2003 and 2004, when the sample was the whole staff. In the regression analysis, the Health Factor was utilised for its better characteristics (range 3-15). In the multiple regression analyses, age group (AG), gender, collar, total amount of physical activity (APA) and intensity of physical activity (IPA, 2 = no activity, 4 = light, 6 = moderate and 8 = vigorous activity) and activity in WFP (WFPI) were independent variables. In the years 1999 and 2004, only the intensity of physical activity was found to create a statistically significant coefficient in the regression analysis, in 2003 the age group was also a significant coefficient.

Formula 13.

year 1999 Health Factor = 0,58*IPA+7,78,
t-value for IPA=6,45 ($p<0,001$), F-value 41,6, ($p<0,001$),
$R^2$=16,9%

year 2003 Health Factor = 0,264*IPA-0,276*AG+10,04,
t-values IPA=3,10 ($p<0,01$), AG=-2,47 ($p<0,05$),
F-value 10,88 ($p<0,001$), $R^2$=10,9%

year 2004 Health Factor = 0,405*IPA+8,81,
t-value for IPA=5,22 ($p<0,001$), F-value 27,2 ($p<0,001$),
$R^2$=11,8%

The intensity (not the amount) of physical activity was essential for Health Factor at the individual level.

The company level follow-up showed relatively parallel changes in PAI and perceived health, especially in white collar workers. The correlation coefficients between PAI and perceived health were r=0,198 (p=ns) and r=0,963 ($p<0,001$) for blue and white collar workers respectively. The results of Health Factor were quite similar with those of perceived health. The correlation coefficients between PAI and Health Factor were r=0,310 ($p<0,063$) and r=0,930 ($p<0,001$) for blue and white collar workers respectively.

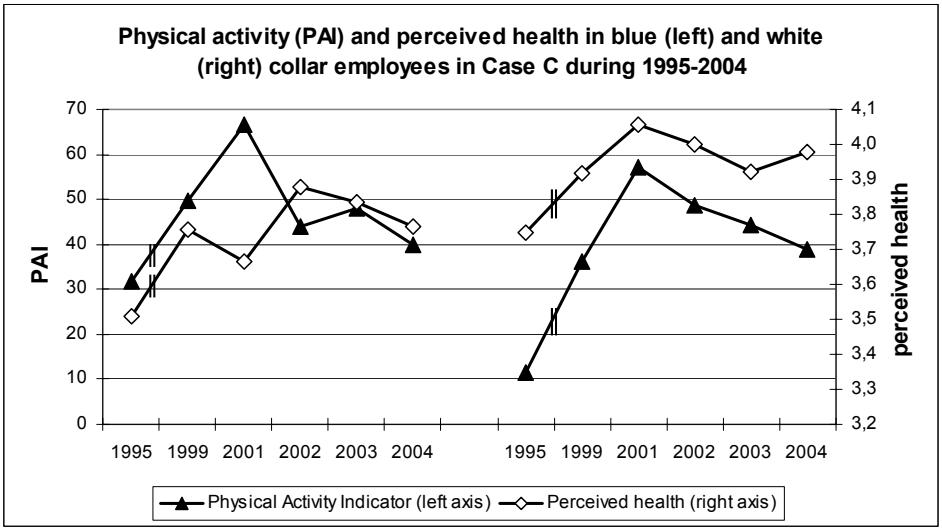


Figure 36. Physical Activity Indicator (PAI) and mean values for perceived health in blue (left) and white collar workers (right) in Case C during 1995-2004.

In Case D, in the psycho-social questionnaire implemented in 2005 for 290 employees, a perceived health question was made (How would you describe your health? The scale of answers was 5=very good, 4=good, 3=moderate, 2=poor and 1=very poor). This material served as data for a regression analysis where perceived health was a dependent variable and gender, age, total amount of physical activity, intensity of physical activity

and WFP activity were independent variables. The result presented in Formula 14 was obtained.

Formula 14.

perceived health = 0,20*IPA+2,73, where
IPA=intensity if physical activity, t-value t=6,56, p<0,001
F-value 43,1, p<0,001, $R^2$ 13,1%

Formula 14 demonstrates that statistically, perceived health was predicted by the intensity of physical activity, not by age, gender or the amount of physical activity.

6.4.4.3 Effects of physical activity and fitness patterns on sick leave

In Case A, a regression analysis was run with sick leave (days/year) as a dependent variable and gender, age, total amount of physical activity, intensity of physical activity and Total Fitness Value as independent variables. The regression analysis gave the result in Formula 15.

Formula 15.

SLD=0,009*APA+2,687,
where SLD=sick leave (days/year)
APA= total amount of physical activity, t-value t=2,25, p<0,05
F-value = 5,19, p<0,05, $R^2$ = 2,8%

The positive coefficient obtained in Formula 15 was due to four "heavy-training" persons (210-450 minutes/week), who also had a high number of sick leave days (20-40 days/year).

In Case B, the mean results regarding sick leave did not differ between years. Further analysis was carried out to see if these variables were dependent on physical activity and physical fitness patterns. In the regression analysis, sick leave was a dependent variable and age, gender, total amount of physical activity, intensity of physical activity, activity in WFP, Total Fitness Value (TFV), estimation of $VO_2$ and estimation of abdominal strength were independent variables. Concerning sick leave no connections between variables was found.

In Case C's business area (basic industry), the main interest and goal in WFP was reducing sick leave, and especially blue collar workers' sick leave. In Finland, at least, that seemed to be the "great mantra" for all Human Resource work in basic industry in the 1990's and into the beginning of the 21st century. Great expectations and hopes were placed upon the WFP also in this respect in Case C, too, but the results revealed some disappointment.

No evidence of the effect of physical activity on sick leave amongst blue collar workers was found in either Figure 37 in the follow-up, nor in the cross-sectional designs. In Figure 37 sick leave for blue collar workers, the follow-up results gathered by the occupational health care were used instead of the results gathered by the physical activity questionnaires. The mean values gathered by occupational health care were on average 4.2 days/year higher than the figures found in the physical activity questionnaire. The

reasons for that may be twofold. First, employees with high sick leave rates may not have received the questionnaire because of sick leave, and second, employees count their sick leave as being five days a week, while the "official record" of occupational health care defines it as six days (including Saturdays). The latter point would thus lead to underestimation of long sick leave in the physical activity questionnaire material.

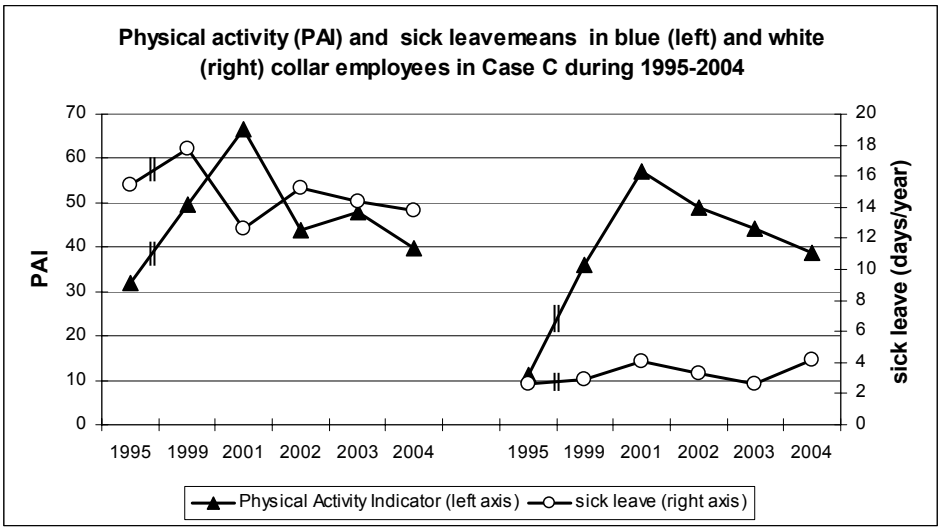


Figure 37. Physical Activity Indicator (PAI) and mean sick leave in blue (left) and white collar workers (right) in Case C during 1995-2004.

Figure 37 demonstrates a great difference between blue and white collar employees' sick leave rates.

In Case D, the mean results of sick leave and self-assessed work ability estimations did not differ statistically between work units. Further analysis was carried out to see if these variables were dependent on physical activity and physical fitness patterns.

In sick leave, a regression analysis was run with sick leave (days/year) as a dependent variable and gender, age, total amount of physical activity, intensity of physical activity, estimations of walking and abdominal tests and Total Fitness Value as independent variables. The regression analysis gave the result in Formula 16.

Formula 16.

SLD=-1,187*WTE+7,981,
where SL=sick leave (days/year)
WTE= Estimation of walking test (endurance), t-value t=-2,35, $p<0,05$
F-value 5,54, $p<0,05$, $R^2 = 1,9\%$

Sick leave followed a pattern where better fitness in endurance (the walking test) predicted a lower number of sick leave days.

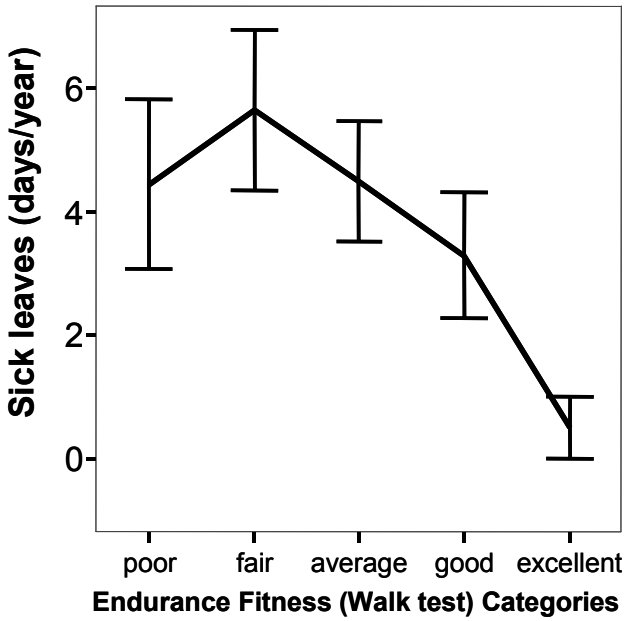


Figure 38. Mean (±SE) sick leave (days/year) in different endurance fitness categories determined by walking test estimation.

6.4.4.4 Effects of physical activity and fitness patterns on work ability assessments

In Case A, self-assessed work ability estimations were dependent on age and the intensity of physical activity. In a regression analysis with work ability estimation as dependent variable, and gender, age, total amount of physical activity, intensity of physical activity and Total Fitness Value as independent variables, the result presented in Formula 17 was obtained.

Formula 17.

WAE=-0,023*age+0,119*IPA+8,639,

where WAE=work ability estimation (scale 0-10)
age=age, t-value t=-2,76, $p<0,01$
IPA= intensity of physical activity, t-value t=2,42, $p<0,05$
F-value = 7,45, $p<0,01$, $R^2 = 7,0\%$

Although gender was not a significant variable in the regression analysis presented above in Formula 17, males tended to have higher WAE values in the fitness-sport group as seen in Figure 39.

With respect to the Worksite Fitness Program, the work ability assessments were found to be higher for those active in the WFP compared to those not active. During the years 1999-2004, 95 employees were regularly active in WFP, while 94 employees were not. The age, gender and the total amount of physical activity of these groups were identical.

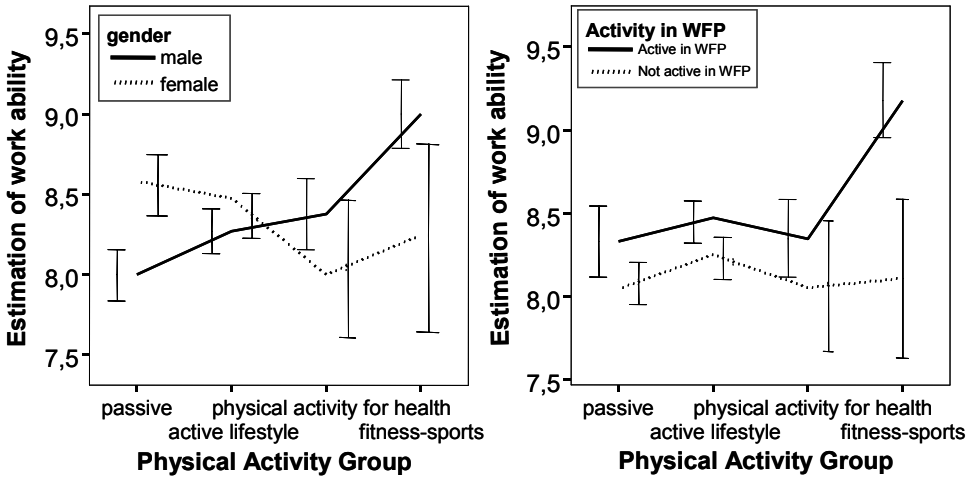


Figure 39. Means (±SE) of work ability assessments in different physical activity groups in males and females (left) and in WFP activity groups (right) in Case A.

The independent sample T-test gave a statistically significant difference for WAE in WFP active and non-active groups ($t=2,30$, $p<0,05$). As shown in Figure 39 in the right, the difference was seen in all physical activity groups. Although these groups were identical in the amount of physical activity (154 min/week for those WFP active and 149 min/week for those WFP non-active, p=ns.), the explanation may be found in the quality of physical activity.

In Case B, the mean self-assessed work ability estimations did not differ between the years. Further analysis was carried out to see if these variables were dependent on physical activity and physical fitness patterns. In a regression analysis, work ability estimation (WAE) was the dependent variable and age, gender, total amount of physical activity, intensity of physical activity, activity in the WFP, Total Fitness Value (TFV), estimation of $VO_2$ and estimation of abdominal strength were independent variables. Concerning WAE, age was found to be a statistically significant coefficient. The results are shown in Formula 18.

Formula 18.

$$WAE=-0,029*age+9,65,$$

t-value for age=-2,63 ($p<0,01$), F-value=6,75, $p<0,05$, $R^2=7,3\%$

In Case C, at the individual level, regression analyses were carried out in 1999, 2003 and 2004, when the sample was the whole staff. In multiple regression analyses, age group, gender, collar, total amount (APA), intensity of physical activity (IPA) and activity in the WFP (WFPI) were independent variables. In all years, only the intensity of physical activity was found to create a statistically significant coefficient in the regression analysis, as presented in Formula 19.

Formula 19.

year 1999 WAE = 0,255*IPA+6,66, t-value for IPA=3,47 ($p<0,001$), F-value 12,0 ($p<0,001$), $R^2$=5,6%

year 2003 WAE = 0,269*IPA+6,38, t-value for IPA=3,56 ($p<0,001$), F-value 12,66 ($p<0,001$), $R^2$=6,6%

year 2004 WAE = 0,223*IPA+6,75, t-value for IPA=3,09 ($p<0,001$), F-value 9,53 ($p<0,001$), $R^2$=4,4%

The intensity (not the amount) of physical activity was essential for self-assessed work ability estimation in individual level.

In the yearly samples, the collar (blue – white) did not have an effect on WAE. The reason for this slightly surprising result was the polarisation of blue collar employees with respect to physical activity and WAE. The less active (passive, active lifestyle) blue collar employees had a lower WAE than the white collar employees at the same physical activity level, but in contrast, the more active blue collar employees (fitness-sports) had a higher WAE than white collar employees at the same physical activity level. Differences between blue and white collar workers were not statistically significant. At the company level, the work ability assessments changed in line with PAI, as shown in Figure 40.

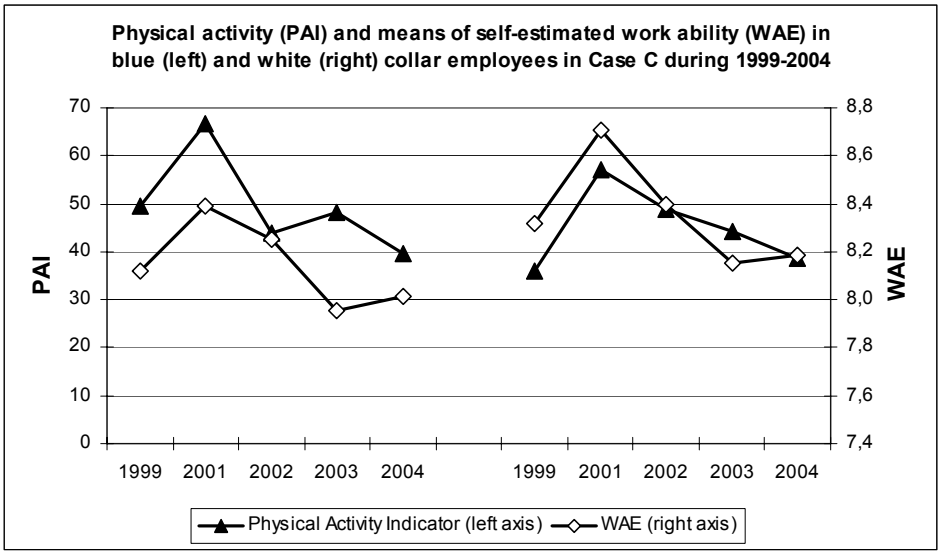


Figure 40. Physical Activity Indicator (PAI) and means of work ability assessments in blue (left) and white collar workers (right) in Case C during 1999-2004.

The follow-up showed relatively parallel changes in PAI and WAE, especially in white collar workers. The correlation coefficients between PAI and WAE were r=0,712 (p=ns) and r=0,810 (p<0,05) for blue and white collar workers respectively. The change from 2003 to 2004 is not in line with earlier changes and could be at least partly be explained by the intensive work in the company climate area which took place after the relatively poor climate questionnaire results obtained in 2003.

In Case D, self-assessed work ability estimations were dependent upon age and the intensity of physical activity. In a regression analysis with work ability estimation as dependent variable and gender, age, total amount of physical activity, intensity of physical activity and Total Fitness Value as independent variables, the result presented in Formula 20 was obtained.

Formula 20.

WAE= 0,218*IPA-0,015*age+7,83,
where WAE=work ability estimation (scale 0-10)
IPA= intensity of physical activity, t-value t=3,89, p<0,001
age=age, t-value t=-2,43, p<0,05
F-value 12,83, p<0,001, $R^2$ = 10,0%

With respect to the Worksite Fitness Program, the work ability assessments were found to be higher for those active in the WFP compared to those not active in the more active physical activity groups (physical activity for health and fitness-sports), and lower in the less active physical activity groups (passive and active lifestyle). The differences were, however, not statistically significant.

6.4.4.5 Effects of physical activity patterns on work related psycho-social factors

A questionnaire on psycho-social factors at work and at the worksite (Dallner *et al*. 2000) complemented with questions on physical activity patterns (level of activity, activity in the WFP) was carried out in all case companies during 2003-2005. In Case A, 54 employees answered the questionnaire anonymously during the fitness testing in 2003 and 2004. In Case B, the same procedure was implemented and 58 employees responded. In Case C, the questionnaire on psycho-social factors was integrated with a Physical Activity barometer survey in 2003 and 2004. A total of 191 and 222 employees responded to the questionnaire in the respective years. In Case D, the questionnaire on psycho-social factors was answered anonymously during the fitness testing in 2005 in all four work units, with a total of 290 employees answering. In Case D, the questionnaire was supplemented with questions on work ability and perceived health estimation (see Appendix 3 for details).

Data for analysis was chosen as follows: in Case A, no differences between the answers in 2003 and 2004 were found and the material was combined for further analysis. The same procedure was adopted in Case B. In Case C, differences in Questions 1 (sufficient communication between staff and management), 2 (support and help from immediate superior) and 3 (work unit climate encouraging and supportive) were found between 2003 and 2004, and thus the analyses were carried out separately for each year. In

case D, no differences between work units were seen and the whole sample was seen as reliable for further analysis.

The results of the standardised psycho-social questionnaire are summarised in this chapter. Table 33 presents the mean results of four case companies compared to the results gathered from Finnish SMEs by Hottinen (2002). The results show that the case companies in this study had better values in Questions 1, 2, and 7, while in Question 4, the values were lower than in the Finnish SMEs. These comparisons must be considered only as providing guidance; no statistical analyses could be made.

Table 33. Summary of the results of the psycho-social questionnaire in four case companies and comparison to the results of Finnish SMEs (Hottinen 2002).

| | Case A | Case B | Case C | Case D | Finnish SMEs |
|---|---|---|---|---|---|
| 1. Is there sufficient communication between staff and management in your department? | 3,9 | 3,8 | 2,5 | 3,7 | 2,8 |
| 2. If needed, can you get support and help with your work from your immediate superior? ... | 4,0 | 3,9 | 3,2 | 4,0 | 3,5 |
| 3. Work unit climate encouraging and supportive. | 3,4 | 3,5 | 3,0 | 3,5 | 3,0 |
| 4. How often do you feel stress because of unfinished job? | 2,9 | 3,0 | 3,5 | 3,1 | 3,4 |
| 5. How often you have problems to carry on your job? | 3,8 | 3,7 | 4,2 | 3,6 | |
| 6. How often you have a good working efficiency? | 3,8 | 3,9 | 3,8 | 3,8 | |
| 7. This organization really inspires me to give my very best job performance | 4,0 | 4,1 | 4,2 | 4,1 | 4,0 |
| 8. How satisfied are you at your present job? | 3,7 | 4,0 | 3,6 | 3,9 | 3,8 |

The four case companies varied in their psycho-social results relatively greatly. Case C as a solely industry-based employer had lower values in most of the questions. Detailed differences between case companies are presented below in the next chapter.

Differences between Case A and Case B were small; statistically significant difference could be found in question 8. (independent t-test, t-value=-2,56, $p<0,05$). Differences between Case A and Case C were prominent; statistically significant difference could be found in Questions 1. to 5. (independent t-test, t-value for Question 1. $t=11,23$, $p<0,001$, for Question 2. $t=6,36$, $p<0,001$, for Question 3 $t=3,14$, $p<0,01$, for Question 4 $t=-4,14$, $p<0,001$ and for Question 5 $t=-3,40$, $p<0,001$). The results of Case A differed from the results of Case D in Questions 1. and 8. (independent t-test, t-value for Question 1. $t=2,74$, $p<0,01$, for Question 8. $t=-2,70$, $p<0,01$). Differences between Case B and Case C were prominent; statistically significant difference could be found in Questions 1. to 5. and in Question 8. (independent t-test, t-value for Question 1. $t=8,57$, $p<0,001$, for Question 2. $t=4,68$, $p<0,001$, for Question 3 $t=3,68$, $p<0,001$, for Question 4 $t=-3,41$, $p<0,001$, for Question 5 $t=-3,35$, $p<0,001$ and for Question 8 $t=3,68$, $p<0,001$). The results of Case B didn't differ from the results of Case D. And finally the results of Case C differed from the results of Case D. in Questions 1. to 5. and in Question 8. (independent t-test, t-value for Question 1. $t=-12,70$, $p<0,001$, for Question 2. $t=-8,70$,

p<0,001, for Question 3 t=-6,22, p<0,001, for Question 4 t=4,60, p<0,001, for question 5 t=6,07, p<0,001 and for Question 8 t=-4,34, p<0,001).

Table 34. Mean figures of the psycho-social factor questionnaire in case companies.

| | passive | active lifestyle | HEPA | fitness-sports |
|---|---|---|---|---|
| 1. Is there sufficient communication between staff and management in your department? | 3,2 | 3,5 | 3,3 | 3,1 |
| 2. If needed, can you get support and help with your work from your immediate superior? ... | 3,7 | 3,8 | 3,7 | 3,8 |
| supportive. | 3,2 | 3,3 | 3,4 | 3,4 |
| 4. How often do you feel stress because of unfinished job? | 3,3 | 3,1 | 3,1 | 3,7 |
| 5. How often you have problems to carry on your job? | 3,8 | 3,8 | 3,8 | 4,3 |
| 6. How often you have a good working efficiency? | 3,5 | 3,8 | 3,8 | 4,1 |
| 7. This organization really inspires me to give my very best job performance | 3,8 | 4,1 | 4,2 | 4,2 |
| 8. How satisfied are you at your present job? | 3,6 | 3,8 | 3,8 | 3,9 |
| | | | | |
| | non-WFPI | WFPI | non-WFPE | WFPE |
| 1. Is there sufficient communication between staff and management in your department? | 3,4 | 3,3 | 3,4 | 3,4 |
| 2. If needed, can you get support and help with your work from your immediate superior? ... | 3,8 | 3,7 | 3,7 | 3,8 |
| supportive. | 3,3 | 3,4 | 3,2 | 3,5 |
| 4. How often do you feel stress because of unfinished job? | 3,3 | 3,1 | 3,2 | 3,2 |
| 5. How often you have problems to carry on your job? | 3,9 | 3,8 | 3,8 | 3,9 |
| 6. How often you have a good working efficiency? | 3,8 | 3,8 | 3,8 | 3,9 |
| 7. This organization really inspires me to give my very best job performance | 4,1 | 4,2 | 4,1 | 4,2 |
| 8. How satisfied are you at your present job? | 3,8 | 3,8 | 3,8 | 3,8 |

In Table 34 different physical activity groups in case companies are presented in upper part and in WFP-active and non-active (WFPI=regularly active, WFPE=active in WFP events) employees in lower part. The scale of the questions was 1 to 5 and in the table answers to questions 4 and 5 were reversed to make the comparisons between questions easy. In the table in all questions “5” means the best alternative and “1” respectively the worst alternative.

The Hotellings T-test was carried out to see the overall effects of case company, physical activity patterns, gender, collar and age group on the measured psycho-social variables. Case company, gender, age group and activity in WFP events were shown to have a statistically significant effect on the measured psycho-social variables, Hotellings Trace F-values being 10,82 ($p<0,001$) for case company; $F=2,94$ ($p<0,01$) for gender; $F=3,42$ ($p<0,001$) for age group and $F=2,29$ ($p<0,05$) for activity in WFP events.

In the MANOVA test with physical activity patterns as independent variables, the answers in Question 6 (6. How often do you have a good working efficiency?) was found to be effected by the level of physical activity (F-value 8,41, $p<0,01$). Regular activity in the WFP had a slightly negatively association with respect to the answers for Question 4 (4. How often do you feel stress because of unfinished work?), F-value 4,41, $p<0,05$.

Further regression analyses were carried out to see the effects of physical activity patterns and some back ground variables on the WRF (work related factor) and IRF (individually related factor), see Chapter 4.3 for details. In a linear stepwise regression analysis, WRF and IRF were independent variables, and gender, age group, collar, amount of physical activity (APA, minutes/week), intensity of physical activity (IPA, in four subgroups), regular activity in the WFP (WFPI) and activity in WFP events (WFPE) served as independent variables.

In IRF the following results were obtained (Formula 21.)

Formula 21.

IRF = 1,04*collar+0,464*IPA-0,231*AG-0,376*WFPI+10,09; where
collar (1=blue, 0=white collar), t-value=4,80, $p<0,001$
IPA=intensity of physical activity, t-value=3,49, $p<0,001$
AG=age group, t-value=-2,86, $p<0,01$
WFPI=regular activity in WFP, t-value=-2,27, $p<0,05$
F-value=15,71, $p<0,001$, $R^2=9,5\%$

The situation was slightly different in IRF compared to WRF (Formula 22), where collar and intensity of physical activity had the same kind of effect as in WRF, but also where the effect of regular activity in the WFP (WFPI) was negative on IRF. This can be interpreted by the suggestion that the employees who already have some symptoms in their daily activities were more involved with regular WFP activities.

In WRF the following results were obtained (Formula 22.)

Formula 22.

WRF = -3,79*collar+0,548*IPA+0,516*WFPE+17,22, where
collar (1=blue, 0=white collar), t-value=-11,07, p<0,001
IPA=intensity of physical activity, t-value=2,72, p<0,01
WFPE=activity in WFP-events, t-value=1,99, p<0,05
F-value=43,46, p<0,001, $R^2$=18,0%

The results were quite interesting. In WRF, the role of collar colour was dominant: blue collar workers had remarkably lower values in WRF than white collar workers. This was already visible in case-specific results where Case C (only with blue collar workers) had clearly lower values in Questions 1, 2 and 3 (*cf*. Table 33). In physical activity patterns, the intensity of physical activity and activity in WFP events had a significantly positive effect on WRF. The intensity of one's personal exercise in combination with activity in WFP events will have positive effects on work-related psycho-social variables.

These findings were confirmed further in a MANOVA test with physical activity patterns as independent variables. Activity in WFP events was found to have a positive effect on Questions 1 (1. Is there sufficient communication between staff and management in your department?), F-value 4,72, p<0,05; on Question 3 (3. Work unit climate encouraging and supportive), F-value 15,04, p<0,001; and on Question 7 (7. This organization really inspires me to give my very best job performance), F-value 3,99, p<0,05.

Evaluation of the results in case companies

In Case A, the results did not differ between males and females. In age groups, the youngest group gave statistically significantly lower values in Question 3 compared to the age group of 30-39 years, and in Questions 7 and 8 compared to all other age groups. With respect to physical activity patterns, two results were found statistically significant. First, those who were regularly active in the WFP had better estimations of working efficiency than those not regularly active in the WFP (t-value 2,08, p<0,05). The second difference was in Question 1 (communication between staff and management in work unit), where those actively taking part in WFP events gave higher values than those not taking part in WFP events. The difference was statistically significant, t-value t=2,10, p<0,05. These results were supported in the interviews with employees and management.

In Case B, the results differed between males and females in Questions 1, 2 and 5, where males had higher values than females. The statistical difference was tested with an independent sample T-test and the t- values were in Question 1 t=2,57, p<0,05, Question 2 t=2,04, p<0,05 and Question 5 t= 2,47, p<0,05.

In age groups, the youngest group gave statistically significantly lower values in Question 4 compared to the age group over 50 years (t=2,30, p<0,05), in Question 5 compared to age groups 30-39 years (t=2,31, p<0,05), 40-49 years (t=2,80, p<0,05) and over 50 years (t=4,65, p<0,001), in Question 6 compared to the age group over 50 years

(t=2,26, p<0,05) and in Question 8 compared to the 30-39 years age group (t=2,30, p<0,05). With respect to physical activity patterns, the only statistically significant difference found was in Question 6, where those actively taking part in WFP events gave higher values than those not taking part. The difference was statistically significant, t-value t=2,02, p<0,05.

In Case C, differences between groups were tested by independent sample T-test and all differences presented here are at least significant on a level p<0,05. In 2003, major differences were seen between males and females, which were mainly explained by differences in collar colour. Females had higher values of answers in Questions 2, 3 and 6 and lower values of answers in question 4. Answers differed greatly between collar colours. Only in Questions 5, 6 and 8 were there no significant differerences. For office work, the answers to all the collective questions (1 to 3) were better than for factory work. In addition, in Question 4 (4. How often do you feel stress because of unfinished job?) blue collar workers gave lower answers than white collar workers, which could be explained by the process-like work blue collar workers do in their factory. Blue collar workers found their job more inspiring than white collar workers.

Differences between groups defined by physical activity patterns were relatively small. In accordance with general physical activity (PAI – active enough in respect to health vs. not active enough) the only statistically significant difference was found in male blue collar employees where the "active enough" subgroup had greater inspiration to give their best in their work than the "not active enough" subgroup (t=-2,25, p<0,05). This single finding is, however, quite impressive from the point of view of employee commitment. A closer analysis at the level of physical activity groups showed some more differences in results. Employees in the "Passive" physical activity group had lower answers in Question 6 (How often do you feel you have a good working efficiency?) than employees in the fitness-sport physical activity group (t=-2,24, p<0,05). Employees in the "Physical activity for health" physical activity group had lower values of answers in Question 5 (5. How often do you have problems carrying on your work?) than employees in the fitness-sport physical activity group (t=2,38, p<0,05).

Activity in the WFP showed some differences in results. For the whole staff (t=2,24, p<0,05) as well as for blue collar employees (t=2,66, p<0,01), activity in the WFP influenced better estimates of work unit climate (3. Work unit climate encouraging and supportive). The same result was obtained when blue collar employees were divided into two subgroups on the basis of activity in WFP events (t=2,82, p<0,01). Male blue collar employees active in the WFP considered that they received help and support more easily from their immediate superiors than employees not active in the WFP (t=2,13, p<0,05). These results received a spontaneous explanation from one female WFP activator when she shouted *"Oh, men have all kinds of games to play together with their bosses. In the office we have male bosses – and we never have physical exercise together!"*

In Case C in 2004, the differences between male and female were high; in Questions 1, 2 and 6, females gave statistically significantly higher values of answers than male, whereas in Question 4, males gave higher values of answers than females. Blue and

white collar workers differed nearly completely in answers, only in Question 5 were the answers similar.

With respect to physical activity patterns, males active enough for health gave better estimates in Question 6 (6. How often do you feel you have a good working efficiency?) than males not active enough for health ($t=-2,32$, $p<0,05$. The same results were found in male blue collar employees ($t=-2,21$, $p<0,05$). Activity in the WFP brought the same results in blue collar male employees as in 2003; male blue collar employees active in WFP estimated that they received help and support more easily from their immediate superiors than employers not active in WFP ($t=2,06$, $p<0,05$).

Based on these results, it can be concluded that WFP have had some importance in the work unit climate and employee–superior relationship, especially for blue collar employees. This gives a new value for WFP – it is not only for activating people to be physically active, it is also company spirit.

In Case D, the first comparison of the results obtained in the psycho-social questionnaire was carried out with the results obtained in the fitness testing protocol. No differences in physical activity patterns were found: the PAI in the psycho-social questionnaire setting was 34,9% and in the fitness testing setting 33,8%. The other variables (sick leave and work ability assessments) showed, however different patterns. In the psycho-social questionnaire setting, sick leave for the "physically active enough" group were 4,93±6,54 days/year and for the "physically not active enough" group 10,50±23,68 (difference $p<0,01$, t-value -3,02). In the fitness testing setting, the sick leave mean values were actually identical (4,34±6,92 days/year for the "physically active enough" group and 4,77±9,42 days/year for the "physically not active enough" group, p=ns). The results of the work ability estimations (WAE) showed the same pattern. In the psycho-social questionnaire setting, the WAEs for the "physically active enough" group were 8,52±0,86 (mean±SD) and for the "physically not active enough" group 8,08±1,16 (difference $p<0,001$, t-value 3,39). In the fitness testing setting, the WAE mean values were not statistically significantly different (8,47±0,83 for the "physically active enough" group and 8,27±1,14 for the "physically not active enough" group, p=ns).

The differences between groups the were tested by an independent sample T-test; all differences presented here are at least significant at a level of $p<0,05$. Major differences between males and females were seen in Questions 1, 3 and 5, where males had higher values of answers than females. In age groups, the youngest group (under 30 years) gave statistically significantly higher values in Question 2 compared to other age groups and lower values of answers in Question 1 than the oldest age group (over 50 years). Question 5 divided the respondents into younger and older: the two younger age groups (under 30 years and 30-39 years) gave statistically very significantly ($p<0,001$) higher values of answers than the two older age groups (40-49 years and over 50 years).

With respect to physical activity patterns, the analyses were run both for the data as a whole and separately for females only. This was done because of the relatively small number of males and the slight differences found between males and females in the PAI. With respect to general physical activity (PAI), the results showed that the "physically active enough" employees had better answers to Questions 5 and 6. In Question 5,

the mean (±SD) value for the "physically active enough" group was 3,87±0,96, and for the "physically not active enough" group it was 3,57±0,98 (difference $p<0,05$, t-value 2,48). For females, the respective figures were for the "physically active enough" group 3,80±0,97, and for the "physically not active enough" group, 3,50±0,98 (difference $p<0,05$, t-value 2,34). In Question 6, the mean (±SD) value for the "physically active enough" group was 3,95±0,59 and for the "physically not active enough" group, 3,75±0,70 (difference $p<0,01$, t-value 2,82). For females, the respective figures were for the "physically active enough" group 3,95±0,61, and for the "physically not active enough" group, 3,72±0,72 (difference $p<0,01$, t-value 2,68). These results indicated that the physically active enough employees had fewer problems in carrying on their work and better working efficiency. These results were supported in several ways in the qualitative interviews.

The respondent population was divided into four groups concerning WFP activities. The most active group (19,0%) was active both in regular WFP activities and at WFP events. 21,4% of respondents were active in regular WFP activities but not at WFP events. An identical 21,4% was active at events but not at regular activities, and finally the fourth group (38,3%) consisted of those who were inactive both in regular WFP activities and at WFP events. Active participation in the WFP did differentiate respondents in Question 5 (5. How often do you have problems in carrying on your job?); employees active in the WFP had lower values of answers (3,54±0,95) than employees not active in WFP (3,77±0,99), $t=-2,00$, $p<0,05$). The respective numbers for females were 3,46±0,95 and 3,71±0,99, $t=-1,98$, $p<0,05$). The results could be explained by assuming that employees who have problems in carrying on their work try to take care of that with WFP activities. This explanation was given also by managers M4 and M7 in the second interpretative interview.

Active participation at WFP events had several positive consequences. People active at WFP events gave more positive answers in Questions 3, 7 and 8, so they found (3) the work unit climate more encouraging and supportive, (7) the organization more inspiring to give one's best, and (8) themselves more satisfied in their present job. In Question 3, people active in WFP events had a mean (±SD) value of 3,78±0,81 and people not active in WFP events had a mean (±SD) value of 3,40±0,91, $t=3,62$, $p<0,001$. The respective numbers for females were 3,74±0,82 and 3,32±0,95, $t=3,78$, $p<0,001$). In Question 7, people active at WFP events had a mean (±SD) value of 4,27±0,65 and people not active at WFP events had a mean (±SD) value of 4,03±0,74, $t=2,90$, $p<0,01$. The respective numbers for females were 4,24±0,66 and 4,02±0,74, $t=2,35$, $p<0,05$). Finally, in Question 8, people active at WFP events had a mean (±SD) value of 4,05±0,69 and people not active in WFP events had a mean (±SD) value of 3,85±0,69, $t=2,44$, $p<0,05$; the respective numbers for females were 4,04±0,72 and 3,83±0,71, $t=2,29$, $p<0,05$).

The results concerning WFP events were highly interesting. People active at WFP events found their working climate more supportive, tried to work harder and were more satisfied in their jobs than those who were inactive in connection with WFP events. The head of the Test-1 work unit in Case D found the results probable, but could not find causality. *"Which was first: satisfied employees who take part in WFP events or WFP events which make employees more satisfied?"* In his sceptical way, he thought the first

alternative more realistic. Nonetheless, it can be concluded that WFP events support community climate and employee satisfaction.

### *6.4.5 Summary of the effects of WFP activity on wellness variables in case companies*

The associations of regular activity in WFP with wellness parameters had been described earlier in the text, therefore only a summary is provided here.

#### 6.4.5.1 The effects of WFP activity on physical activity and fitness of employees in Case A

In Case A, the physical activity patterns at a general level, defined by physical activity groups, did not differ between WFP-active and WFP-non-active employees. Closer observation reveals that the intensity of physical activity was higher in WFP active employees. The active employees had better physical fitness (abdominal test and Total Fitness Value) and better self-assessment of work ability, which can be considered an important finding.

Table 35. Summary of the differences between the results of the employees regularly active in WFP and non-active in WFP in Case A.

| | Active in WFP | | Not active in WFP | | t-value | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | (Chi square value) | statistical difference |
| female (%) | 46,3 | | 36,2 | | (-2,07) | ns |
| age | 42,2 | 8 | 42,4 | 8,6 | -0,18 | ns |
| BMI | 24,6 | 3,4 | 25,2 | 3,8 | -1,16 | ns |
| Total amount of physical activity | 154,6 | 118,1 | 149,4 | 116,6 | 0,31 | ns |
| Intensity of physical activity | 6 | 1,4 | 5,6 | 1,6 | 2,01 | 0,05 |
| $VO_2$ | 36,1 | 8,8 | 34,3 | 7,4 | 1,57 | ns |
| Abdominal reps/30 sec | 18,1 | 6,2 | 15,9 | 6,2 | 2,3 | 0,05 |
| $VO_2$ estimation | 2,7 | 2 | 2,3 | 1,7 | 1,8 | ns |
| Abdominal estimation | 4,2 | 1,8 | 3,3 | 1,6 | 3,61 | 0,001 |
| Total Fitness Value | 3,4 | 1,5 | 2,7 | 1,3 | 3,19 | 0,01 |
| Physical Fitness Indicator | 53,4 | | 42 | | (-3,34) | ns |
| Physical Activity Groups | | | | | | |
| - passive | 18,9 | | 22,3 | | | |
| - active lifestyle | 48,4 | | 50 | | | |
| - physical activity for health | 21,1 | | 18,1 | | | |
| - fitness-sports | 11,6 | | 9,6 | | | |
| Physical Activity Indicator | 32,6 | | 27,7 | | (-0,56) | ns |
| Sick leave (days/year) | 3,56 | 4,43 | 4,46 | 6,81 | -1,05 | ns |
| WAE | 8,51 | 0,92 | 8,16 | 1,14 | 2,3 | 0,05 |

In Table 35 means, SD's or %-fractions and statistical difference tested by independent samples T-test or Pearsson Chi-square test (in parantheses) are presented.

6.4.5.2 The effects of WFP on physical activity and fitness of employees in Case B

In Case B, the better physical fitness (endurance VO2 and TFV) of WFP active employees was the main difference between WFP-active and non-active employees. This was caused in some part by the higher intensity of physical activity and more wide selection of sports that WFP-active employees had. No differences in sick leave and work ability assessments were found.

Table 36. Summary of the differences between the results of the employee active in WFP and non-active in WFP in Case B.

| | Active in WFP | | Not active in WFP | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t-value, (Chi-square value) | statistical difference |
| male (%) | 29,6 | | 37,8 | | (-0,67) | ns |
| female (%) | 70,4 | | 62,2 | | (-0,67) | ns |
| age | 42,7 | 9,3 | 42,2 | 9,4 | 0,25 | ns |
| BMI | 24,7 | 2,5 | 24,7 | 4,8 | 0,04 | ns |
| Total amount of physical activity | 159,5 | 74,1 | 150,1 | 96,8 | 0,52 | ns |
| Intensity of physical activity | 6,0 | 1,2 | 5,4 | 1,4 | 1,85 | ns |
| $VO_2$ estimation | 3,2 | 1,2 | 2,3 | 1,6 | 3,04 | p<0,01 |
| Abdominal estimation | 4,4 | 1,7 | 3,7 | 2,3 | 1,56 | ns |
| Total Fitness Value | 3,8 | 1,2 | 3,0 | 1,7 | 2,62 | p<0,01 |
| Physical Fitness Indicator | 79,6 | | 59,5 | | (-4,38) | p<0,05 |
| Physical Activity Groups | | | | | | |
| - passive | 9,3 | | 13,5 | | | |
| - active lifestyle | 63,0 | | 62,2 | | | |
| - physical activity for health | 18,5 | | 13,5 | | | |
| - fitness-sports | 9,3 | | 10,8 | | | |
| Physical Activity Indicator | 27,8 | | 24,3 | | (-0,14) | ns |
| Sick leave, days/year | 4,8 | 7,0 | 3,4 | 2,6 | 1,1 | ns |
| WAE | 8,4 | 0,9 | 8,3 | 1,1 | 0,53 | ns |

In Table 36 means, SD's or %-fractions and statistical difference tested by independent samples T-test or Pearsson Chi-square test (in parantheses) are presented.

6.4.5.3 The effects of WFP on the physical activity of employees in Case C

The physical activity patterns were more active and more intense for the WFP-active compared to the WFP-non-active employees in most years in Case C. The only statistically significant difference in the background variables between the WFP-active and non-active employees could be seen in the Health Factor in males in 1999.

Table 37. Summary of the differences between the results of the employees active in WFP and non-active in WFP in years 1999, 2003 and 2004 in Case C.

| | **male** | | | | **female** | | | |
|---|---|---|---|---|---|---|---|---|
| | **active in WFP** | **not active in WFP** | (Chi square value) | statistical | **active in WFP** | **not active in WFP** | (Chi square value) | statistical |
| **1999** | Mean | Mean | t-value | difference | Mean | Mean | t-value | difference |
| under 30y | 53,2 | 26,3 | | | 20,0 | 27,9 | | |
| 30-39y | 30,6 | 38,9 | | | 45,0 | 32,6 | | |
| 40-49y | 6,5 | 24,2 | (14,99) | p<0,01 | 20,0 | 20,9 | (1,02) | ns |
| 50-59y | 9,7 | 10,5 | | | 15,0 | 18,6 | | |
| blue collar | 39,6 | 60,4 | (0,60) | ns | 22,2 | 77,8 | (0,58) | ns |
| white collar | 46,5 | 53,5 | | | 35,2 | 64,8 | | |
| APA | 209,1 | 133,4 | 4,72 | p<0,001 | 157,4 | 139,9 | 0,85 | ns |
| IPA | 6,9 | 5,7 | 6,10 | p<0,001 | 5,9 | 6,0 | -0,19 | ns |
| PAI | 61,3 | 32,6 | (12,51) | p<0,001 | 47,6 | 32,6 | (1,37) | ns |
| Health factor | 10,7 | 9,5 | 4,40 | p<0,001 | 10,5 | 10,2 | 0,87 | ns |
| Sick leave | 6,8 | 11,2 | -1,47 | ns | 4,8 | 3,9 | 0,46 | ns |
| WAE | 8,3 | 8,0 | 0,95 | ns | 8,2 | 8,5 | -1,02 | ns |
| **2003** | | | | | | | | |
| under 30y | 23,5 | 23,0 | | | 31,8 | 12,5 | | |
| 30-39y | 48,5 | 32,2 | | | 31,8 | 43,8 | | |
| 40-49y | 13,2 | 28,7 | (8,26) | ns | 18,2 | 12,5 | (2,68) | ns |
| 50-59y | 13,2 | 16,1 | | | 18,2 | 31,3 | | |
| blue collar | 42,1 | 57,9 | (0,83) | ns | 11,1 | 88,9 | (11,01) | p<0,001 |
| white collar | 50,0 | 50,0 | | | 74,1 | 25,9 | | |
| APA | 182,5 | 161,0 | 1,26 | ns | 206,1 | 174,5 | 1,01 | ns |
| IPA | 6,5 | 6,0 | 2,66 | p<0,01 | 6,1 | 6,0 | 0,22 | ns |
| PAI | 45,6 | 40,2 | (0,45) | ns | 59,1 | 68,8 | (0,37) | ns |
| Health factor | 10,3 | 9,9 | 1,25 | ns | 10,1 | 10,8 | -1,41 | ns |
| Sick leave | 11,1 | 7,9 | 0,99 | ns | 6,0 | 3,7 | 0,76 | ns |
| WAE | 7,9 | 8,1 | -0,94 | ns | 8,1 | 8,0 | 0,27 | ns |
| **2004** | | | | | | | | |
| under 30y | 23,4 | 19,2 | | | 25,6 | 16,7 | | |
| 30-39y | 46,8 | 30,8 | | | 33,3 | 43,3 | | |
| 40-49y | 20,8 | 32,1 | (6,70) | ns | 15,4 | 23,3 | (3,32) | ns |
| 50-59y | 9,1 | 17,9 | | | 20,5 | 16,7 | | |
| blue collar | 50,7 | 49,3 | (0,01) | ns | 60,0 | 40,0 | (0,13) | ns |
| white collar | 50,0 | 50,0 | | | 57,4 | 42,6 | | |
| APA | 180,8 | 139,6 | 2,46 | p<0,05 | 188,1 | 129,1 | 2,37 | p<0,05 |
| IPA | 6,5 | 6,0 | 2,38 | p<0,05 | 6,3 | 5,6 | 2,04 | p<0,05 |
| PAI | 45,5 | 29,1 | (4,46) | p<0,05 | 46,2 | 37,5 | (0,54) | ns |
| Health factor | 10,5 | 10,1 | 1,52 | ns | 10,6 | 10,5 | 0,27 | ns |
| Sick leave | 10,2 | 8,6 | 0,37 | ns | 4,6 | 4,3 | 0,19 | ns |
| WAE | 8,2 | 8,0 | 0,96 | ns | 8,2 | 8,1 | 0,36 | ns |

In Table 37 means or %-fractions and statistical difference tested by independent samples T-test or Pearsson Chi-square test (in parentheses) are presented. APA=amount of

physical activity in week (min/week), IPA=intensity of physical activity, Sick leave is presented in days/year, WAE=work ability estimation.

6.4.5.4 Effects of WFP on the physical activity and fitness of employees in Case D

In the data for all of Case D's 239 employees, the intensity of physical activity as well as the Physical Activity Indicator (PAI) were both found to be higher in the WFP-active employees than the WFP-non-active employees. This was probably one of the main causes of the WFP-active employees' better physical fitness. In the follow-up work unit, Test-1, the same differences were seen, though not so significantly. No differences in background variables (sick leave, work ability estimation) were found.

Table 38. Summary of the differences between the results of the employee active in WFP and non-active in WFP in Case D.

| | **Whole Case D (239 employess)** | | | | **Test-1 work unit (78 employees)** | | | |
|---|---|---|---|---|---|---|---|---|
| | Active in WFP | Not active in WFP | t-value (Chi-square-value) | stat. diff. | Active in WFP | Not active in WFP | t-value (Chi-square-value) | stat. diff. |
| age | 42,0 | 43,5 | | ns | 42,1 | 44,3 | | ns |
| gender (female-%) | 88,6 | 84,5 | | ns | 91,7 | 83,3 | | ns |
| BMI | 24,2 | 24,7 | | ns | 24,6 | 24,9 | | ns |
| IPA | 5,6 | 5,0 | 4,00 | 0,001 | 5,4 | 4,9 | | ns |
| APA | 170,0 | 149,0 | | ns | 179,0 | 154,5 | | ns |
| Sick leave, days/year | 4,8 | 4,5 | | ns | 3,8 | 3,6 | | ns |
| WAE | 8,4 | 8,3 | | ns | 8,2 | 8,3 | | ns |
| Abd. est. | 4,2 | 3,7 | 2,61 | 0,01 | 4,1 | 3,4 | | ns |
| WT est | 2,9 | 2,4 | 3,29 | 0,001 | 2,9 | 2,5 | | ns |
| TFV | 3,6 | 3,1 | 3,19 | 0,01 | 3,6 | 3,0 | 2,07 | 0,05 |
| PFI | 73,2 | 49,1 | (-14,56) | 0,001 | 79,2 | 40,0 | (-12,3) | 0,001 |
| Phys. Act. groups (%) | | | | | | | | |
| - passive | 10,6 | 13,8 | | | 8,3 | 10,0 | | |
| - active lifestyle | 48,0 | 62,9 | | | 58,3 | 70,0 | | |
| - HEPA | 38,2 | 21,6 | | | 33,3 | 20,0 | | |
| - fitness-sports | 3,3 | 1,7 | | | 0,0 | 0,0 | | |
| PAI | 41,5 | 23,3 | (-8,98) | 0,01 | 33,3 | 20,0 | | ns |

In Table 38 means or %-fractions and statistical difference tested by independent samples T-test or Pearsson Chi-Square test are presented. BMI=body mass index, IPA=intensity of physical activity, APA=total amount of physical activity, WAE=Work Ability Estimation, Abd.est.=abdomidal test estimatiuon, WT est=walk test estimation, TFV=Total Fitness Value, PFI= Physical Fitness Indicator, HEPA = physical activity for health, PAI=Physical Activity Indicator.

*6.4.6 Intellectual Capital characteristics and measures in case companies*

6.4.6.1 Assessment of IC's components

The assessments of Intellectual Capital were based on the owner and management interviews and was confirmed by interviews of employees and a number of written documents (annual report, client magazines, etc). In a semi-structured interview, the interviewees first had described to them the structure of IC and some examples of the essential elements in each component of IC (Figure 15 in section 4.5.1 of Methods). The question by posed the researcher was framed as follows: "Which of the three components of IC is the most important in this (case) company, which is of second importance and which is less important?" and further "Which could be the most important elements or content of IC components in this company?"

In Case A, the management and owner gave the following answers in assessing the elements of IC:

M1 in Case A: *"In this IT sector, the first things are IT competencies, I mean programming skills, project development and management skills, and so on. Also important are relationship competencies, language skills and other things based on the need to co-operate with the customer. And in Case A, know-how of joint partnership, like the way to operate are important as well. And of course, the elements of management are essential, and for the last, wellbeing and physical fitness of personnel".*

M2 in Case A: *"If we think of IC, we have in our BSC's personnel card a certain competence matrix, or competence profile, which is based mainly on the technical skills of the personnel. Technical skills are essential in this kind of company, although I feel that more and more things like relationship management, co-operation, teamwork, project work and so on are getting more focus. People have certain technical skills and personal characteristics, but we have to be sure these will produce some additional value for the customer. In the background, there is also job satisfaction".*

M3 in Case A: (responsible for wellbeing and maintaining of work ability): *"The basic things are company culture and the company's values, the way things have been done – and have been learned to do. I mean honesty, openness, human growth and such things. In the long run, those large companies which have these ethical aspects right will survive and be successful. Behind these philosophical questions there are more concrete things, such as how we run projects, how we take care of people's wellbeing, how we see and handle customers, and so on. To be more exact, the most important aspect is external structures, which in our case means one (and only one) customer. We co-operate according to long agreements, but still we have to fulfil the customer's needs constantly. To be able to do this, we need competent personnel and good working processes".*

M4 in Case A: *"The Competence of the staff is a key factor in co-operation with customers, and in this respect I mean basic educational level, know-how of the business and the most modern programming techniques and skills, which are important in creat-*

*ing additional value for the customer. In internal structures, the process of work is essential and job satisfaction and climate behind that. A very close partnership with customers is characteristic for Case A compared to companies who compete in open markets."*

Three out of four managers emphasised Human Capital as the most important component of IC, Structural Capital was a secondary priority and Relational Capital was seen as the least important component of IC. This would seem peculiar, unless the close owner-like relationship with the customer is remembered. As M3 stated "*We co-operate according to long agreements, but still we have to fulfil customer's needs constantly" –* the need for good customer service is obvious is spite of the long agreements. A summary of the managers' assessments are presented in Table 39.

Case A is owned jointly by a conglomerate and the customer and the governing board is composed of managers of both parties. The analysis of IC was given by the vice chairman (and officer in charge of IT functions) of the board of Case A. Owner A says: *"The IT functions are discussed by the board, but the financial decisions and human relations guidelines are given by the conglomerate of Case A."*

The owner in Case A describes co-operation with Case A as follows: *"We've been working together for a long time and thus we know each other. Trust is the crucial thing in our work. The processes of Case A are so effective and clear that we can trust that they do what we agree. Plans are made on a yearly basis for both development and routine work, and changed if needed – very flexible! The quality of work, fixed (and on schedule!) timetables and reasonable expenses are essential parts of joint operating work. Disciplined process-like working gives us as a customer a great benefit in comparison with our havingto do the same work ourselves. On the other hand, this kind of outsourcing is based on effectiveness and thus gain through financial savings is a natural key point to our co-operation".*

In analysing IC, the Owner in Case A describes the background: *"The knowledge and competences of Case A correspond our (customer's) future needs, that's number one in this respect taking a long-term view. On the other hand, the process work is essential. All work is based on our (customer's) strategy and its implementation (or Case A's ability to implement) of IT functions. This discussion is active amongst Case A's management; they will know where we are aiming and what it requires from Case A and its personnel's competencies. The scope of customers is widening and becoming more international, so Case A also has to take that into consideration; it is no longer clear that Case A will do all the IT work, even to maintain their position they have to be alert and work hard. Case A has to take care of the equilibrium of its competences and expenses. In competencies are included IT competences, language and cultural aspects."*

After this introduction, the researcher asked Owner A to define IC: "What are the main aspects in Case A's IC as a whole and in detail?"

Owner in Case A: *"Case A has the competence and experience that we as a customer need. To this is linked their dynamic, flexible way of operating, no bureaucracy. Process-like working is essential, we get what we've agreed with Case A, and we can trust*

*that Case A does what we need, to a fixed timetable and with reasonable expenses. The work is very professional! On HC, co-operation requires knowledge of our (customer's) business in detail to ensure the proper operation of the software; this is based solely on long experience. On the other hand, we expect initiatives in technical solutions, creativity and partnership. It is not important simply to work according to agreement, but also to see if applications can be improved with ease during the working process. That is something that we appreciate very much."*

The researcher's interpretation of the Owner in Case A's assessment was that HC and SC were both of the same importance and RC was of less importance. All the assessments given by managers and the owner are presented as "weighted" percentage values in Table 39.

In Case B, the management and owner gave the following answers in assessing the elements of IC.

M1 in Case B: "*If I begin with RC, we have long customer relations, with some over 40 years. That is important, we work closely in partnership and the customers trust us. Nowadays, the main customers are also our owners, which is like a safety factor for us. In SC, our processes are strictly defined and we carry out inclusive follow-up all the time. If we find something odd, we are able to fix it immediately. It is important that everybody knows the processes so that if we have some problem we can focus on that and we don't have to think how to approach the problem. In HC, experience in most important, our people know our customers and processes really well. There must be good motivation behind the fact that they have stayed with us so long time."*

M2 in Case B: (responsible for wellbeing and maintaining of work ability): *"Our operations are based on a deep know-how of our business area. With customers we operate in a tight partnership and we know our customer's needs and we also know the special questions in our business. So the competence of the people (employees) is a key factor, and especially the know-how in the business area, that's the way our customers trust us. So our business is based on our employees, their competence and motivation behind that. We use to joke that every evening our assets walk away and we hope they will come back next morning. People's welfare and satisfaction is essential for us."*

M3 in Case B: *"Most important for us is taking care of employees' competence and its development so that we know our customers' operations and special elements of our business area. Although we operate in the IT sector, IT competence is not the key, but the knowledge of the customer and business area. Our relationship with customers is a strong partnership, which creates for us an opportunity to develop our competence in our business area, yet also requires a certain trust so that we can create special value for our customers with our IT competence. To be able to do this, we have to have satisfied and motivated staff."*

M4 in Case B: "*HC is most important and know-how of the business area and the special technologies in it. In SC, our working processes form a key to our success, although the social relationships in the worksite are important as well. In RC, the long customer relationships give us security and trust for future."*

Three out of four managers emphasised Human Capital as the most important component of IC, Structural Capital was a secondary priority and Relational Capital was seen as the least important component of IC. A summary of these priorities is presented in Table 39.

Case B is owned jointly by a conglomerate and customers and the governing board is composed of managers of both parties. The analysis of IC was given by the chairman (and officer in charge of IT functions in one of the customers) of the board of Case B.

The Owner in Case B describes co-operation with Case B as follows: *"We've been working together over 40 years, with this ownership for the last ten years. Case B is specialised in our business area, they have good experience and we trust them.* After this introduction, the researcher asked Owner B to define IC: "What are the main aspects in Case B's IC as a whole and in detail?"

Owner in Case B: *"Structural Capital is the most important and reliable process within that. We have to be able to trust that their processes are operating properly and the output we get is reliable. In those inner processes, Human Capital is important, but that could be also bought outside, so the SC is number one. In HC, the experience and knowledge of our business area is essential besides good programming skills. The role of Relational Capital is minor in this setting, we work – and are owned – jointly, so I don't see RC as being so relevant.*

Later, the Owner in Case B stated: *"As a customer, we have a strict follow-up system to evaluate the quality of Case B's processes. Feedback is given from each project several times a year and those results are presented also to our board."*

The researcher's interpretation of the Owner in Case B's assessment was that SC was most important, HC of secondary importance and RC was of least importance. All the assessments given by managers and owner are presented as "weighted" percentage values in Table 39.

In Case C, the management and owner gave the following answers in assessing the elements of IC.

M1 in Case C: *"The most important is HC and professional competence within it. In our factory, we have a very high level of competence, which is based both on long traditions and R&D activities which are taking place here. In structural capital, which is of secondary importance, job satisfaction and company climate are essential. In this respect, the most essential thing in the near future is to develop all kind of feedback systems to employees. And thirdly, in our present strategy, relational capital is of minor importance out of these three elements of IC. Of course, customers and the quality of our products are important, but basically other actors in our group take care of the customer work. Finally, to simplify, it is important that all people know what we (as a large unity) are doing! That gives you depth in your job and acts as a basis for job satisfaction."*

M2 in Case C: *"In our company, our kind of methods are very important, we have a flat organization and people feel they can work freely. This has influenced job satisfaction and our climate; people say they have a good time at work. Also, the attitude and pride regarding the employer are good. In HC, experience has always been ahead of formal education; people can advance in their careers in a way "learning by doing". The customer view has been strong in our company compared to other companies in our conglomerate. We have been pioneers in that respect."*

In Case C, one manager emphasised Human Capital as the most important component of IC, one put Structural Capital in first place, and both thought that Relational Capital was the least important component of IC.

Case C is owned jointly by a conglomerate and the governing board is composed of managers of the company and group. The analysis of IC was given by the chairman (and chief officer in charge of European functions in the group) of the board of Case C. The Owner in Case C focused first upon Case C's strategic position in the group as a production plant or factory: *"In our present strategy, Case C is an order-fulfilment factory, which takes care of production with good quality and efficiency. That's all they have to take care of! I believe in their strength, when employees are managed in a proper way they know what to do – and everything operates well!"*

In analysing IC, the Owner in Case C describes the priorities as follows: *"HC is most certainly the most important element of IC, in it are capabilities such as competence, experience and positive attitude. Structural capital means mainly managing the system which makes it possible to achieve given strategic goals. Relational capital is in Case C's case less important, in RC I like to assess the local availability of good workforce, both blue collar and also engineering competences. Most important task for Case C is developing Human Capital in its different forms. My hypothesis in management is, that "the harder the environment – I mean factory – the softer the management methods". And vice versa, the softer the environment (like marketing functions) the harder the methods!*

The researcher's interpretation of the Owner in Case C's assessment was that HC was most important; SC second and RC was of least importance. All the assessments given by managers and owner are presented as "weighted" percentage values in Table 39.

In Case D, management and owners gave the following answers in assessing the elements of IC. Interviews of management at the national office level as well as the work unit level were utilised. The owners represented national level governing bodies.

M1 in Case D (vice director-general of Case D): *"Human Capital is definitely most important. Competence and experience are the main factors in this, in our area we have to train our staff; you can't get that kind of special knowledge from any school. Values are also important; people think they do valuable work in this society. Structural Capital is of secondary importance, we have moved from a very hierarchical management towards more open management. Job satisfaction and work unit climate are relevant indicators to follow up in this respect. We've also developed our IT systems quite a lot, most information is in e-format nowadays. This requires a lot of staff training too. In*

*Relational Capital, we have to follow legislation and other orders given by other authorities. That requires a lot of co-operation with several governing bodies."*

M2 in Case D (Chief financial officer of Case D): *"In Human Capital, which is most important, our education level and experience are essential elements. Also, people's attitudes and willingness to do their job correctly is important. In Structural Capital, our organisational culture is good, we have good job satisfaction and people's employment is really life-long. In Relational Capital, we have to ensure all financing for our tasks, that's a hard job and requires collaboration with different governmental actors."*

M3 in Case D (manager in HR-department of Case D): *"If we think about IC, we have to think, 'What are we for?' And we are for the Finnish people, we have to serve them. In that respect, RC is important and within it the quality of customer work, we have to do our job accurately. On the other hand, Human Capital is, of course, also important, employee's values and attitudes especially. Attitudes are essential in how people do their job and how the customers are served. I see Structural Capital as being between HC and RC and within it working climate and job satisfaction are important, which are of course, culture dependent."*

M4 in Case D (head of Test-1 work unit): *"We have experienced and rather well-educated staff, our average age is quite high, but still we also have some younger employees to make our staff in a way a proper mixture of experience and innovativeness. In Structural Capital, our problem is some kind of stiffness in our organisation, things have been done rather slowly in the past and the the requirements of modern world are much greater. But we can live with it! People are little by little used to the ideat that it is not only the "big boss" who can make decisions but also they themselves, and their closest superiors can do it, too. In Relational Capital, we have to collaborate with many local authorities and other actors, so in that respect mainly I am busy, our staff is operating at the customer level and that's important as well."*

M6 in Case D (head of Test-2 work unit): "*Our culture, our course of action in this work unit is the most important single thing in IC. Our work is "pure processes", but for me it is important to create and support a good working climate. Our turnover is small, so probably people are happy with what they do. In Human Capital, it is more education and a big task is ensuring that competences are adequate. I see also the importance of physical activity as being rather high, it also effects mental freshness. In Relational Capital, we co-operate with many local authorities, in that job, my goal is openness and trust. In our customer work, the range is wide and employees are busy serving them with good quality."*

The managers in general emphasised Human Capital's importance in IC. Two exceptions were found, M3 emphasised RC, and M6 SC as the most essential element of IC.

Case D is a public office and it is governed by political governing bodies. In the assessment of IC, two members of these bodies were interviewed: Owner D-1, the chairman of the highest governing body, and Owner D-2, a vice-chair of more operational governing body.

Owner D-1 in Case D: *"Case D's duty is to serve the Finnish people so that they receive what the law means them to receive. In this respect, the competence of the employees is essential. Enactments and guidelines behind the decisions they have to make many times a day are so complicated that a thorough knowledge is needed to do the job. Good management skills are important in creating an effective course of action in work units. In Structural Capital, we have developed our IT systems to a rather high level. I see customer work as a consequence of HC and SC. It is important that the decisions are correct and people get their decisions as fast as possible."*

Owner D-2 in Case D: *"I see the competence and the experience of employees as the main thing in IC. Although we nowadays have quite an effective IT system, it is still the human beings that operate the computers! We have to ensure the continuous development of competence and of course continue to develop our IT system. In the near future, a lot of staff will retire and with good training of the present staff we won't have to recruit as many employees as are retiring, that's also a financial fact. In Structural Capital, I see working climate as the only thing! And that we can improve with good management and training of managers. In Relational Capital, we have a certain social responsibilitybe diligent and careful, that requires co-operation with several authorities and social actors."*

The researcher's interpretation of both the Owners' assessments was that HC was of greatest, SC of secondary, and RC of tertiary importance in IC. All the assessments given by managers and owners are presented as "weighted" percentage values in Table 39.

Table 39. Assessment of IC in Case A, B, C and D. according to the weighted values of components of IC.

| **Case A.** | M1 | M2 | M3 | M4 | Owner | **IC** |
|---|---|---|---|---|---|---|
| HC | 50 | 50 | 25 | 50 | 42 | **43** |
| SC | 33 | 33 | 25 | 25 | 42 | **32** |
| RC | 17 | 17 | 50 | 25 | 16 | **25** |

| **Case B.** | M1 | M2 | M3 | M4 | Owner | **IC** |
|---|---|---|---|---|---|---|
| HC | 33 | 50 | 50 | 50 | 33 | **43** |
| SC | 33 | 17 | 33 | 33 | 50 | **33** |
| RC | 33 | 33 | 17 | 17 | 17 | **23** |

| **Case C.** | M1 | M2 | Owner | **IC** |
|---|---|---|---|---|
| HC | 50 | 33 | 50 | **44** |
| SC | 33 | 50 | 33 | **39** |
| RC | 17 | 17 | 17 | **17** |

| **Case D.** | M1 | M2 | M3 | M4 | M5 | M6 | Owner-1 | Owner-2 | **IC** |
|---|---|---|---|---|---|---|---|---|---|
| HC | 50 | 50 | 33 | 50 | 50 | 33 | 50 | 50 | **47** |
| SC | 33 | 33 | 17 | 33 | 33 | 50 | 33 | 33 | **33** |
| RC | 17 | 17 | 50 | 17 | 17 | 17 | 17 | 17 | **19** |

According to Table 39 Human Capital was the most important component of Intellectual Capital in all case companies, while Structural Capital was rated as being slightly more important than Relational Capital. In Case A, the interviews of employees confirmed this assessment; most of the employees estimated the effective working process (SC) and their own competence (HC) as the key components of IC. The customer (RC) was seen important, but for most of the employees it was seen as a self-evident fact that the customer is more like a working partner, not a real customer. In Case B, the interviews of employees confirmed this assessment; their own competence and effective processes were seen as the most important elements of IC, although most of the employees evaluated RC to be an important factor in IC. In Case C, the interviews of employees confirmed this assessment; most of the employees estimated their own competence, motivation and experience (HC) as the key components of IC. In SC, employees found job satisfaction and a good climate important. The customers (RC) were seen as important, although employees found customers quite remote in Case C's global business. In Case D, the interviews of employees confirmed this assessment; four of five employees evaulated HC (competence, experience, motivation, health) as being the most important component of IC. SC was seen as being of secondary priority, with properties such as working climate, job satisfaction and effective working processes. In RC, the employees emphasised only the customer work and its quality.

The written documents were contradictory in the assessing (or analysing) of IC in Cases A and B. In the IT service industry, the client magazines and other public documents always emphasised collaboration with customers as a first priority. In that respect, the elements of HC and SC were not mentioned. In Case C, collaboration with customers was also put in the spotlight, but the achievements of the personnel were presented as well. In Case D, the written documents supported the managers' and owners' views of IC. In the yearly report, and especially in the Human Resource accounting report, such elements as basic education, competence, experience, turnover and age distribution were presented. IC as a whole was not dealt with in these documents.

#### 6.4.6.2 Assessment of IC's components' essential elements

In the interviews of management and owners, more deep and detailed questions were posed to define the essential elements of each IC component, for example, "What are the most important elements (or phenomena) in Structural Capital, can you describe them according to your knowledge and experience of this company?" In this phase, the transcripts were analysed according to the principles of narrative analysis, using analytic induction and selective coding (Bryman & Bell, 2003: 435-442). In the final phase, two to four "essential elements" were defined in each of the components of IC in each company.

The answers of the management and owners were referred to in the previous chapter. According to these answers, in Case A, employees' competence, knowing the business (of the customer) and ability to work hard appeared as the most essential elements of Human Capital. In Structural Capital, the efficiency of customer work as a whole and in different projects were the main elements. Job satisfaction and proper turnover of staff would be good background indicators to guarantee the use of employees' competence.

In Relational Capital, the quality of the customer work based on feedback measures in different levels was seen as the most important element.

In Case B, employees' competence, experience and professional training appeared as the most essential elements of Human Capital. In Structural Capital, the efficiency of customer work as a whole and in different projects were the main elements. HR capital (employee satisfaction) would be a good background indicator to guarantee the use of employees' competence. In Relational Capital, the feedback from the customer at different levels was seen as the most important unity.

In Case C, employees' competence, motivation and ability to work hard appeared as the most essential elements of Human Capital. In Structural Capital, the corporate climate (employee satisfaction) and quality and speed of production as a whole were the main elements. Job satisfaction and proper turnover of staff would be good background indicators to guarantee the use of employees' competence. In Relational Capital, feedback from the customers was the only indicator chosen in Case C's IC measure.

In Case D, employees' competence and experience appeared as the most essential elements of Human Capital. In Structural Capital, social relationships, job satisfaction and work efficiency were the main elements. In Relational Capital, the service feedback given by customers was seen as the most important element.

#### 6.4.6.3 Indicators of IC

Indicators were seen as a tool to evaluate the level and changes of IC during the follow-up period. The indicators were selected from either the indicators case companies used in their strategic management and customer feedback, or the indicators the researcher was able to collect during the study (physical activity, sick leave, work ability). The choice of each indicator was made by the researcher after the second round interpretative interviews with the management.

The chosen indicators in Cases A and B are presented in Table 40 More detailed descriptions of indicators are given in Appendix 5. In Case A, indicators for job satisfaction could not be used, as the questionnaire and interpretation changed during the follow-up period (old measures 1999-2001 and new measures 2002-2004).

The chosen indicators in Cases C and D are presented in Table 41 More detailed descriptions of indicators are given in Appendix 5.

In Case C, for the most essential elements no constant measure could be found. In some cases, the measure did change during the follow-up period, for some essential elements there simply was no measure available. In Human Capital, the Health Factor and sick leave were selected to represent one aspect of employee efficiency.

Table 40. The essential elements and chosen indicators of Human Capital, Structural Capital and Relational Capital in Cases A. and B.

| **Case A** | |
|---|---|
| **Essential elements of IC** | **Indicators** |
| | |
| **Human Capital** | **Human Capital** |
| Competence of the personnel | High-level competence (% of staff) |
| Competence of the personnel | Education (% of work time) |
| Activity of employees | Work ability estimation (average) |
| | |
| **Structural Capital** | **Structural Capital** |
| Efficiency of customer work | Customer work (% of work time) |
| Efficiency of customer work | Time spent in projects (% of planned) |
| Competence of the company | Staff turnover (%) |
| Job satisfaction | no measure found |
| | |
| **Relational Capital** | **Relational Capital** |
| The quality of customer work | Customer-value-index |
| The quality of customer work | Project feedback |
| The quality of customer work | Maintaining feedback |
| **Case B** | |
| | |
| **Human Capital** | **Human Capital** |
| Competence of the management | Competence in project management |
| Competence of the personnel | Competence in maintaining work |
| Competence of the personnel | Staff training (%) |
| Experiency of the personnel | Job career (mean years) |
| | |
| **Structural Capital** | **Structural Capital** |
| Efficiency of customer work | Customer work (% of work time) |
| Efficiency of customer work | Time spent in projects (% of planned) |
| Efficiency of customer work | Productivity of system work |
| Job satisfaction | HR-capital |
| | |
| **Relational Capital** | **Relational Capital** |
| The quality of customer work | Customer benefit |
| The quality of customer work | Project feedback |
| The quality of customer work | Maintaining feedback |

Table 41. The essential elements and chosen indicators of Human Capital, Structural Capital and Relational Capital in Cases C and D.

| **Case C** | |
|---|---|
| **Essential elements of IC** | **Indicators** |
| | |
| **Human Capital** | **Human Capital** |
| Competence of the personnel | no constant measure found |
| Motivation of the personnel | no constant measure found |
| Ability to work hard | Work ability estimation |
| | |
| **Structural Capital** | **Structural Capital** |
| Corporate climate | no constant measure found |
| Efficiency of production | Efficiency-% |
| Quality of production | Waste-% |
| Job satisfaction | no constant measure found |
| Staff permanence | no constant measure found |
| | |
| **Relational Capital** | **Relational Capital** |
| The quality of production and logistics | Complaints |
| | |
| **Case D** | |
| | |
| **Human Capital** | **Human Capital** |
| Competence of the personnel | Staff training |
| Competence of the personnel | Competence self-evaluation |
| Experience of the personnel | Job career |
| | |
| **Structural Capital** | **Structural Capital** |
| Job satisfaction | Job satisfaction |
| Work unit climate | Social relationships |
| Work unit climate | Satisfaction to management |
| Efficiency of work | Process time |
| | |
| **Relational Capital** | **Relational Capital** |
| The quality of work | Service feedback |

6.4.6.4 Weighting and scaling of the IC indicators

To build up the IC measure, the IC indicators were weighted and scaled to get a standardised and effective scale of one to ten for each indicator. The average figures of each measure (indicator) over a longer period of time (± 2SD) were used when possible to define those lower and upper limits. When no SDs were available, the researcher estimated lower and upper limits according to his best knowledge from literature. The scaling procedure is described in more detail in Methods, Chapter 4.5.4.

Table 42. The indicators of IC in Case A over 1999-2004 in original figures, lower and upper limits, and scaled figures.

| **Case A** | **Human Capital** | | | **Structural Capital** | | | **Relational Capital** | | |
|---|---|---|---|---|---|---|---|---|---|
| Original indicator values | WAE | EDU | HLC | OS | ST | CW | CVI | PF | MF |
| 1999 | 8,30 | 3,7 | 55,4 | 109 | 4,2 | 65,3 | 3,7 | 4,0 | 4,0 |
| 2000 | 8,30 | 4,8 | 54,5 | 103 | 5,6 | 64,3 | 3,9 | 4,0 | 4,0 |
| 2001 | 8,21 | 4,6 | 53,1 | 103 | 5,5 | 64,1 | 3,9 | 4,1 | 4,1 |
| 2002 | 8,27 | 3,5 | 55,0 | 102 | 2,2 | 66,2 | 3,7 | 4,1 | 3,9 |
| 2003 | 8,34 | 3,2 | 60,6 | 102 | 2,2 | 62,9 | 3,9 | 4,2 | 4,2 |
| 2004 | 8,39 | 3,8 | 62,9 | 105 | 2,2 | 62,7 | 4,0 | 4,2 | 4,2 |
| min. value | 8,21 | 3,2 | 53,1 | 102 | 2,2 | 62,7 | 3,7 | 4,0 | 3,9 |
| max. value | 8,39 | 4,8 | 62,9 | 109 | 5,6 | 66,2 | 4,0 | 4,2 | 4,2 |
| average | 8,3* | 3,9 | 56,9 | 104* | 3,7 | 64,3 | 3,85 | 4,11* | 4,07* |
| SD | 1,0* | 0,6 | 3,9 | 6,6* | 1,7 | 1,4 | 0,12 | 0,25* | 0,32* |
| given min. | 7,3 | 2,7 | 49,1 | 110,6 | 7,0 | 61,5 | 3,61 | 3,86 | 3,75 |
| given max. | 9,3 | 5,2 | 64,7 | 97,4 | 1,0 | 67 | 4,09 | 4,36 | 4,39 |
| | | | | | | | | | |
| Scaled indicator values | WAE | EDU | HLC | OS | ST | CW | CVI | PF | MF |
| 1999 | 5,5 | 4,7 | 4,6 | 2,1 | 5,2 | 7,2 | 2,7 | 3,6 | 4,6 |
| 2000 | 5,5 | 8,6 | 4,1 | 6,2 | 3,1 | 5,6 | 6,4 | 3,6 | 4,6 |
| 2001 | 5,1 | 7,9 | 3,3 | 6,2 | 3,3 | 5,3 | 6,4 | 5,4 | 6,0 |
| 2002 | 5,3 | 4,0 | 4,4 | 6,9 | 8,2 | 8,7 | 2,7 | 5,4 | 3,2 |
| 2003 | 5,7 | 2,9 | 7,6 | 6,9 | 8,2 | 3,3 | 6,4 | 7,2 | 7,4 |
| 2004 | 5,9 | 5,0 | 8,9 | 4,8 | 8,2 | 2,9 | 8,3 | 7,9 | 7,4 |

The abbreviations in Table 42 are; WAE=work ability estimation. EDU=staff education, HLC=high level competence, OS=on schedule, ST=staff turnover, CW=customer work, CVI=customer value index, PF=project feedback, MF=maintenance feedback. In Table 42 the averages (and SDs) marked with * are based on large samples of Case A and averages without * are averages from the figures 1999-2004 presented in Table 42.

Certain general features can be seen from Table 42. During the period 1999-2004, high level competence has risen, turnover has deepened to the 2.2% level and project feedback has developed positively.

Table 43. The indicators of IC in Case B over 2001-2004 in original figures, lower and upper limits, and scaled figures.

| **Case B** | **Human Capital** | | | | **Structural Capital** | | | **Relational Capital** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Original indicator values | JC | CPM | CMW | ST | TSP | PSW | CW | CB | PF | MF |
| 2001 | 11,0 | 198 | 386 | 7,0 | 101 | 4,5 | 61,0 | 3,7 | 3,5 | 4,0 |
| 2002 | 11,8 | 152 | 354 | 5,2 | 101 | 5,2 | 60,0 | 3,7 | 3,7 | 3,9 |
| 2003 | 11,2 | 150 | 369 | 4,2 | 104 | 6,2 | 64,7 | 3,9 | 3,6 | 3,9 |
| 2004 | 11,6 | 158 | 376 | 4,3 | 100 | 9,1 | 66,6 | 4,1 | 3,8 | 4,1 |
| min. value | 11,0 | 150 | 354 | 4,2 | 100 | 4,5 | 60,0 | 3,7 | 3,5 | 3,9 |
| max. value | 11,8 | 198 | 386 | 7,0 | 104 | 9,1 | 66,6 | 4,1 | 3,8 | 4,1 |
| average | 11,4 | 164,5 | 371,3 | 5,2 | 101,5 | 6,3 | 63,1 | 3,85 | 3,65 | 3,98 |
| SD | 0,4 | 22,6 | 13,5 | 1,3 | 1,7 | 2 | 3,1 | 0,19 | 0,13 | 0,1 |
| given min. | 10,7 | 119,3 | 344,3 | 2,6 | 105 | 10,3 | 56,9 | 3,47 | 3,39 | 3,78 |
| given max. | 12,1 | 209,7 | 398,2 | 7,8 | 98 | 2,3 | 69,3 | 4,23 | 3,91 | 4,17 |
| | | | | | | | | | | |
| Scaled indicator values | JC | CPM | CMW | ST | TSP | PSW | CW | CB | PF | MF |
| 2001 | 3,0 | 8,8 | 8,0 | 8,7 | 6,1 | 7,5 | 4,0 | 3,7 | 2,9 | 6,1 |
| 2002 | 7,9 | 4,3 | 2,6 | 5,5 | 6,1 | 6,7 | 3,3 | 3,7 | 6,4 | 3,7 |
| 2003 | 4,2 | 4,1 | 5,1 | 3,8 | 2,3 | 5,4 | 6,7 | 6,1 | 4,6 | 3,7 |
| 2004 | 6,8 | 4,9 | 6,3 | 4,0 | 7,4 | 2,4 | 8,1 | 8,4 | 8,1 | 8,4 |

The abbreviations in Table 43 are; JC = job career, CPM = competence in project management, CMW = competence in maintaining work, ST = staff training, TSP = time spent in projects, HRC = HR capital, PSW = productivity of system work, CW=customer work, CB = customer benefit, PF = project feedback, MF = maintaining feedback.

Certain general features can be seen from Table 43 during 2001-2004. In HC-indicators values of CPM and CMW were both at their highest in 2001. In SC-indicators TSP had its lowest value in 2003 and PSW in 2004. In RC-indicators all indicators had developed positively during the follow-up period.

Table 44. The indicators of IC in Case C over 1999-2004 in original figures, lower and upper limits, and scaled figures.

| **Case C** | **Human Capital** | | | **SC** | | **RC** |
|---|---|---|---|---|---|---|
| Original indicator values | WAE | HF | SL | Waste | EFF | COMP |
| 1999 | 8,2 | 10,1 | 7,9 | 9,2 | 73,0 | 1,6 |
| 2000 | 8,4 | 10,2 | 7,3 | 9,1 | 75,4 | 1,6 |
| 2001 | 8,5 | 10,3 | 6,6 | 8,9 | 77,9 | 1,6 |
| 2002 | 8,4 | 10,3 | 5,0 | 8,3 | 74,5 | 1,4 |
| 2003 | 8,0 | 10,1 | 8,5 | 8,5 | 74,2 | 1,7 |
| 2004 | 8,1 | 10,3 | 7,9 | 8,8 | 73,0 | 1,3 |
| min. value | 8,04 | 10,1 | 5 | 8,3 | 73 | 1,29 |
| max. value | 8,52 | 10,3 | 8,5 | 9,2 | 77,9 | 1,7 |
| average | 8,3 | 10,2 | 7,2 | 8,8 | 74,7 | 1,53 |
| SD | 0,2 | 0,1 | 1,3 | 0,4 | 1,8 | 0,15 |
| given min. | 7,9 | 10 | 4,7 | 9,5 | 71 | 1,8 |
| given max. | 8,6 | 10,4 | 9,7 | 8,1 | 78,3 | 1,2 |
| | | | | | | |
| Scaled indicator values | WAE | HF | SL | Waste | EFF | COMP |
| 1999 | 4,5 | 2,4 | 6,9 | 2,8 | 3,5 | 4,2 |
| 2000 | 6,6 | 5,0 | 5,6 | 3,8 | 6,5 | 4,6 |
| 2001 | 8,8 | 7,6 | 4,4 | 4,8 | 9,4 | 5,1 |
| 2002 | 6,6 | 6,5 | 1,6 | 8,8 | 5,3 | 6,9 |
| 2003 | 2,6 | 3,6 | 7,8 | 7,5 | 4,9 | 2,9 |
| 2004 | 4,0 | 8,0 | 6,7 | 5,2 | 3,4 | 9,3 |

The abbreviations in Table 44 are; WAE = work ability estimation, HF = Health Factor, SL = sick leave, days/year, Waste = % of the raw material that has been wasted during production, EFF = efficiency of production, COMP = complaints, refunds paid to the customers, % of total sales.

Certain general features can be seen from Table 44 during 1999-2004. In HC-indicators the changes were in line with changes of physical activity indicators (PAI, WFPI) as already discussed in section 6.4.4. In SC-indicators. Waste and EFF were changing quite irregularly In RC-indicator COMP the best value was achieved in the end of the follow-up period.

Table 45. The indicators of IC in Case D. over 2002-2005 in original figures, lower and upper limits, and scaled figures.

| **Case D** | **Human Capital** | | | **Structural Capital** | | | | **RC** |
|---|---|---|---|---|---|---|---|---|
| Original indicator values | ST | CSE | JC | JS | SR | STM | PT | SF |
| 2002 | 1,08 | 8,09 | 19,0 | 62,1 | 7,29 | 30,2 | 16,7 | 7,97 |
| 2003 | 0,95 | 8,19 | 18,7 | 84,5 | 7,23 | 49,0 | 16,7 | 8,07 |
| 2004 | 0,94 | 8,29 | 18,6 | 85,7 | 7,55 | 53,7 | 11,1 | 8,19 |
| 2005 | 1,18 | 8,26 | 19,0 | 82,5 | 7,65 | 67,3 | 9,6 | 8,97 |
| min. value | 0,94 | 8,09 | 18,6 | 62,1 | 7,23 | 30,2 | 9,6 | 7,97 |
| max. value | 1,18 | 8,29 | 19,0 | 85,7 | 7,65 | 67,3 | 16,7 | 8,97 |
| given min. | 0,50 | 6,65 | 14,3 | 55,8 | 5,64 | 34,2 | 17,2 | 7,29 |
| given max. | 2,00 | 9,77 | 20,3 | 97,9 | 9,41 | 83,2 | 8,0 | 9,65 |
| mean of whole office | | 8,2 | 17,3 | 76,9 | 7,5 | 58,7 | 12,6 | 8,5 |
| SD of whole office | | 0,8 | | 42,1 | 0,9 | 49,1 | 4,6 | 1,2 |
| | | | | | | | | |
| Scaled indicator values | ST | CSE | JC | JS | SR | STM | PT | SF |
| 2002 | 3,9 | 4,6 | 7,8 | 1,5 | 4,4 | 1,0 | 0,6 | 2,9 |
| 2003 | 3,0 | 4,9 | 7,3 | 6,8 | 4,2 | 3,0 | 0,5 | 3,3 |
| 2004 | 2,9 | 5,2 | 7,2 | 7,1 | 5,1 | 4,0 | 6,7 | 3,8 |
| 2005 | 4,5 | 5,1 | 7,8 | 6,3 | 5,3 | 6,8 | 8,3 | 7,1 |

The abbreviations in Table 45 are; ST = staff training, CSE = competence self evaluation, JC = job career, JS = job satisfaction, SR = social relationship, STM = satisfaction to management, PT = process time, SF = service feedback.

Certain general features can be seen from Table 45 during 2002-2005. All HC-indicators were relatively constant during the follow-up period. In SC-indicators clear positive development could be seen. In RC-indicator SF the best value was achieved in the end of the follow-up period.

6.4.6.5 Constructing the IC measure

The IC measure was constructed based on the qualitative assessment of the fractions of IC's components and on scaled figures of the chosen indicators. The IC measure's maximum value was chosen to be 30 units, constituted from three pieces of 10 units in the case that all IC components are of equal importance. For non-equal situations, a formula v = fraction/33,3*10 was utilised, where the fraction was the assessed fraction of a particular IC component.

In Case A the components reached the following values: HC 43,4% (value between 1,3 - 13,0), SC 31,7% (value between 0,95 - 9,5) and RC 24,9% (value between 0,75 - 7,5). In Case B. the component reached following values: HC 43,3% (value between 1,3 - 13,0), SC 33,3% (value between 1,0-10,0) and RC 23,3% (value between 0,7 - 7,0). In Case C. the component reached following values: HC 44,4% (value between 1,3 - 13,3), SC 38,9% (value between 1,2 – 11,7) and RC 16,7% (value between 0,5 – 5,0). In Case D. the component reached following values: HC 47,2% (value between 1,4 – 14,2), SC 33,3% (value between 1,0 – 10,0) and RC 19,4% (value between 0,6 – 5,8).

To generate a value for each IC component, an average of individual indicators was calculated for each year. Table 46 presents the averages of weighted and scaled indicators on the left and the final IC measures on the right for each of the case companies.

Table 46. Constructed IC-measures of case companies.

| **Case A** | HC | SC | RC | **IC-measure** |
|---|---|---|---|---|
| 1999 | 6,4 | 4,9 | 2,7 | 14,1 |
| 2000 | 7,9 | 5,1 | 3,6 | 16,6 |
| 2001 | 7,0 | 5,0 | 4,4 | 16,5 |
| 2002 | 5,9 | 7,8 | 2,8 | 16,6 |
| 2003 | 7,0 | 6,1 | 5,2 | 18,3 |
| 2004 | 8,6 | 5,3 | 5,9 | 19,8 |

| **Case C** | HC | SC | RC | **IC-measure** |
|---|---|---|---|---|
| 1999 | 6,1 | 5,1 | 3,4 | 14,6 |
| 2000 | 7,7 | 6,5 | 3,2 | 17,3 |
| 2001 | 9,2 | 7,9 | 3,0 | 20,1 |
| 2002 | 6,5 | 7,1 | 2,1 | 15,7 |
| 2003 | 6,2 | 7,9 | 4,0 | 18,2 |
| 2004 | 8,3 | 4,0 | 0,9 | 13,2 |

| **Case B** | HC | SC | RC | **IC-measure** |
|---|---|---|---|---|
| 2001 | 8,6 | 6,8 | 2,5 | 17,9 |
| 2002 | 6,4 | 5,3 | 3,1 | 14,8 |
| 2003 | 5,8 | 4,8 | 4,1 | 14,7 |
| 2004 | 7,8 | 5,5 | 5,7 | 19,1 |

| **Case D** | HC | SC | RC | **IC-measure** |
|---|---|---|---|---|
| 2002 | 7,7 | 1,9 | 1,7 | 11,2 |
| 2003 | 7,2 | 3,6 | 1,9 | 12,8 |
| 2004 | 7,2 | 5,7 | 2,2 | 15,2 |
| 2005 | 8,3 | 6,7 | 4,2 | 19,1 |

4.6.6.6 Reporting of IC measure

The constructed IC measure was presented to the CEO as well as to the MWA group of Case A. The CEO responded positively in a spontaneous way by saying: *"This looks very interesting. It is nice to see that the relational capital has increased – I have focused on the importance of customer work during recent years in all my speeches and writing to the staff. On the whole, this could operate as a device for long-term planning."* In the MWA group (maintaining of work ability) no special comments were raised concerning the IC measure.

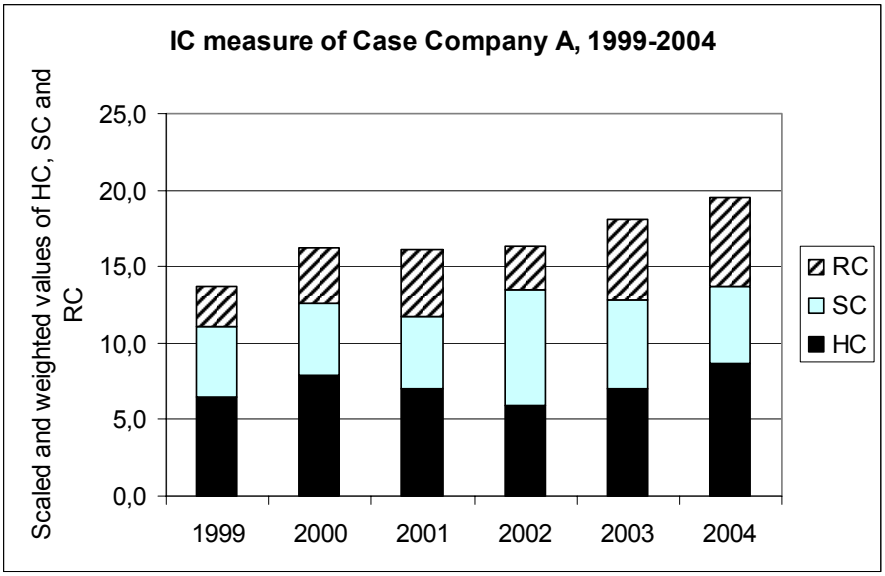


Figure 41. The IC measure in Case A.

The IC measure shows some fluctuation over the years, although the general trend is rising. Examining, some details, Relational Capital was at its lowest in 2002, when both the customer value index and the feedback on sustaining work were very low. As mentioned in the managers' and owners' interviews, the year 2002 was demanding in implementing the Euro change in the software products. Human Capital rose to its maximum at 2004, affected mainly by the high percentage of high level competence that year.

The IC measure provides an interesting tool for long-term strategic planning. As Figure 41 demonstrates, the changes in IC are fluid and take place across a long range. The IC measure should be constructed and interpreted to support the strategy of a company.

In Case B, the constructed IC measure was presented to the CEO. The CEO responded with curiosity in a positive and spontaneous way by saying: *"I'm worried how the things were at their best in year 2001 and declined for two years after that. What have*

*you done to get these numbers?* After going through the IC measure in more detail the CEO responded: *"OK, in 2002 we recruited quite a lot of new people and that caused the drop in the competence of whole company (CPM and CMW indicators), the newcomers are not at first real specialists."* and later, *"this is something I can't see in my measures with all those tens of numbers. This kind of priority seems to be relevant; some of the measures are investments for the future and some are results. Combining those would have some sense."*

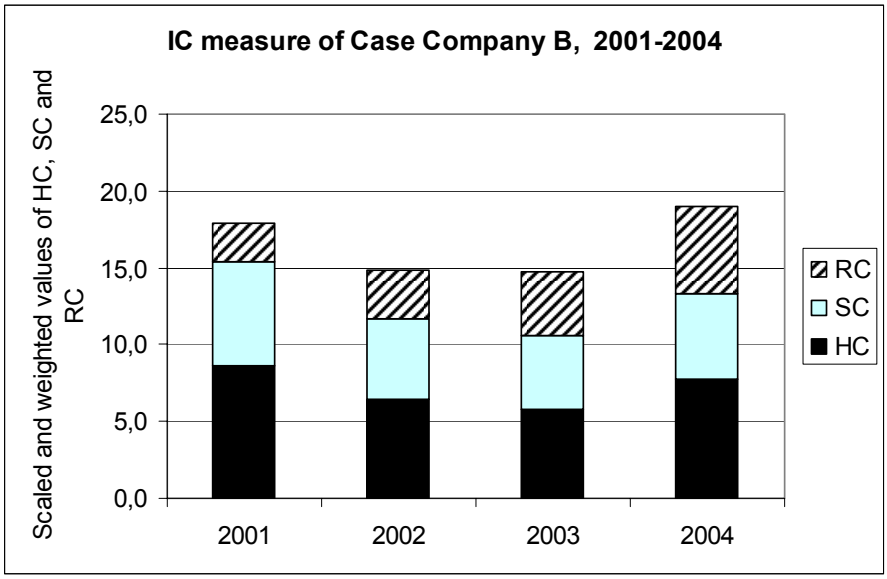


Figure 42. The IC measure in Case B.

The IC measure shows some fluctuation over the years. In 2001, both HC and SC were at a high level. In HC, that depended on high levels of competences and staff training, whereas in SC the productivity of system work was high. RC was highest in 2004 because of good customer feedback.

The IC measure provides an interesting tool for long-term strategic planning. As Figure 42 demonstrates, the changes in IC are fluid and take place across a long range. The IC measure should be constructed and interpreted to support the strategy of a company.

In Case C, the constructed IC measure was presented to the CEO and manager M2. The CEO responded quite positively by saying: "This measure has the same features as our own new 'intangible measure – measure of fluent activity'. That measure was developed after our strategy was confirmed to be a productive factory – and nothing else. Other units take care of R&D, marketing, etc. With our measure, we follow safety at work, job satisfaction, quality work and leadership and interaction. That measure would be good for your (researcher's) purposes also, but we just began to implement it in 2004, and in 2005 the whole factory will be involved with it." With manager M2, more or less technical details were discussed.

The reasons for building up the measure "Measure of fluent activity" are manifold. After interviewing the CEO, manager M2 and the expert responsible for the WFP, the following conclusions could be drawn: The 'Measure of fluent activity' has many "fathers" - on the one hand, (as the CEO stated) the strategy work gave Case C a certain focus to operate as a production unit, and (as the CEO said) good production is based on safety, work climate and quality, but on the other hand, the expert responsible for safety in work had also created a measure to enhance the level of safety at work - his goal is simple: "zero accidents at work!" Thirdly, the manager M2 and the expert responsible for the WFP had taken part in many innovative Intellectual Capital sessions alongside this research project; this might have had some at least some motivating input into the process. To conclude, at the moment (2006), Case C utilises the "Measure for fluent activity" in its management besides the more traditional measures of production and finance.

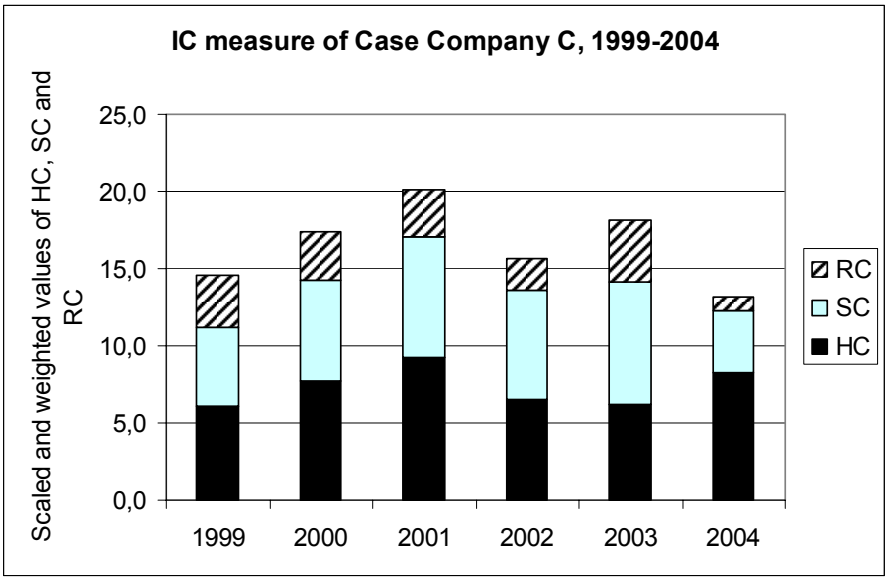


Figure 43. The IC measure in Case C.

The IC measure provides an interesting tool for long-term strategic planning. As Figure 43 demonstrates, the changes in IC are fluid and take place across a long range. One clear shortcoming in Case C's IC measure are the indicators used in measuring HC. All the indicators are collected within the Physical Activity Questionnaire which may cause some problems with the indicators. On the other hand, several important essential elements of HC could not be measured because of a lack of a proper and/or constant indicator during the period 1999-2004.

Measures of SC and RC are based on the production measures of Case C. In SC, as in HC, many essential indicators could not be used. For these reasons, the IC measure of Case C is more or less descriptive in nature in comparison with the IC measures of Case A and Case B.

In Case D, the constructed IC measure was presented to the head of the Test-1 work unit as well as to the Case D research monitoring group. The work unit head responded with suspicion to the measure by saying: *"This looks interesting, but I doubt that a few indicators would indicate the whole truth in this respect. Management and work in general is a far more complicated thing!"* The Head of the Test-1 work unit gave much valuable advice concerning the indicators to be finally chosen in the IC measure. In the research monitoring group, no comments were raised concerning the IC measure. These experiences lead to conclusion that the management in Case D is satisfied with the management and HR measures that they have.

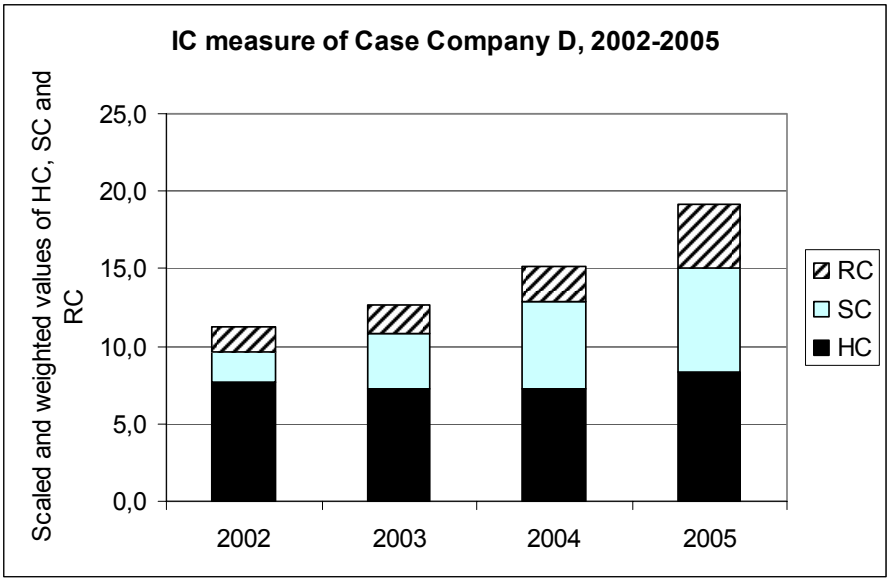


Figure 44. The IC measure in Case D (Test-1 work unit.).

The IC measure shows a clear rise over the years. Examining some details, Structural and Relational Capital was at its lowest in 2002, when social relationships, satisfaction with management, process time and service feedback were at their lowest. Human Capital was relatively constant over the follow-up period.

*6.4.7 Relationships between Intellectual Capital and physical activity and fitness patterns in case companies*

6.4.7.1 Case A

To evaluate the relationships between components of IC and physical activity and fitness patterns in Case A, a series of analyses were carried out. The first correlation analyses of the IC components and PAI, PFI and WFPI from 1999-2004 were calculated to find out the overall effects of physical activity and fitness patterns on IC. No statistically significant findings connecting physical activity and fitness to IC were found; the correlation coefficients are presented in Figure 45.

| | PAI | PFI | WFPI | HC | SC | RC |
|---|---|---|---|---|---|---|
| **PAI** | | 0,77* | -0,70 | 0,26 | -0,58 | -0,11 |
| **PFI** | 0,77* | | -0,75 | 0,08 | -0,25 | -0,11 |
| **WFPI** | -0,70 | -0,75 | | 0,27 | 0,41 | 0,28 |
| **HC** | 0,26 | 0,08 | 0,27 | | -0,54 | 0,74 |
| **SC** | -0,58 | -0,25 | 0,41 | -0,54 | | -0,24 |
| **RC** | -0,11 | -0,11 | 0,28 | 0,74 | -0,24 | |

Figure 45. The correlation coefficients linking IC components and physical activity and fitness indicators in Case A during the period 1999-2004.

The correlation between PAI and PFI was significant at a level of $p<0,05$. Closer analysis of individual indicators of IC and PAI, PFI and WFPI showed, that "on schedule" was positively correlated with both PAI ($r=0,82$, $p<0,05$) and PFI ($r=0,90$, $p<0,01$) and negatively correlated with WFPI ($r=-0,905$, $p<0,01$). This may have an explanation in the work loads discussed by the interviewees during the second interviews. In 2001-2002, when the Euro-change was at its most difficult phase, everybody worked hard to get the work done. The work was done in planned schedules, as the "on schedule" indicator indicates. At the same time, employees (and managers!) felt they had no time or energy for physical activity. In 1999 and 2004, when the "on schedule" indicator was at its highest, employees probably worked at a slightly slower pace ("on schedule" went up!) and had energy for physical activity as well. The negative correlation between "On schedule" and WFPI was caused by the relatively low WFPI value at the beginning of the study in 1999.

Correlation matrixes from years 1999-2004 and respectively from years 2001-2004 are presented in Figure 46 the abbreviations are; PAI=Physical Activity Indicator, WFPI=Worksite Fitness Program Indicator, PFI=Physical Fitness Indicator, WAE=work ability estimation. EDU=staff education, HLC=high level competence, OS=on schedule, ST=staff turnover, CW=customer work, CVI=customer value index, PF=project feedback, MF=maintenance feedback.

**Correlation Matrix**

| | | PAI | WFPI | PFI | WAE | EDU | HLC | OS | ST | CW | CVI | PF | MF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation | PAI | 1,000 | -,696 | ,767 | ,510 | -,033 | ,228 | ,821 | ,138 | -,117 | -,067 | -,322 | ,083 |
| | WFPI | -,696 | 1,000 | -,660 | -,050 | ,251 | ,028 | -,905 | -,095 | -,146 | ,419 | ,299 | -,009 |
| | PFI | ,767 | -,660 | 1,000 | ,600 | -,331 | ,430 | ,850 | -,298 | ,005 | -,164 | ,019 | ,044 |
| | WAE | ,510 | -,050 | ,600 | 1,000 | -,447 | ,919 | ,200 | -,598 | -,596 | ,430 | ,550 | ,542 |
| | EDU | -,033 | ,251 | -,331 | -,447 | 1,000 | -,565 | -,059 | ,891 | ,012 | ,310 | -,492 | -,166 |
| | HLC | ,228 | ,028 | ,430 | ,919 | -,565 | 1,000 | ,025 | -,734 | -,727 | ,539 | ,826 | ,739 |
| | OS | ,821 | -,905 | ,850 | ,200 | -,059 | ,025 | 1,000 | ,148 | ,143 | -,304 | -,339 | -,062 |
| | ST | ,138 | -,095 | -,298 | -,598 | ,891 | -,734 | ,148 | 1,00 | ,158 | ,034 | -,723 | -,248 |
| | CW | -,117 | -,146 | ,005 | -,596 | ,012 | -,727 | ,143 | ,158 | 1,000 | -,911 | -,689 | -,964 |
| | CVI | -,067 | ,419 | -,164 | ,430 | ,310 | ,539 | -,304 | ,034 | -,911 | 1,00 | ,595 | ,809 |
| | PF | -,322 | ,299 | ,019 | ,550 | -,492 | ,826 | -,339 | -,723 | -,689 | ,595 | 1,00 | ,754 |
| | MF | ,083 | -,009 | ,044 | ,542 | -,166 | ,739 | -,062 | -,248 | -,964 | ,809 | ,754 | 1,00 |
| Sig. (1-tailed) | PAI | | ,062 | ,038 | ,151 | ,475 | ,332 | ,023 | ,397 | ,413 | ,449 | ,267 | ,438 |
| | WFPI | ,062 | | ,077 | ,463 | ,316 | ,479 | ,007 | ,429 | ,391 | ,204 | ,282 | ,493 |
| | PFI | ,038 | ,077 | | ,104 | ,261 | ,197 | ,016 | ,283 | ,496 | ,378 | ,485 | ,467 |
| | WAE | ,151 | ,463 | ,104 | | ,187 | ,005 | ,352 | ,105 | ,106 | ,197 | ,129 | ,133 |
| | EDU | ,475 | ,316 | ,261 | ,187 | | ,121 | ,456 | ,009 | ,491 | ,275 | ,161 | ,377 |
| | HLC | ,332 | ,479 | ,197 | ,005 | ,121 | | ,482 | ,048 | ,051 | ,135 | ,021 | ,047 |
| | OS | ,023 | ,007 | ,016 | ,352 | ,456 | ,482 | | ,390 | ,393 | ,279 | ,255 | ,454 |
| | ST | ,397 | ,429 | ,283 | ,105 | ,009 | ,048 | ,390 | | ,383 | ,474 | ,052 | ,318 |
| | CW | ,413 | ,391 | ,496 | ,106 | ,491 | ,051 | ,393 | ,383 | | ,006 | ,065 | ,001 |
| | CVI | ,449 | ,204 | ,378 | ,197 | ,275 | ,135 | ,279 | ,474 | ,006 | | ,106 | ,026 |
| | PF | ,267 | ,282 | ,485 | ,129 | ,161 | ,021 | ,255 | ,052 | ,065 | ,106 | | ,042 |
| | MF | ,438 | ,493 | ,467 | ,133 | ,377 | ,047 | ,454 | ,318 | ,001 | ,026 | ,042 | |

**Correlation Matrix**

| | | PAI | WFPI | PFI | WAE | EDU | HLC | OS | ST | CW | CVI | PF | MF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation | PAI | 1,000 | -,541 | ,753 | ,943 | -,357 | ,973 | ,643 | -,512 | -,853 | ,784 | ,998 | ,815 |
| | WFPI | -,541 | 1,000 | ,015 | -,242 | -,310 | -,364 | -,396 | -,374 | ,899 | -,891 | -,504 | -,924 |
| | PFI | ,753 | ,015 | 1,000 | ,829 | -,265 | ,777 | ,780 | -,616 | -,361 | ,430 | ,756 | ,293 |
| | WAE | ,943 | -,242 | ,829 | 1,000 | -,597 | ,991 | ,514 | -,766 | -,643 | ,535 | ,959 | ,592 |
| | EDU | -,357 | -,310 | -,265 | -,597 | 1,000 | -,553 | ,352 | ,914 | ,027 | ,253 | -,411 | ,000 |
| | HLC | ,973 | -,364 | ,777 | ,991 | -,553 | 1,000 | ,519 | -,694 | -,735 | ,620 | ,985 | ,691 |
| | OS | ,643 | -,396 | ,780 | ,514 | ,352 | ,519 | 1,00 | ,000 | -,543 | ,749 | ,608 | ,500 |
| | ST | -,512 | -,374 | -,616 | -,766 | ,914 | -,694 | ,000 | 1,00 | ,052 | ,132 | -,560 | ,000 |
| | CW | -,853 | ,899 | -,361 | -,643 | ,027 | -,735 | -,543 | ,052 | 1,00 | -,944 | -,831 | -,997 |
| | CVI | ,784 | -,891 | ,430 | ,535 | ,253 | ,620 | ,749 | ,132 | -,944 | 1,000 | ,747 | ,937 |
| | PF | ,998 | -,504 | ,756 | ,959 | -,411 | ,985 | ,608 | -,560 | -,831 | ,747 | 1,00 | ,792 |
| | MF | ,815 | -,924 | ,293 | ,592 | ,000 | ,691 | ,500 | ,000 | -,997 | ,937 | ,792 | 1,000 |
| Sig. (1-tailed) | PAI | | ,229 | ,123 | ,029 | ,321 | ,013 | ,178 | ,244 | ,074 | ,108 | ,001 | ,093 |
| | WFPI | ,229 | | ,493 | ,379 | ,345 | ,318 | ,302 | ,313 | ,051 | ,055 | ,248 | ,038 |
| | PFI | ,123 | ,493 | | ,085 | ,367 | ,112 | ,110 | ,192 | ,319 | ,285 | ,122 | ,353 |
| | WAE | ,029 | ,379 | ,085 | | ,202 | ,004 | ,243 | ,117 | ,179 | ,233 | ,021 | ,204 |
| | EDU | ,321 | ,345 | ,367 | ,202 | | ,224 | ,324 | ,043 | ,487 | ,374 | ,294 | ,500 |
| | HLC | ,013 | ,318 | ,112 | ,004 | ,224 | | ,240 | ,153 | ,132 | ,190 | ,008 | ,154 |
| | OS | ,178 | ,302 | ,110 | ,243 | ,324 | ,240 | | ,500 | ,229 | ,125 | ,196 | ,250 |
| | ST | ,244 | ,313 | ,192 | ,117 | ,043 | ,153 | ,500 | | ,474 | ,434 | ,220 | ,500 |
| | CW | ,074 | ,051 | ,319 | ,179 | ,487 | ,132 | ,229 | ,474 | | ,028 | ,085 | ,001 |
| | CVI | ,108 | ,055 | ,285 | ,233 | ,374 | ,190 | ,125 | ,434 | ,028 | | ,127 | ,032 |
| | PF | ,001 | ,248 | ,122 | ,021 | ,294 | ,008 | ,196 | ,220 | ,085 | ,127 | | ,104 |
| | MF | ,093 | ,038 | ,353 | ,204 | ,500 | ,154 | ,250 | ,500 | ,001 | ,032 | ,104 | |

Figure 46. Correlation matrix based on yearly values in 1999-2004 (upper) and 2001-2004 (lower), Case A.

After 2001, many indicators had risen and more correlations with PAI were statistically significant. The following correlated positively with PAI: Work Ability Estimation (WAE) (r=0,943, p<0,029), Competence Index (r=0,973, p<0,013) and Project Feedback (r=0,998, p<0,001). The relation between PAI and WAE is in line with the finding of the preliminary study. The other results may have some indications of the overall energy level of employees and positive results in work-related indicators. In may be, at least to some extent, that the rise in the physical activity level has an effect on normal, quite demanding development work, which is followed by project feedback figures. On the other hand, the competence index is influenced by both recruitment policy and education, which makes the connection more indistinct.

Over the years 2001-2004, data on WFPI and sick leave correlated positively (r=0,967, p<0,05). This can be explained by coincidence, or perhaps increased activity in WFP predisposes employees to illnesses such as colds, the flu etc.

6.4.7.2 Case B

To evaluate the relationships between components of IC and physical activity and fitness patterns in Case B, a series of analyses were carried out. First, correlation analyses of the IC components and PAI, PFI and WFPI from the years 2001-2004 were calculated to find out the overall effects of physical activity and fitness patterns on IC. Correlation coefficients with their significance levels are presented in Figures 47 and 49. The changes in follow-up are presented in Figure 48.

| | PAI | PFI | WFPI | HC | SC | RC |
|---|---|---|---|---|---|---|
| **PAI** | | -0,97** | -0,26 | -0,10 | 0,54 | 0,97** |
| **PFI** | -0,97** | | 0,50 | 0,28 | -0,34 | -0,99*** |
| **WFPI** | -0,26 | 0,50 | | 0,87* | 0,62 | -0,40 |
| **HC** | -0,10 | 0,28 | 0,87* | | 0,78 | -0,13 |
| **SC** | 0,54 | -0,34 | 0,62 | 0,78 | | 0,46 |
| **RC** | 0,97** | -0,99*** | -0,40 | -0,13 | 0,46 | |

Figure 47. The correlation coefficients between IC components and physical activity and fitness indicators in Case B. in years 2001-2004.

The results presented in Figure 47 are to some extent surprising. First of all, correlation between PAI and PFI was very negative (r=-0,97, p<0,01), which is against all theories of physical activity and exercise. If the fluctuations of PAI and PFI are correct, then the correlations between PAI and RC, and PFI and RC seems to be peculiar. If an increase in physical activity increases RC, how then can decrease in physical fitness also increase RC? The correlation between WFPI and HC seems to be relevant; changes in WFP activity were connected with changes in HC.

A closer analysis of individual indicators of IC, PAI, PFI and WFPI showed that the contradiction between PAI and PFI continues: in some correlations, PAI is highly positive and at the same time PFI is highly negative.

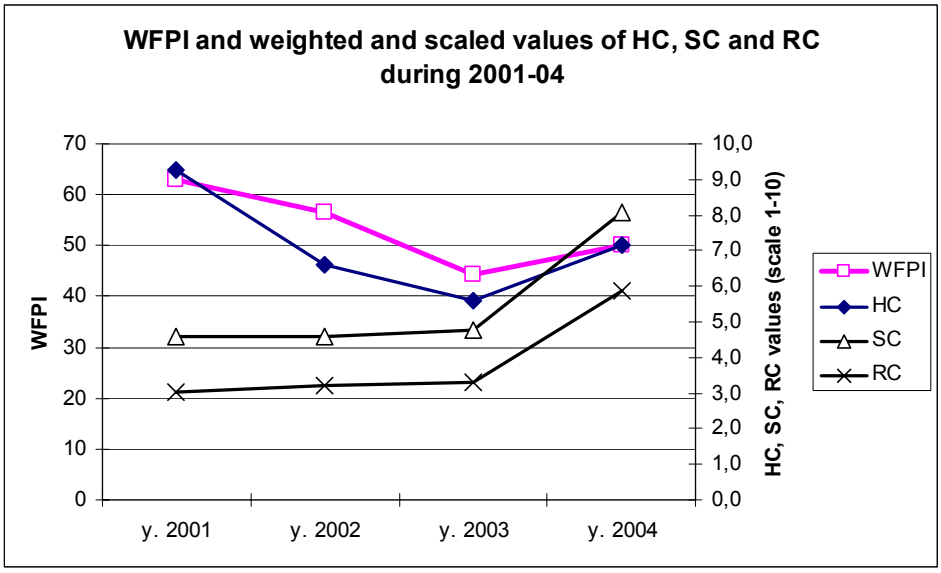


Figure 48. The weighted (and scaled) means of WFPI and IC-components in Case B during 2001-2004.

**Correlation Matrix**

| | | PAI | WFPI | PFI | WAE | SL | CPM | CMW | ST | TSP | PSW | CW | CB | PF | MF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation | PAI | 1,000 | -,265 | -,967 | ,922 | -,483 | -,313 | ,026 | -,492 | -,639 | ,913 | ,649 | ,800 | ,923 | ,779 |
| | WFPI | -,265 | 1,000 | ,499 | ,054 | -,694 | ,793 | ,275 | ,935 | -,568 | -,601 | -,754 | -,697 | -,346 | ,106 |
| | PFI | -,967 | ,499 | 1,000 | -,802 | ,242 | ,460 | ,003 | ,674 | ,421 | -,984 | -,801 | -,915 | -,901 | -,697 |
| | WAE | ,922 | ,054 | -,802 | 1,000 | -,755 | -,202 | -,110 | -,254 | -,844 | ,688 | ,303 | ,505 | ,905 | ,693 |
| | SL | -,483 | -,694 | ,242 | -,755 | 1,000 | -,356 | -,071 | -,424 | ,977 | -,090 | ,294 | ,108 | -,430 | -,545 |
| | CPM | -,313 | ,793 | ,460 | -,202 | -,356 | 1,000 | ,781 | ,917 | -,315 | -,461 | -,369 | -,424 | -,589 | ,316 |
| | CMW | ,026 | ,275 | ,003 | -,110 | -,071 | ,781 | 1,000 | ,469 | -,165 | ,073 | ,284 | ,188 | -,360 | ,628 |
| | ST | -,492 | ,935 | ,674 | -,254 | -,424 | ,917 | ,469 | 1,000 | -,304 | -,719 | -,707 | -,731 | -,634 | ,020 |
| | TSP | -,639 | -,568 | ,421 | -,844 | ,977 | -,315 | -,165 | -,304 | 1,000 | -,285 | ,084 | -,101 | -,539 | -,704 |
| | PSW | ,913 | -,601 | -,984 | ,688 | -,090 | -,461 | ,073 | -,719 | -,285 | 1,000 | ,894 | ,972 | ,821 | ,679 |
| | CW | ,649 | -,754 | -,801 | ,303 | ,294 | -,369 | ,284 | -,707 | ,084 | ,894 | 1,000 | ,974 | ,491 | ,559 |
| | CB | ,800 | -,697 | -,915 | ,505 | ,108 | -,424 | ,188 | -,731 | -,101 | ,972 | ,974 | 1,000 | ,670 | ,636 |
| | PF | ,923 | -,346 | -,901 | ,905 | -,430 | -,589 | -,360 | -,634 | -,539 | ,821 | ,491 | ,670 | 1,000 | ,487 |
| | MF | ,779 | ,106 | -,697 | ,693 | -,545 | ,316 | ,628 | ,020 | -,704 | ,679 | ,559 | ,636 | ,487 | 1,00 |
| Sig. (1-tailed) | PAI | | ,367 | ,017 | ,039 | ,259 | ,343 | ,487 | ,254 | ,181 | ,043 | ,176 | ,100 | ,038 | ,110 |
| | WFPI | ,367 | | ,250 | ,473 | ,153 | ,104 | ,362 | ,033 | ,216 | ,199 | ,123 | ,152 | ,327 | ,447 |
| | PFI | ,017 | ,250 | | ,099 | ,379 | ,270 | ,499 | ,163 | ,289 | ,008 | ,099 | ,042 | ,049 | ,151 |
| | WAE | ,039 | ,473 | ,099 | | ,122 | ,399 | ,445 | ,373 | ,078 | ,156 | ,349 | ,247 | ,047 | ,154 |
| | SL | ,259 | ,153 | ,379 | ,122 | | ,322 | ,465 | ,288 | ,012 | ,455 | ,353 | ,446 | ,285 | ,227 |
| | CPM | ,343 | ,104 | ,270 | ,399 | ,322 | | ,110 | ,041 | ,342 | ,269 | ,315 | ,288 | ,206 | ,342 |
| | CMW | ,487 | ,362 | ,499 | ,445 | ,465 | ,110 | | ,266 | ,418 | ,464 | ,358 | ,406 | ,320 | ,186 |
| | ST | ,254 | ,033 | ,163 | ,373 | ,288 | ,041 | ,266 | | ,348 | ,140 | ,146 | ,134 | ,183 | ,490 |
| | TSP | ,181 | ,216 | ,289 | ,078 | ,012 | ,342 | ,418 | ,348 | | ,357 | ,458 | ,450 | ,231 | ,148 |
| | PSW | ,043 | ,199 | ,008 | ,156 | ,455 | ,269 | ,464 | ,140 | ,357 | | ,053 | ,014 | ,089 | ,160 |
| | CW | ,176 | ,123 | ,099 | ,349 | ,353 | ,315 | ,358 | ,146 | ,458 | ,053 | | ,013 | ,254 | ,221 |
| | CB | ,100 | ,152 | ,042 | ,247 | ,446 | ,288 | ,406 | ,134 | ,450 | ,014 | ,013 | | ,165 | ,182 |
| | PF | ,038 | ,327 | ,049 | ,047 | ,285 | ,206 | ,320 | ,183 | ,231 | ,089 | ,254 | ,165 | | ,256 |
| | MF | ,110 | ,447 | ,151 | ,154 | ,227 | ,342 | ,186 | ,490 | ,148 | ,160 | ,221 | ,182 | ,256 | |

Figure 49. Correlation matrix between physical activity and fitness patterns and indicators of IC based on yearly values in 2001-2004, Case B.

The abbreviations in Figure 49 are; PAI = physical activity indicator, WFPI = worksite fitness program indicator, PFI = physical fitness indicator, WAE = work ability estimation, SL = sick leave, JC = job career, CPM = competence in project management, CMW = competence in maintaining work, ST = staff training, TSP = time spent in projects, HRC = HR-capital, PSW = productivity of system work, CB = customer benefit, PF = project feedback, MF = maintaining feedback.

During the years 2001-04 PAI was changing in a similar to that of Work Ability Estimation (WAE) (r=0,922, p<0,039), Productivity of System Work (r=0,913, p<0,043) and Project Feedback (r=0,923, p<0,038). Activity in the Worksite Fitness Program (WFP) had positive correlation with Staff Training (r=0,935, p<0,033). PFI correlated negatively with several indicators; Productivity of System Work (r=-0,984, p<0,08), Customer Benefit (r=-0,915, p<0,042) and Project Feedback (r=-0,901, p<0,049).

6.4.7.3 Case C

To evaluate the relationships between components of IC and physical activity and fitness patterns in Case C, a series of analyses were carried out. The results are summarised in Figure 50 and in Figure 51.

| | PAI | WFPI | WFPE | HC | SC | RC |
|---|---|---|---|---|---|---|
| **PAI** | | 0,59 | 0,41 | 0,55 | 0,74 | -0,39 |
| **WFPI** | 0,59 | | 0,98*** | 0,30 | -0,13 | 0,62 |
| **WFPE** | 0,41 | 0,98*** | | 0,09 | -0,30 | 0,62 |
| **HC** | 0,55 | 0,30 | 0,09 | | -0,02 | 0,42 |
| **SC** | 0,74 | -0,13 | -0,30 | -0,02 | | 0,53 |
| **RC** | -0,39 | 0,62 | 0,62 | 0,42 | 0,53 | |

Figure 50. Correlation matrix between physical activity patterns and components of IC in Case C during 1999-2004, partly 1995-2004.

Figure 50 demonstrates that only statistically significant correlations were found between WFP indicators WFPI and WFPE; which seems rather natural. No statistically significant correlations were found between components of IC and physical activity and fitness patterns. A closer examination over certain periods reveals that some uniform changes have, however, happened in PAI and HC during the years 1999-2003 (correlation coefficient from that period r=0,98, p<0,001). The change from 2003 to 2004 was not in line with earlier trends and could be influenced by the determined work to improve company climate after the first new job satisfaction measure in 2003.

The abbreviations in Figure 51 are; PAI = physical activity indicator, WFPI = worksite fitness program indicator, WFPE=Worksite Fitness Program Events Indicator, WAE=work ability estimation, HF=Health Factor, SL=sick leave, Eff=efficiency of production, Waste=% of the raw material that has been wasted during production, Comp=complaints, refunds paid to the customers, % of total sales.

| | | PAI | WFPI | WFPH | WAE | SL | HF | Eff | Waste | Comp. |
|---|---|---|---|---|---|---|---|---|---|---|
| Correlation | PAI | | 0,59 | 0,41 | 0,77 | -0,16 | 0,71 | 0,31 | -0,04 | 0,36 |
| | WFPI | 0,59 | | 0,98 | -0,24 | 0,10 | 0,87 | 0,22 | -0,48 | -0,60 |
| | WFPH | 0,41 | 0,98 | | -0,43 | 0,06 | 0,44 | 0,28 | -0,63 | -0,53 |
| | WAE | 0,77 | -0,24 | -0,44 | | -0,74 | 0,54 | 0,51 | 0,03 | -0,14 |
| | SL | -0,16 | 0,10 | 0,06 | -0,74 | | -0,25 | -0,90 | 0,49 | 0,32 |
| | HF | 0,71 | 0,87 | 0,44 | 0,54 | -0,25 | | 0,48 | -0,24 | -0,76 |
| | Eff | 0,31 | 0,22 | 0,28 | 0,51 | -0,90 | 0,48 | | -0,82 | -0,25 |
| | Waste | -0,04 | -0,48 | -0,63 | 0,03 | 0,49 | -0,24 | -0,82 | | 0,08 |
| | Comp. | 0,36 | -0,60 | -0,53 | -0,14 | 0,32 | -0,76 | -0,25 | 0,08 | |
| Sig. (1-tailed) | PAI | | 0,092 | 0,236 | 0,062 | 0,382 | 0,058 | 0,306 | 0,477 | 0,275 |
| | WFPI | 0,092 | | 0,001 | 0,347 | 0,426 | 0,012 | 0,361 | 0,207 | 0,143 |
| | WFPH | 0,236 | 0,001 | | 0,230 | 0,462 | 0,227 | 0,322 | 0,127 | 0,178 |
| | WAE | 0,062 | 0,347 | 0,230 | | 0,078 | 0,173 | 0,19 | 0,481 | 0,409 |
| | SL | 0,382 | 0,426 | 0,462 | 0,078 | | 0,315 | 0,02 | 0,204 | 0,303 |
| | HF | 0,058 | 0,012 | 0,227 | 0,173 | 0,315 | | 0,208 | 0,349 | 0,069 |
| | Eff | 0,306 | 0,361 | 0,322 | 0,19 | 0,02 | 0,208 | | 0,047 | 0,341 |
| | Waste | 0,477 | 0,207 | 0,127 | 0,481 | 0,204 | 0,349 | 0,047 | | 0,451 |
| | Comp. | 0,275 | 0,143 | 0,178 | 0,409 | 0,303 | 0,069 | 0,341 | 0,451 | |

Figure 51. Correlation matrix between physical activity patterns and indicators of IC in Case C during 1999-2004, partly 1995-2004.

With the company based indicators, positive correlations with PAI were found with the HC indicators Work Ability Estimation ($r=0,774$, $p<0,062$) and Health Factor ($r=0,708$, $p<0,058$). As already discussed in sections 6.4.4.2 and 6.4.4.4, these variables had statistically significant correlations in the 'collar colour'-based examination. WFPI correlated positively with Health Factor ($r=0,87$, $p<0,012$). Within other indicators, sick leave correlated negatively with production efficiency ($r=-0,90$, $p<0,020$).

#### 6.4.7.4 Case D

To evaluate the relationships between components of IC and physical activity and fitness patterns in Case D, a series of analyses were carried out. The follow-up period was very short to get reliable results, only two years. A correlation matrix was calculated to see the overall effects of physical activity and fitness patterns on IC.

| | **PAI** | **PFI** | **WFPI** | **HC** | **SC** | **RC** |
|---|---|---|---|---|---|---|
| **PAI** | | -0,91 | 0,96 | 0,63 | -0,02 | 0,55 |
| **PFI** | -0,91 | | -0,99 | -0,24 | 0,44 | -0,15 |
| **WFPI** | 0,96 | -0,99 | | 0,39 | -0,30 | 0,30 |
| **HC** | 0,63 | -0,24 | 0,39 | | 0,34 | 0,80 |
| **SC** | -0,02 | 0,44 | -0,30 | 0,34 | | 0,82 |
| **RC** | 0,55 | -0,15 | 0,30 | 0,80 | 0,82 | |

Figure 52. Correlation matrix with physical activity and fitness patterns and components of IC in Case D during 2002-05.

Figure 52 shows some interesting results. First of all, PAI and WFPI were highly negatively correlated to PFI, which should not be possible in the light of common knowledge of the connections of exercise and physical fitness (see, e.g., Cooper 1982, Rhea *et al*. 2003). It must be concluded that the results are coincidental.

Further analyses were carried out to create a correlation matrix for physical activity and fitness patterns and IC indicators. Physical activity indicators (PAI and WFPI) had a negative correlation with sick leave (r=-0,912, p<0,135 and r=-0,987, p<0,051, respectively), while PFI had a positive correlation (r=1,00, p<0,003). Within all the IC indicators, work ability and competence self-evaluation (r=0,990, p<0,046) and satisfaction with management and service feedback (r=0,992, p<0,041) correlated positively, while social relationship and process time had a negative correlation (r=-0,999, p<0,013).

**Correlation Matrix**

| | | PAI | WFPI | PFI | WAE | SL | ST | CSE | JC | JS | SR | STM | PT | SF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation | PAI | 1,000 | ,966 | -,915 | -,491 | -,912 | ,660 | -,611 | ,800 | -,882 | -,125 | ,421 | ,165 | ,533 |
| | WFPI | ,966 | 1,000 | -,988 | -,700 | -,987 | ,443 | -,795 | ,617 | -,729 | -,378 | ,171 | ,415 | ,295 |
| | PFI | -,915 | -,988 | 1,000 | ,800 | 1,000 | -,302 | ,878 | -,491 | ,617 | ,514 | -,020 | -,548 | -,147 |
| | WAE | -,491 | -,700 | ,800 | 1,000 | ,806 | ,330 | ,990 | ,130 | ,022 | ,926 | ,584 | -,940 | ,476 |
| | SL | -,912 | -,987 | 1,000 | ,806 | 1,000 | -,293 | ,882 | -,483 | ,610 | ,521 | -,011 | -,556 | -,138 |
| | ST | ,660 | ,443 | -,302 | ,330 | -,293 | 1,000 | ,191 | ,979 | -,937 | ,663 | ,959 | -,632 | ,987 |
| | CSE | -,611 | -,795 | ,878 | ,990 | ,882 | ,191 | 1,000 | -,014 | ,165 | ,862 | ,461 | -,882 | ,344 |
| | JC | ,800 | ,617 | -,491 | ,130 | -,483 | ,979 | -,014 | 1,000 | -,988 | ,496 | ,881 | -,460 | ,934 |
| | JS | -,882 | -,729 | ,617 | ,022 | ,610 | -,937 | ,165 | -,988 | 1,00 | -,358 | -,799 | ,320 | -,869 |
| | SR | -,125 | -,378 | ,514 | ,926 | ,521 | ,663 | ,862 | ,496 | -,358 | 1,000 | ,848 | -,999 | ,773 |
| | STM | ,421 | ,171 | -,020 | ,584 | -,011 | ,959 | ,461 | ,881 | -,799 | ,848 | 1,000 | -,825 | ,992 |
| | PT | ,165 | ,415 | -,548 | -,940 | -,556 | -,632 | -,882 | -,460 | ,320 | -,999 | -,825 | 1,000 | -,747 |
| | SF | ,533 | ,295 | -,147 | ,476 | -,138 | ,987 | ,344 | ,934 | -,869 | ,773 | ,992 | -,747 | 1,00 |
| Sig. (1-tailed) | PAI | | ,084 | ,132 | ,337 | ,135 | ,270 | ,291 | ,205 | ,156 | ,460 | ,362 | ,447 | ,321 |
| | WFPI | ,084 | | ,048 | ,253 | ,051 | ,354 | ,207 | ,288 | ,240 | ,377 | ,445 | ,364 | ,405 |
| | PFI | ,132 | ,048 | | ,205 | ,003 | ,402 | ,159 | ,337 | ,288 | ,328 | ,494 | ,315 | ,453 |
| | WAE | ,337 | ,253 | ,205 | | ,202 | ,393 | ,046 | ,458 | ,493 | ,123 | ,302 | ,111 | ,342 |
| | SL | ,135 | ,051 | ,003 | ,202 | | ,405 | ,156 | ,340 | ,291 | ,325 | ,497 | ,312 | ,456 |
| | ST | ,270 | ,354 | ,402 | ,393 | ,405 | | ,439 | ,065 | ,114 | ,269 | ,091 | ,282 | ,051 |
| | CSE | ,291 | ,207 | ,159 | ,046 | ,156 | ,439 | | ,496 | ,447 | ,169 | ,348 | ,156 | ,388 |
| | JC | ,205 | ,288 | ,337 | ,458 | ,340 | ,065 | ,496 | | ,048 | ,335 | ,157 | ,348 | ,116 |
| | JS | ,156 | ,240 | ,288 | ,493 | ,291 | ,114 | ,447 | ,048 | | ,383 | ,205 | ,396 | ,165 |
| | SR | ,460 | ,377 | ,328 | ,123 | ,325 | ,269 | ,169 | ,335 | ,383 | | ,178 | ,013 | ,219 |
| | STM | ,362 | ,445 | ,494 | ,302 | ,497 | ,091 | ,348 | ,157 | ,205 | ,178 | | ,191 | ,041 |
| | PT | ,447 | ,364 | ,315 | ,111 | ,312 | ,282 | ,156 | ,348 | ,396 | ,013 | ,191 | | ,232 |
| | SF | ,321 | ,405 | ,453 | ,342 | ,456 | ,051 | ,388 | ,116 | ,165 | ,219 | ,041 | ,232 | |

Figure 53. Correlation matrix with physical activity and fitness patterns and IC-indicators in Case D. during 2002-05.

The abbreviations in Figure 53 are; PAI = physical activity indicator, WFPI = worksite fitness program indicator, PFI = physical fitness indicator, WAE = work ability estimation, SL = Sick Leave, ST = staff training, CSE = competence self evaluation, JC = job career, JS = job satisfaction, SR = social relationship, STM = satisfaction to management, PT = process time, SF = service feedback.

6.4.7.5 Summary of the findings

A descriptive summary of the results obtained in the quantitative analyses in the case companies are presented in Figure 54 and Figure 55. Continuous lines connect those variables which were found to correlate in follow-up settings; dotted lines represent findings in either cross-sectional settings (regression analysis) or differences between two groups (e.g., employees active in WFP vs employees not active in WFP. Double lines (in Case B) represent negative correlations in follow-up settings.

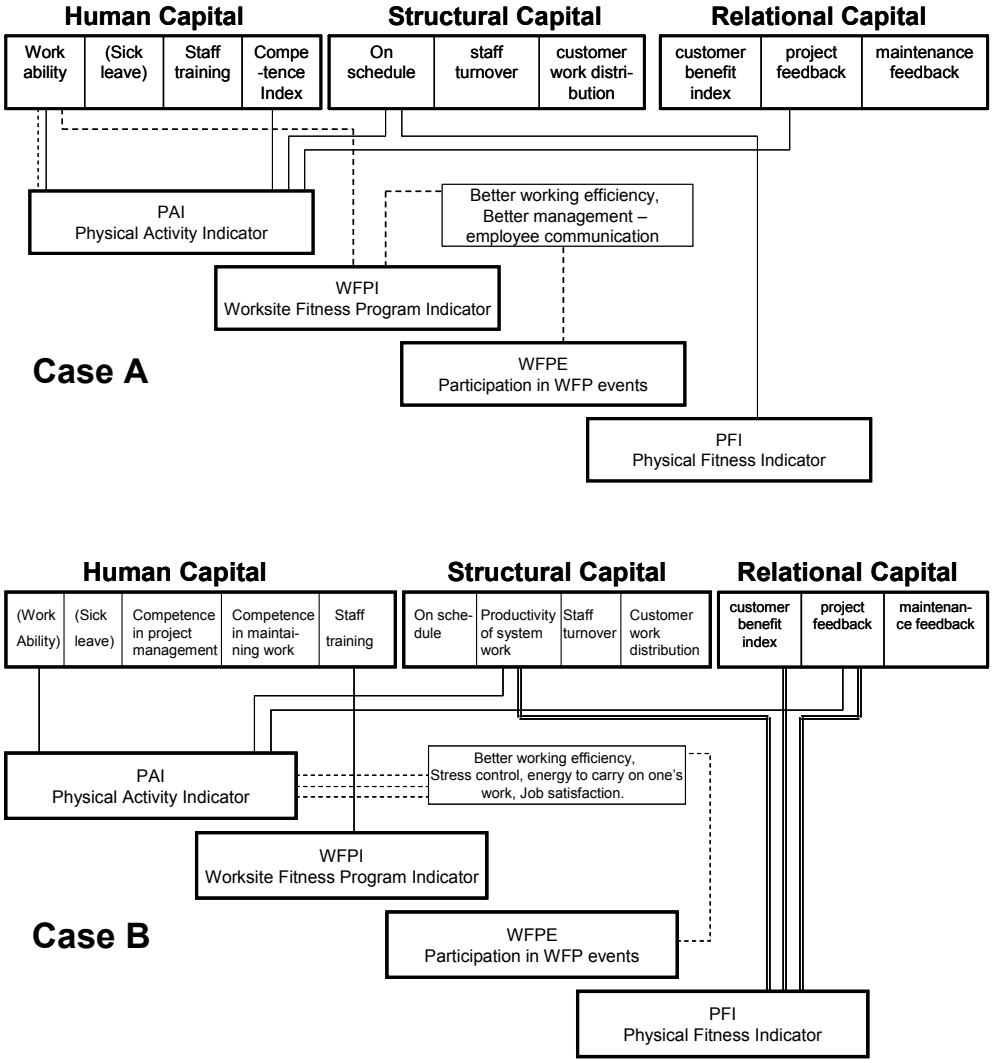


Figure 54. Descriptive summary of the findings in Case A. (upper) and in Case B. (lower).

In Figure 54 sick leave in both case companies and work ability estimation in Case B. are presented in parentheses; while they were not indicators of HC in IC measure.

In Case A, besides the results based on quantitative analyses, many qualitative findings support the role of WFP in developing IC. First of all, employees rated the importance of WFP investments very highly. WFP is seen as an important part of good employership. In interviews of employees and management, the role of physical activity at the individual level was found to be relevant in increasing the daily level of energy. As more connected to WFP, many interviewees found WFP activities to be important from a social communication perspective. WFP was seen to be a good way "to get to know people better".

In Case B, besides the results based on quantitative analyses, many qualitative findings support the role of WFP in developing IC. First of all, employees rated the importance of WFP investments very highly (*cf.* Table 25). WFP is seen as a natural part of an employer's activities. In interviews of employees and management, the role of physical activity at the individual level was seen as a good source of wellness and relaxation. As more connected to WFP, many interviewees (also customers!) found WFP activities to be important inform a social communication perspective. WFP was seen to be good way "of getting to know people".

In Case C, besides the results based on quantitative analyses, many qualitative findings support the role of WFP in developing IC. First of all, employees rated the importance of WFP investments very highly and WFP is seen as a natural part of an employer's activities. In interviews of employees and management, the role of physical activity at the individual level was seen as a good source of wellness and relaxation. As more connected to WFP, many interviewees (also customers!) found WFP activities to be important from a social communication perspective. WFP was seen to be a good way "of getting to know people".

In Case D, besides the results based on quantitative analyses, many qualitative findings support the role of WFP in developing IC. First of all, employees rated the importance of WFP investments very highly and WFP is seen as a natural part of a good employer's way of talking care of its employees, thus strengthening SC. In interviews of employees and management, the role of physical activity at the individual and worksite level was found to be important in increasing the daily level of energy and mental stamina at work. As more connected to WFP, many interviewees found WFP activities to be important from the social communication perspective. WFP was seen to be a good way "to get to know people better".

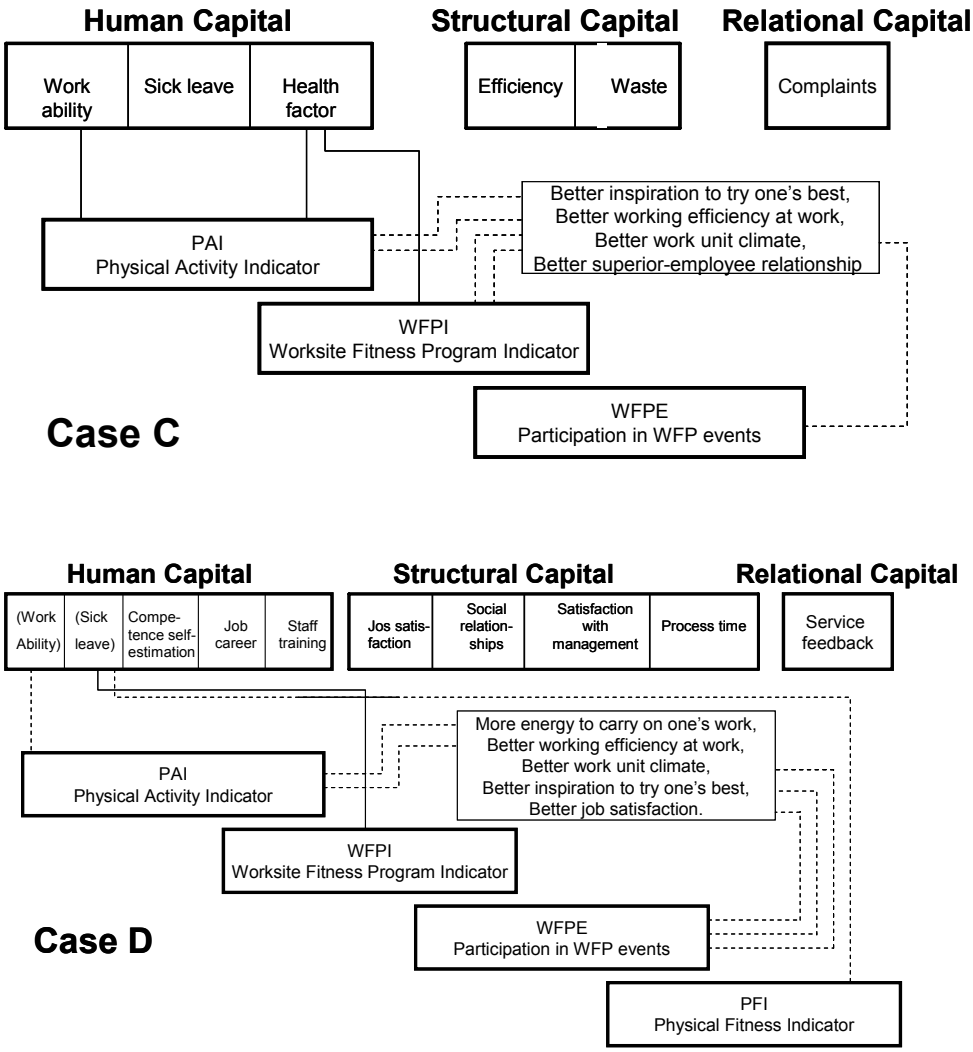


Figure 55. Descriptive summary of the findings in Case C. (upper) and in Case D. (lower).

In Figure 55 sick leave and work ability estimation in Case D. are presented in parentheses; while they were not indicators of HC in IC measure.

# 7 SUMMARY OF THE RESULTS OF THE PRELIMINARY STUDY AND CASE STUDIES

In this chapter, overviews of the results of the case studies and, to some extent, the preliminary study are given. This is done to clarify to the readers the role of WFP as an organizational phenomenon and to examine more closely the role physical activity and fitness patterns play with regard to IC.

## *7.1 The role of Worksite Fitness Program as an element of Intellectual Capital*

### *7.1.1 Worksite Fitness Program policy as an active element of Intellectual Capital*

In Case A, from the management point of view, the most outstanding result obtained during the follow-up was that "physical condition" was taken as a part of company's balance score card's (BSC) personnel card. To the researcher's knowledge, this is the first company in Finland to have valued physical fitness and activity to such a prominent level in its management procedures. The CEO and manager M3 responsible for MWA are distinguished by this achievement. Their role and enthusiasm will be discussed later in more detail in the discussion of the thesis. This will pinpoint the level of WFP policy in Case A.

The positive attitude of management did have an effect on the excellent collaboration with occupational health care in respect to physical activity. After the preliminary phase of this case study, physical activity and fitness were positioned as a part of occupational health care's regular age group examination. This allowed and inspired all employees to take part in fitness testing and promotion of physical activity on a very personal level. This could be seen as a very important element in case company A's process in promotion of health and physical activity as a part of the behavioural modification model described in chapter 6.4.1.2.

In interviews, many employees accentuated the role of WFP in Case A. WFP was seen as a natural part of Case A's normal life; the role of WFP was seen as important in building and strengthening relationships between employees.

In Case B, WFP policy does not have as important a position as in case companies A and C. In Case B, WFP was organized technically properly in line with the MWA group and the company WFP club. WFP activities are run mainly on a voluntary basis, which probably has some effect on the efficiency of WFP. Collaboration with occupational health care was negative at the early phase of study; after changing the OHC supplier, the situation improved remarkably. This stemmed from some of the attitude in Case B, one could say "Physical activity is important – but if the OHC doesn't want to promote WFP, that's fine for us". To the credit of Case B, the OHC supplier was changed, and health and physical activity promotion improved greatly after this change.

An important part of WFP was found to be the building and strengthening of inner and outer social relationships. In Case B, many managers, employees and also customers stated the importance of WFP as "getting to know people" and through that improving

the working climate and fluency of work. The customer's opinion was a kind of a flashback from history, but still it had some relevance.

In Case C, the WFP policy did strengthen Case C's Intellectual Capital during this study. In the beginning, in the mid 1990's, WFP had the role of competitive activity among sporty employees. During the late 1990's and early 2000's, the situation changed towards more health-enhancing forms of physical activity. In policymaking, the best example would be the campaign "Physical activity for productivity" which aimed (and succeeded) in enhancing superiors' support for WFP-activators.

Professional internal communication material was an essential part of Case C's WFP during those years. The value of this material to employees' knowledge cannot be underestimated. Over the years 2002-04, the trend in PAI has been decreasing, although employees' activity in WFP has increased constantly. This would have had more effect on SC instead of HC. One aspect of Case C's WFP policy is the positioning physical activity habits as a part of recruitment procedure, which in turn will secure future HC. Manager M2 stated: *"And* [*a*] *positive attitude to physical activity is one of the criteria when we recruit people. This is officially agreed with workers' unions and instructed to superiors."*

In Case C, as probably in most industrial plants, the role of modern Human Relation functions has been traditionally quite low. Production was planned and managed mainly on engineering skills and phenomena like Structural Capital were of less importance. In Case C, it can be claimed that the WFP program "Team in Shape" was a strong element in building SC. With a degree of caution, it can be even said that WFP was the only SC activity between blue-collar workers and management during 1995-2003. In 2003, the company climate measure showed such bad figures that some activities were promoted. Those activities resulted in, amongst other things, the measure "measure of fluent activity" and alongside this, yearly employee-superior discussions began. The results of the psycho-social questionnaire gave some support to this conclusion; in 2003 (when no SC action had yet begun) activity in WFP affected blue-collar employees' commitment and relationships with superiors. In 2004 (after SC actions had begun) no such relation was found. This would emphasize the importance of WFP in respect to SC at least in this type (Case C) of factory-like company

In Case D, the WFP policy was different compared to other case companies. In Case D, WFP was organized on a voluntary basis, which evidently diminishes WFP's value in the framework of IC. Although WFP is strongly supported by head-office's functions it was considered as "non-managerial" and "non-work-related" activity by both employees and managers. From the beginning of 2005, the responsibilities regarding WFP were clarified in this respect; the voluntary WFP-club will be responsible for all WFP activities, instead of the earlier situation where MWA groups of work units had some responsibility in WFP. In this situation, the role and input of local management is more dependent upon their (the management's) attitudes and desire to support WFP.

This change in responsibilities may lead to decreased collaboration with occupational health care (OHC) with respect to WFP. This would be crucial, as already during this two-year follow-up period, collaboration with OHC could be seen differing from work

unit to work unit. Principally, OHC was actively involved with in MWA-planning and activities, but based on employee interviews, no actual physical activity promotion was done. According to the interviews of management at a local level, changes in OHC supplier will result in loss of all (the only) tacit knowledge of the physical activity and fitness of employees.

As a whole, the importance of WFP policy can be seen to be rather broad. Firstly, it supports employees' physical activity patterns developing in a more wide and balanced direction thus developing the basis for health, work ability and general wellbeing, which in turn will effect positively on HC. Secondly, WFP supports inner and outer networking and employer satisfaction, thus supporting SC and, in part also, RC. The importance of WFP is thus far more broad than the quite general aspect of simply activating employee's physical activity to its proper level. To achieve the above-mentioned wider goals, an intensive and patient WFP policy is needed.

### *7.1.2 Effects and associations of activity in a Worksite Fitness Program on Intellectual Capital*

To study the effects and associations of WFP activity on IC, three sets of data could be utilized. First, in quantitative analyses, the collected data of physical activity and fitness patterns in line with wellness parameters (perceived health, sick leave and self-assessed work ability) were used. The second data were gathered with a questionnaire on psychosocial factors at work and worksite (Dallner *et al.* 2000). Third data were qualitative in nature and collected mainly through the interviews of management, owners and employees.

In Case A, in a group level comparison, employees active in WFP had a better self-assessment of work ability (WAE) than employees not active in WFP.

In Case C, a follow-up design activity in WFP was highly correlated with perceived health and in the case of white collar workers also with work ability estimations. These results were confirmed by individual level analysis over several years. In these analyses, as pinpointed earlier, the importance of intensity of physical activity rose to an essential role. This is not emphasized in any documents concerning WFP in Case C, but most of the activities, however, supports quite intensive exercise in WFP sports. The desired results on positive relationships between physical activity and sick leave were not found.

On the analysis of psycho-social factors at work and at the worksite, some positive results were found in respect of activity in WFP. Employees regularly active in WFP found their self-efficacy better than the non-active (Cases A and C). This finding is in line with the findings between physical activity and work ability estimations and will support the Human Capital of case companies. In Case C, employees active in WFP estimated the employee-superior collaboration and work unit climate better than employees not active in WFP. These findings are promising in respect to the Structural Capital of Case C.

In Case A, employees actively participating in WFP events found communication between staff and management better than those not active such events. In Case B, employees active in WFP events found their self-efficacy at work better than employees not attending these, while within the blue collar employees in Case C, those active in WFP events found the work unit climate more encouraging and supportive than those not active. In Case D, employees active in WFP events found their work unit climate more encouraging and supportive, felt organization to be more inspiring to give one's best, and felt themselves more satisfied at their present job than employees not attending these events.

In the more comprehensive analysis of the psycho-social questionnaires, a work related factor was created after the factor analysis (see chapter 6.4.4.5.). In the regression analysis, the intensity of physical activity and activity in WFP events were found to be significant coefficients in addition to the nature of work. Activity in WFP events will improve the work-related (SC) factors.

These findings were supported in many phases in the interviews, where management, employees and customers stated the importance of WFP in respect to the quality of physical activity and the role of WFP in "getting to know people", which will in turn improve working climate and fluency of work. All these findings will strengthen the role of WFP in supporting both the Human and Structural Capital of case companies, although the head of test-1 work unit in Case D wondered in his interpretative interview: *"Which was first: satisfied employees who take part in WFP events or WFP events which make employees more satisfied?"* In his sceptical way, he thought the first alternative more realistic.

In the qualitative analysis of interviews, managers and employees in all case companies emphasized the role of WFP as a way "to get to know people better". Joint WFP events in connection with, for instance, project kick-offs will offer a good opportunity to develop personal relationships with customers and thus strengthen customer loyalty and the fluency of process type co-operation. These aspects in relation to Relational Capital can not be underestimated, especially in a close partnership, such as the B to B business models that Cases A and B are operating. The owner (and at the same time a customer) of Case A stated: "*We have had all the time (*co-operation with Case A besides work meetings) – *not so much, but regularly. Case A has been active in organising events in the final phases of certain projects. Usually some outdoor activities and dinner in a relaxed atmosphere, feedback from our (customer's) side has been very positive. These joint happenings will increase understanding of people and trust between people and thus help the co-operation and partnership on the level of personnel also*."

Customer of Case B said: *"When I compare the time when I was younger and was involved in sports with them (Case B), we made friendships through free-time sports, we exercised together. Today there are no joint activities in sports. At that time, you got to know people better; communication is easier if you know each other and you have shared experiences, that's what it (WFP) helps."*

n Case C, in qualitative analysis, the importance of WFP was found to have some relevance to RC as well. Manager M1 highlighted the role of physical activity (WFP

events) in collaboration with managers in the conglomerate as well as the role of spectator in sports events with customers. Manager M2 focused on the importance of WFP in the local reputation of Case C, which in the case of an "old fashioned basic industry company" would be rather relevant (interpretation in brackets is made by researcher). The positive influence of WFP on employer reputation could be seen also in the recruitment processes, *"all jobseekers knew we have a good WFP system"* as M2 said. And further he commented: *"And a positive attitude to physical activity is one of the criteria when we recruit people. This is officially agreed with worker's unions and instructed to superiors."*

Case C invested considerably in internal communication in WFP. A professional media agency was responsible for these activities, which resulted not only in excellent internal WFP material, but also some external media material. Case C has become known for its excellent WFP activities, and (as M2 stated) *"We are actively involved with the local "Fitness Network" (collaboration network with 10 companies), it's good to know other people working in the field of WFP and that's also important for our reputation. Besides this co-operation with other companies, the role of our WFP has risen important in recruitment sector; all people who are applying job from us know that we have a good WFP system – and that's why they all seem to be physically very active. Maybe they think that active people are in the front line when we select our staff – and they are not so wrong in that!"* It can be concluded that WFP is an essential part of Case C's Relational Capital, especially when it concerns local PR and even reputation as a good employer.

In Case D, the collective aspects of WFP described in interviews were supported strongly in the results of the psycho-social questionnaire. Thus, it can be concluded that WFP and also physical activity in itself have some influence on SC. In the case of Case D as a public employer, no influence of WFP on RC could be seen.

To summarize, the effects of WFP are physiologically combined to the intensity of exercise, which in practice means activity in sport events such as gym training, music sports and different ball games (see Tables 15 and 29 for details), which then emphasizes the role of WFP n Human Capital. In respect to more "mental" or "social" aspects, many sports in WFP are practised in groups, which then raise the role of WFP in respect to Structural Capital.

### *7.2 Associations and interrelations of company level physical activity and fitness indicators on IC-indicators*

In this chapter, an overview will be provided of the results of the association of company-level physical activity and fitness indicators (WFPI, WFPE, PAI, PFI) on IC indicators as estimated using each case company's constructed IC measure. A more detailed summary of the association between physical activity & fitness patterns and certain other IC indicators as well as wellness parameters will be given in the following chapters.

In Case A, the relatively long follow-up period of five years offered the possibility to see the effects and interrelations between the demands of work and physical activity

patterns. Changes in work load were reflected in the results obtained in PAI (Millennium, Euro in 2002). Based on the interpretations made by employees and management, PAI could be a measure in "individual resources measure mix", as PAI reflects both work load and pressures in personal life. Levels of physical activity and fitness fluctuate with the same pattern during the period 1999-2004. Activity in the Worksite Fitness Program (WFP) was low in 1999, and after that quite constant. The management and employee explanation for the decline in PAI and PFI in the years 2001-2002 was the very heavy work stress caused by the millennium and and the arrival of the Euro in 2002. After that time, the working pace has been more normal and both PAI and PFI values have increased.

In Case A, observations based on individual testing and questionnaires in 1999-2004 (n=189) revealed that the intensity of physical activity was positively connected with Work Ability Estimations in a regression analysis ($t=2,42$, $p<0,05$). This finding was confirmed in the follow-up setting in 2001-2005. This was strongly supported in the qualitative results; most interviewees saw the importance of the effects of physical activity on well-being, stamina at work, stress control and relaxation, which can all be seen as elements of work ability. Activity in WFP reflected better fitness characteristics and better Work Ability Estimations, which will support the Human Capital of Case A.

In the results of the five-year follow-up, only significant correlations with PAI and PFI were found with the SC indicator "On schedule" ($r=0,821$, $p<0,023$ for PAI and $r=0,850$, $p<0,016$ for PFI), which indicated that in those "hard years of the Euro-change" of 2000-2002, work was done as scheduled, and in the "normal years" of 1999 and 2003-04 employees had time also for physical activity. The correlation itself seems to be irrelevant, but the explanations given by both management and employees confirmed this connection. This will emphasize the association between physical activity and fitness patterns and Structural Capital.

After 2001, when the working environment became more "normal", many indicators had risen and some additional correlations with PAI were statistically significant. First, the PAI and competence index had positive correlation ($r=0,973$, $p<0,05$). In interpreting this finding, one has to admit that the competence index is influenced mostly by recruitment policy and staff education, which makes the connection quite uncertain. On the other hand, the positive correlation between PAI and project feedback may reflect the overall energy level of employees and its positive influence on work related factors. It could be stated that, at least to some extent, the increase in physical activity level would have associated with the quality of demanding developmental work, which is followed by project feedback figures. This is some slight evidence of the role of physical activity on Relational Capital.

In the qualitative analysis of the interviews, managers, employees and customers emphasized the role of WFP as a way "to get to know people better". Joint WFP events in connection with, for example, project kick-offs offer a good opportunity to develop personal relationships with customers and thus strengthen customer loyalty and the fluency of process-type co-operation. These aspects in relation to Relational Capital cannot be underestimated in a close partnership such as the B to B business Case A is operating.

In Case B, the results of a three-year follow-up brought up some very interesting results. The activity in WFP (WFPI) was found to correlate with staff training. The causality of this finding is difficult to estimate; one possible explanation is that (physically) more active employees will attend more training, or people met in staff training form groups and attend WFP activities more actively. This finding will emphasize the role of WFP activity in supporting the Human Capital of Case B.

The follow-up results of physical activity and fitness patterns were contradictory in Case B. If we accept the fact that the physical activity level was increasing constantly from 2001 to 2004, it had a very positive correlation with the constructed RC value ($r=0,97$, $p<0,01$). On the other hand, at the same time, PFI was decreasing and brought up a correlation coefficient with the RC value ($r=-0,99$, $p<0,001$). With these inconsistent results, it is quite difficult to draw reliable conclusions. An interesting finding is, however, the role of the IC measure (and the RC value in it) in estimating the fluctuations of RC during 2001-04. The selected three separate indicators (customer benefit index, project feedback and maintenance feedback) fluctuate in relatively different patterns; while the combination of those (the RC value) has a steady slightly rising nature in 2001-03 and a steep rise in 2003-04. This finding could emphasize the importance of looking at RC indicators as a larger unity than merely as separate indicators. This kind of framework was also indirectly supported by the CEO in a second interpretative interview. To conclude, physical activity had a positive (or physical fitness had a negative) correlation with Relational Capital in Case B.

In Case C, the HC part of the IC measure was constructed based on wellness parameters collected by the researcher. The quantitative results of the physical activity questionnaires demonstrated the positive association between physical activity and perceived health and self-reported Work Ability Estimation both in follow-up data as well as in cross-sectional analyses in different years. On the individual level, the intensity of physical activity as a single variable had an influence on perceived health or WAE, while the amount of physical activity was not relevant. Physical activity patterns where the intensity of activity is highlighted include those people exercising more with ball games, gym exercise, music sports and racquet sports than people with only a moderate or light intensity.

This was strongly supported in the qualitative results; most interviewees saw the importance of physical activity on wellbeing, maintaining health, stamina at work and relaxation, which all can be seen as elements of perceived health and work ability. Physical activity changes were in line with work ability and perceived health changes, which underlined the effects of physical activity on Human Capital.

In Case D, over a very short follow-up period of two years, no associations between IC indicators and physical activity and fitness patterns were found.

## *7.3 The role of employee physical activity and fitness patterns in an Intellectual Capital framework*

### *7.3.1 Effects and associations of physical activity patterns on Intellectual Capital*

In this study, many interviewees (both managers and employees) defined health and work ability as a part of Human Capital. This is not the case usually in the literature (see Hussi 2005) and was obviously affected by the framework used to examine IC in this study. The researcher tends to agree with these perspectives. From this standpoint, its evident that the results of the preliminary study and case studies, both in cross-sectional and follow-up settings, strongly support the importance of physical activity on perceived health and work ability and thus on Human Capital. Chapter 7.4 pinpoints the role of the intensity of physical activity in this respect.

In Case A, as already mentioned in chapter 7.1, observations based on individual testing and questionnaires over the period 1999-2004 (n=189) revealed that the intensity of physical activity was positively connected with Work Ability estimation in regression analysis. This finding was confirmed in the follow-up setting during the years 2001-2005 and will support the association of physical activity with Human Capital in Case A.

In Case B, in data collected with a psycho-social questionnaire using a low criterion for PAI (physical activity at least three times a week) more active employees had less stress and had less problem in carrying on their work than the less active employees. These findings emphasized the importance of physical activity in Human Capital. In addition, the more active (level of three times a week) employees were more satisfied at their job than less active employees. This finding will underline the role of WFP in supporting Structural Capital in Case B.

In Case C, on the analysis of psycho-social factors at work and worksite some positive results were found in respect of physical activity. Blue collar male employees physically active enough had better inspiration to give their best work performance than those not enough active. Males active enough to be healthy gave better estimates in question of working efficiency at work than males not active enough to be healthy. The former would highlight the importance of physical activity on Structural Capital, the latter would verify the above-mentioned effects of physical activity on Human Capital.

In Case D, employees physically active enough had fewer problems in carrying out their work and had better working efficiency than those not sufficiently active. These results confirm the above-mentioned findings on the importance of physical activity in Human Capital.

In qualitative analyses, the importance of physical activity from an individual point of view was seen as important to improve overall wellbeing and health, to support social relationships, and to balance life between work and leisure time. With respect to work and worksites, the role of physical activity and WFP were seen to maintain and enhance

wellbeing and work ability, to release stress and to improve health. These all can be seen as relevant elements of Human Capital.

#### *7.3.2 Effects and associations of physical fitness patterns on Intellectual Capital*

In Case D, a cross-sectional (regression) analysis demonstrated the relation between cardio-respiratory fitness and amount of sick leave. Employees in better shape had fewer sick leave days than employees in poorer shape. This was the only finding gained in respect of physical fitness and indicators of HC. An impression may arise that the role of physical activity *per se* is more important than the role of physical fitness in relation to HC.

### *7.4 Effects and associations of physical activity and fitness patterns on selected wellness parameters behind Intellectual Capital*

In associations between physical activity patterns and wellness parameters (perceived health, sick leave and self-assessed work ability) the intensity of physical activity (IPA) was found to most important. Findings were similar in the preliminary study with more data (n=14 420) and with case studies with less data (n varied 91 – 233). For the results of regression analyses see formulas 6., 7., and 8. respectively. In perceived health factors the importance of IPA was highest in the Health Factor, which could be described as the denominator for general health status.

#### *7.4.1 Effects and associations of physical activity and fitness patterns on perceived health*

In the preliminary study material (n=14 420) the intensity of physical activity was strongly associated with perceived health and Health Factor (see Formula 7.). In the preliminary study WFP activity had statistically significant association with perceived health (Health Factor) both in the regression analysis (t-value 5,56, $p<0,001$) and in group level observation (see Formula 7. and Figure 29 for more details.).The importance of WFP activity was prominent especially in white collar workers in less active physical activity groups (see Table 22). This finding was confirmed in case studies cross-sectional analyses in cases C. and D. as well as in follow-up setting in Case C. ($r=0,87$, $p<0,05$).

In Cased D. the physical activity questionnaires were carried out as a part of psychosocial questionnaire. With a population of all employees in Case D. (n=290), a regression analysis showed that the intensity of physical activity was found to influence perceived health positively. This result was strongly supported in the qualitative interviews, most interviewees saw the importance of physical activity on wellbeing and health.

#### *7.4.2 Effects and associations of physical activity and fitness patterns on sick leave*

In the preliminary study material (n=14 420) the intensity of physical activity was associated with sick leave (see Formula 6.). In the preliminary study the activity in WFP did

not have a statistically significant effect on sick leave in the regression analysis. In closer group level analysis (groups divided by gender, nature of work and physical activity) employees regularly active in WFP services had fewer sick leave days in the male, white-collar, passive group and more sick leave days in the female, blue collar, fitness-sport group. In case D, a negative correlation between cardio-respiratory fitness and sick leave days was found; employees in better shape had less sick leave.

In Case D, in the follow-up, design activity in WFP was correlated with sick leave with a correlation of r=-0,987, p<0,051. This finding is not statistically significant, but will to some extent describe the importance of WFP activity in decreasing sick leave.

*7.4.3. Effects and associations of physical activity and fitness patterns on self-assessed work ability*

In the preliminary study material (n=14 420), self-assessed work ability estimation (WAE) WFP activity had a slight significance in the regression analysis (t-value 2.46, p<0,05, see Formula 8 for details). In the above-mentioned group level analysis, employees regularly active in WFP services had better WAE in the male, blue collar, passive employee category and in the female, white collar, active lifestyle employee category.

In Case B. observations based on individual testing and questionnaires over 2001-2004 (n=91) didn't found any relations between physical activity patterns and sick leave and work ability estimations (WAE). On the other hand a follow-up over the years 2001-2004 found parallel changes between PAI and WAE. This finding was on the line with the results of the preliminary study and emphasized the importance of physical activity in Human Capital. Activity in WFP reflected better fitness characteristics.

In Case D. the quantitative results of the whole tested group demonstrated association between physical activity and self-assessed Work Ability Estimation, where the intensity of exercise had an important role. This result was strongly supported in the qualitative interviews, most interviewees saw the importance of physical activity in counterbalancing work, stress control and relaxation, which can all be seen as elements of work ability.

In follow-up settings also the changes in PAI were correlated to work ability estimation (average WAE) figures in Case A. (r=0,943, p<0,05), Case B. (r=0,922, p<0,05), and in Case C's white collar (r=0,810, p<0,05). These findings confirm the importance of physical activity in self-evaluated indicators of health and work ability.

## 8 DISCUSSION AND CONCLUSIONS

In the discussion of this thesis, the following issues will be examined. First, methodological considerations are made, these are followed by a thorough estimation of the IC measure used in this study. The evaluation of results is based partly on comparisons in Finnish studies; a wider perspective is taken in evaluating results obtained in IC assess-

ments. Some issues are brought up in a more discursive manner. These are then followed by answers for the research questions posed, then this in turn is followed by suggestions for future research.

## *8.1 Methodological considerations*

In this study, the phenomenon "WFP policy (physical activity and fitness patterns) and IC" was researched through survey type measurements and case study follow-ups. In the case studies, some qualitative methods were implemented whereas the preliminary study was more quantitative in nature. In the preliminary phase, all material was collected in connection with customer work, the companies paid for the services which were produced by researcher in his position at the Finnish Sport for All Association. However, the measures (questionnaires and fitness testing protocol) as well as the data collection procedures were kept standardised. HR type measurements (e.g. questionnaires) in this respect can be described more as short and practical than long and scientific. In the Physical Activity Barometer (see Appendix 1), the questionnaire was four to five pages, in other surveys, the space was more limited. These considerations have to be borne in mind while observing this study from the point of view of the traditions of the discipline of sports medicine.

### *8.1.1 General overview of case companies and case studies*

Case A offered a brilliant subject for a case study. In Case A, the situation for WFP was optimal in many ways: the company is mid-sized, located in one location, the company's financial situation is permanently good, the conglomerate's support of WFP activities is excellent, the general working climate is good and relaxed, the staff are permanent and there is a proper mixture of employees of different ages. In addition to these aspects, the management's enthusiasm for physical activity was also overwhelming. From the point of view of critically evaluating the results obtained, it must be considered whether the situation in Case A is even "too complete".

Case B, was also a good subject for a case study. In Case B, the situation for WFP was optimal in many ways: the company is mid-sized, located in one location, the company's financial situation is permanently good, the conglomerate's support for WFP activities is excellent, the general working climate is good, the staff are permanent and there is a proper mixture of employees of different ages. In the first two years of the follow-up, Case B had its own WFP facilities; later, in 2003-04, it utilised commercial facilities located nearby.

The researcher's collaboration with Case C began as early as 1995 when the first physical activity questionnaire was completed. Subsequently, for several years the role of the researcher was more consultative, involved in research practices that could be termed action research. No measurements were, however, carried out over the period 1996-1998. Some results were followed from 1995 to 2004, which provided a long time perspective for the study. The more intensive phase in the study was, however, over the years 1999-2004.

In Case C, the situation for the WFP was optimal in many ways, but also challenging in many respects, too: the company is mid-sized, located in one location, the staff are permanent and there is a proper mixture of employees of different ages. In addition to these aspects, the management's attitude towards physical activity was also positive. As an industrial employer, Case C, has had some challenges in their working climate and several strikes and smaller industrial actions have been negatively affected their developing WFP. As manager M2 stated in the second, interpretative interview: "*And I have to admit also that in some phases the work of trade unions have negatively effected the work to develop WFP and employees' physical activity, health and work ability!*" Financially, the company's situation has been changing due to the global market prices, but this has not substantially affected investments in WFP.

Case D was different in several ways compared to other case companies in this study. First of all, Case D was the only public sector employer of the case companies. Secondly, the study was implemented from head-office as a development project, so the motives did not stem from a studied work unit(s). Two out of four work units asked agreed to participate, but only one could get the project implemented. Commitment to such project-type activities is presumably hard to gain from sufficiently high in the hierarchy. The planned experimental design gradually became a case study, which itself was a fruitful result for the field of IC-supporting a WFP. To be able to develop IC with the help of WFP, the motives behind and management of the WFP should be strongly in the hands of the work unit's (or probably company's) own, local management.

When the results of the case study in Case D are considered, it can be concluded that at the work unit level (Test-1 work unit) the situation for a WFP was optimal in several respects. The working community was located at one main place with a few smaller offices nearby, the financial situation was stable, the bureau's support for the WFP was good, the working climate was good and the staff was permanent, although quite old.

### *8.1.2 Preliminary study and case study setting and overall reliability of findings*

The data for the preliminary study was collected with survey-type questionnaires from 33 companies (14 420 respondents) and with fitness testing proceedures from altogether 136 companies (87 in 1998-2002 and 49 in 2003-04) with 5 970 tested employees (4 424 and 1 556 respectively). The questionnaires and testing procedures were took place at random times during the active work year, which means during a period from September to May. This will eliminate the possible effects of the time of year in results. In physical activity questionnaires, the response rates were relatively high, which will strengthen the reliability of the findings. Participation in the fitness testing protocol was voluntary, which most likely led to a slight overrepresentation of physically active employees, and which, in turn, probably led to better average values in cardio-respiratory fitness. These limitations would not reduce the value of PFI in a company context; physical fitness measured in companies will always have these characteristics. This also means that the results obtained from fitness testing procedures in companies do not fully represent the fitness characteristics at the population level.

In Case A, the follow-up study was based on a sample of employees taking part in the regular health examination at three to five year intervals. These examinations began at the age of 35 years, so a sample of younger employees was randomly selected and added to the tested group annually. The number of employees participating in the fitness testing and physical activity questionnaire yearly varied between 29 and 41, which corresponded to 13-19% of the employees annually. This was estimated to be a relatively small but nonetheless sufficient number for follow-up purposes. The random selection based on age (35, 40, 45, 50, 53, 56, 59, and 62 years) was the basis for this conclusion.

The reliability of the results in general can be assessed from three perspectives. First, the results regarding physical activity and fitness patterns for follow-up were gathered from a randomly-collected sample of 13-19% of employees yearly. These findings (PAI, WFPI, and PFI) can be considered as guiding. Second, the cross-sectional analyses regarding physical activity and fitness patterns in relation to sick leave and work ability variables were based on analyses made involving all tested employees (189 persons), which provides a high degree of reliability for those results. In the psycho-social questionnaire, a random sample of 54 employees responded; this was considered sufficiently reliable. Third, the indicators used in both constructing the IC measure and in analysing the associations that physical activity and fitness patterns have with the IC indicators were collected with standardized routines by the case company at the same time as its management measures. The reliability of those indicators can thus be considered to be very good. The principles and methods in constructing the IC measure are discussed in more detail in Chapters 8.1.4 and 8.1.6.

In Case B, the follow-up study was based on the sample of randomly selected employees who were asked to participate for four years in the study. In the first year, the number of employees was 62 which equalled 36% of personnel. In the following years, the test group was randomly supplemented mainly because of staff turnover to keep the sample size within the range of 25-30% of personnel yearly. Table 24 demonstrates the changes in the test group during the follow-up years. As a conclusion, the sample was considered both large enough and varied enough to represent the entire personnel during the follow-up.

The reliability of the results in general can be assessed from three perspectives. First, the results regarding physical activity and fitness patterns for follow-up were gathered from a randomly-selected sample of 34-36 of employees yearly. As described above, some of the employees were in the follow-up for four years, some fewer. The findings (PAI, WFPI, and PFI) must be regarded with a critical eye; thus the results can be considered as guiding. Second, the cross-sectional analyses concerning physical activity and fitness patterns in relation to sick leave and work ability variables were based on analyses made involving all tested employees (91 persons, the first fitness test from each person was applied), which provides a high degree of reliability for those results. In the psycho-social questionnaire, a random sample of 58 employees responded; this was considered sufficiently reliable. Third, the indicators used in both constructing the IC measure and analysing the associations that physical activity and fitness patterns have with the IC indicators were collected with standardized routines by the case company at the same time as its management measures. The reliability of those indicators

can thus be considered to be very good. The principles and methods used in constructing the IC measure are discussed in more detail in Chapters 8.1.4 and 8.1.6.

In Case C, the research material for the case study was collected with questionnaires for the entire staff in the years 1995, 1999, 2003 and 2004. Response rates were high with the exception of the first questionnaire implemented. In the years 2001 and 2002, a smaller sample of one third of the personnel was utilised. Results from those years are not as reliable as for other years. On the whole, the data collected was considered to be reliable enough for the researcher's purposes.

The indicators used in both constructing the IC measure and analysing the associations between physical activity patterns and IC indicators were collected with standardized routines by the case company at the same time as its management measures. The reliability of those indicators can thus be considered to be very good. The principles and methods used in constructing the IC measure are discussed in more detail in Chapters 8.1.4 and 8.1.6. Some problems were evident; indicators for, for example, job satisfaction and competence could not be gathered. The reason was either that such of measures were not collected at all by Case C, or the measurement method changed during the follow-up period (1999-2004 for IC indicators). In primary industry of this kind, the tradition of Human Resource measurements appears to be rather short. These limitations will probably lower the value of constructed IC measure in Case C.

As described above in the methods of Case D, the setting of Case D, was planned to be experimental with two experimental and two control groups. Reliable follow-up measures could only be received from one work unit and thus the final setting became a case study. This, from the point of view of an experimental study would seem to be disaster, but from the point of view of learning how IC could be supported with a WFP, the finding seems relevant. As already discussed in previous chapter, an IC-supporting WFP should originate deeply in the company's strategy and management's will.

The follow-up results on physical activity and fitness patterns in the Test-1 work unit were based on participation rates of 38-51%, which can be considered to be relatively low. In addition, the follow-up period was quite short which also served to decrease the significance of the findings.

The cross-sectional analyses carried out in Case D were based on relatively high numbers of employees. In the studying of physical activity and fitness patterns, altogether 239 employees took part (when tested for the first time), which was 56% of case D's personnel at that time. In the psycho-social questionnaire, yet more (290 employees, 68% of personnel) were active. These high numbers will raise the reliability of the cross-sectional analyses made.

### *8.1.3 Qualitative methods*

Qualitative methods were based to a large extent on interviews, which were analysed partly through analytic induction and selective coding, and partly through coding into concepts and creating categories of the concepts (Bryman & Bell 2003). The results

were presented in a descriptive manner to show interviewees' motives or opinions. In interviews, the validity was increased by pilot interviews and by interviewing a relatively large amount of people (nine to thirteen interviews per case company). In addition, summary tables were constructed to present the key findings from each subject. Tables were also a good way to avoid 'anecdotalism' (Silverman 2005) in the interviews' conclusions.

In a discussion on validity, double-hermeneutics (Giddens 1984) have to be taken into consideration in my study. This kind of double hermeneutic circle was possible during the interviews concerning motives and the effects of physical activity. One issue is that people tend to answer to some degree as they are expected to answer. In this respect, for instance, physical activity patterns were examined using several questions from different views to minimise this phenomenon.

There were originally three case studies (Case A, B and C) and one experimental design (Case D) planned. During the study, Case D became a case study as well. This was not, however, interpreted as a disappointment, more as a result showing how a WFP should be managed, or perhaps *vice versa*, how a WFP should not be managed. It seemed that head office supervision was no solution in managing a WFP. In the beginning of work with Case C, during 1995-99, the researcher's role was quite intense, educating people about the WFP activators, for example, but after 1999, the role became more one of being an interpreter of the physical activity questionnaires set on an annual basis in 2001-04. It was concluded that such early activities did not affect the reliability of the results from Case C too greatly.

### *8.1.4 Assessment and measurement of Intellectual Capital*

Assessment and measurement of IC as a whole wouldn't have been necessary to find relevant results between physical activity, WFP and IC-indicators. Proper selection of reasonable IC-indicators would have been other, and presumably an adequate solution. IC-measure as a whole was constructed because the managers in case companies wanted "to see" their IC. In Finnish management traditions, at least in these case companies a slogan "what you measure you manage" is still true. After long and not always so encouraging discussions with thesis supervisors a tentative IC-measure was constructed.

In constructing IC-measure a "human" standpoint of IC was taken in stead of more financial or accounting emphasis. This was influenced by researcher's way of seeing IC and also the fact that three of the case companies were part of stock listen companies which in turn would have made it nearly impossible to evaluate (or measure) case companies' market values and other financial variables. Fourth case company was a public bureau which would have made described measurements even impossible. Three of case companies being part of stock listen companies had another effect on evaluation of IC. These three cases didn't produce their own annual reports which could have been used in analysing IC. The respective conglomerates had annual reports where these case companies were hardly mentioned. Analysing (or assessing, measuring) IC inside the case companies with management and owners seemed to be only solution.

A score card type IC-measure was developed (see e.g. Kaplan & Norton 1996, Edvinsson & Malone 1997, Sveiby 1997, and more recently Danish Ministry of Science, Technology and Innovation (2003). In constructing IC-measure the first step was to assess the importance of IC's components, that mean to evaluate which of the three components (HC, SC and RC) is most important and which less important. In interviews with management and owners this task was seen relatively easy and the results should thus be relatively valid. The weighting principles used by Roos *et al*. (1997) were applied to obtain the distribution of IC components in numerical form. In the assessment, the most important component was assigned three points, the second two points and the least important one point. For further calculations, the most important was weighted at 50% (3/6), the second at 33% (2/6) and the third as 17% (1/6). It was then possible to calculate an average of the assessments given by different managers and owners.

Assessing the essential element (fundamentals for indicators) was the second phase in constructing the IC measure. In this phase, three to four elements were chosen and the transcripts of the interviews were analysed with great care to identify those most relevant. The validity of the findings in this phase was based upon the appropriate conclusions reached by the researcher.

The third step in constructing the IC measure was critical in some cases. After defining the essential elements of HC, SC and RC, valid indicators were to be found among the measures each company utilised. However, the required indicators could not be found in all case companies, which decreased the value of the IC measure. This could not be easily rectified as any attempt by the researcher to speculate could have lead to incorrect or inaccurate indicators.

All the main analyses of the associations between physical activity and fitness patterns were done with IC indicators chosen as described in step three in the previous chapter. To finish the IC measure, the fourth and most critical step was taken: IC indicators were weighted and scaled to operate in a comparable effective scale of one to ten. In this phase, weighting would mean to set each indicator a functional lower and upper limit. Weighting would make the indicators operate more sensitively, whereas scaling then would put all indicators in the same line. Company-based data was used in the weighting procedure. Based on the indicators' average (±2SD) a calculation was made to set each indicator's lower and upper limit; which would usually cover 90% of individual values of indicators; in most indicators the year-to-year changes were relatively small.

In Case A, some indicators had larger databases (e.g. feedback figures from 30-40 projects per year). For the weighting, some indicator results from the follow-up were utilised. In Case B, figures from the three-year follow-up were utilised, whereas in Case C, the figures came from the five-year follow-up. In Case D, more judgement from the researcher was needed due to the short follow-up period of just two years. Several indicators could be weighted based on the figures of the whole public office.

The fifth phase in constructing the IC measure was the final construction. The indicators for each IC component were averaged on a yearly basis and thus the values of HC, SC and RC obtained were totalled. Finally, the totals for HC, SC and RC were weighted

according to the distribution assessed in phase one. This then lead to reporting, which was the sixth phase in constructing the IC measure.

*8.1.5 Case companies' CEOs comments on IC-measure*

IC-measure was reported to CEOs during second interviews at the end of the follow-up period. IC-measures presented were completed except for the data of the last year of follow-up. CEOs were all interested on IC-measure and gave several spontaneous comments. CEO of Case A. *"This looks very interesting. It is nice to see that the relational capital has increased – I have focused on the importance of customer work during recent years in all my speeches and writing to the staff. On the whole, this could operate as a device for long-term planning."* In case B CEO responded with curiosity in a positive way in a spontaneous way by saying: *"I'm worried how the things were at their best in year 2001 and declined for two years after that. What have you done to get these numbers?* After going through the IC measure in more detail the CEO responded: *"OK, in 2002 we recruited quite a lot of new people and that caused the drop in the competence of whole company (CPM and CMW indicators), the newcomers are not at first real specialists."* and later, *"this is something I can't see in my measures with all those tens of numbers. This kind of priority seems to be relevant; some of the measures are investments for the future and some are results. Combining those would have some sense."*

CEO of Case C. responded quite positively by saying: *"This measure has the same features as our own new 'intangible measure – measure of fluent activity'. That measure was developed after our strategy was confirmed to be a productive factory – and nothing else. Other units take care of R&D, marketing, etc. With our measure, we follow safety at work, job satisfaction, quality work and leadership and interaction. That measure would be good for your (researcher's) purposes also, but we just began to implement it in 2004, and in 2005 the whole factory will be involved with it."* In case D. the head of Test-1 unit commended: *"This looks interesting, but I doubt that a few indicators would indicate the whole truth in this respect. Management and work in general is a far more complicated thing!"*

*8.1.6 What does the constructed "IC measure" measure?*

The comments of the CEOs in the case companies gave positive feedback for the researcher with respect to the constructed IC measure. But what does the IC measure really measure? The researcher's view is that the IC measure will give a constructive view of each case company's IC at the company level on a relative scale. Assessment of IC components and essential elements are based on the company's strategy and selected indicators are part of the company's management tool. Weighting and scaling the indicators (in addition to IC components) will generate an IC measure in an easy and understandable format. As a whole, however, the IC measure must be considered with a longer perspective; changes in IC measure are important, the actual level is not necessarily so crucial.

A clear weakness in the IC measure is its inability to demonstrate the interaction or overlap of different IC components. According to several authors (see, e.g., Edvinsson & Malone 1997, Steward 1997, Sveiby 1997), the interaction between HC, SC and RC will generate new, additional value in this intangible economy. This was first visualised by Edvinsson & Malone (1997), see Figure 6. in this thesis. For the purposes of this study, the IC measure was seen relevant, but further research has to be carried out to solve these problems with overlap.

The IC measure constructed was the result of the initial idea of "resolving IC into one single number", although the IC measure contains three values according to the basics of IC. This is a different approach compared to many other contributions in the literature. Models presented for example by Edvisson & Malone (1997), Skandia (1998), Lev (2001), Meritum (2001) and the Danish Ministry of Science, Technology and Innovation (2003) tend to highlight the numerous different indicators, whereas the IC measure constructed in this study attempts to reduce the number of indicators and especially the actual numbers used in reporting IC. From experience in reporting the IC measures to the CEOs of the case companies, the researcher strongly believes that this choice (to simplify the IC measure) was both necessary and correct. The reduction in the number of indicators provides a justified reason to argue about the critical choice regarding which indicators should be used. The choice should always be based on the strategy of the company and the IC measure should be considered a long-term strategic tool for the management and owners of a company.

### *8.1.7 Measurements of physical activity and fitness*

Great concern was shown in maintaining both the validity and reliability of the methods used at a high level. The validity of the physical activity questionnaires was confirmed by several expert group discussions in companies before the questionnaires were delivered to the employees. Some of the questions were already scientifically validated (see Tuomi *et al.* 1998). The reliability of the physical activity questionnaire was examined in case company D, where the fitness-testing protocol and psycho-social questionnaires were performed over the same time period in 2005. No statistically significant differences in physical activity patterns were found, and so the reliability was concluded to be sufficiently high. In the fitness-testing protocol, the results presented by Greiwe *et al.* (1995), Louhevaara *et al.* (1980) and Takalo (2001) were utilised to confirm the validity and reliability of the measurements used.

In measuring the physical activity patterns (PAI, WFPI, WFPE) great emphasis has been placed on the reliability of the measurements (a representative sample of employees should be taken on an annual basis). In addition, the validity of the questionnaire is critical, in this study, a two-fold, three-level questionnaire was utilised (activity was dealt with separately for fitness and commuting activities, the amount in hours and minutes, and the intensity of different activities). As could be seen in case companies A, B and D, different formulations in the questionnaires had possibly some effect on the calculated PAI. In the case of WFPI and WFPE, the basic questions are more obvious and possibilities for misunderstanding are quite limited.

## *8.2 Evaluating results*

### *8.2.1 Activity in the WFP in the case companies*

Employee activity in the WFP was high in all four case companies, reaching values from 35 to even 65% during the follow-up periods. In the preliminary study of 33 companies, the respective spread was on average (±SD) 38.9±12.5%. In Finland in general, in a barometer-type survey, the managers estimated that 34-39% of employees were active in the WFP services during the years 2002-05 (Työpaikkaliikunnan barometri marraskuu 2005). The WFP services and internal communication were better than for the average company in Finland. These differences have to be taken into consideration when the results of this study are generalised.

### *8.2.2 Intellectual Capital characteristics of case companies*

An IC assessment and measurement procedure was created in this study to discover the possible associations between physical activity and fitness patterns on the one hand with IC and its components on the other. The assessment procedure (described in detail in Chapter 4.5) produced first a distribution of IC components (HC, SC and RC), and second the IC indicators of each case company. Figure 56 summarises the percentages for the factors comprising IC in the case companies.

In assessments of IC, little difference was found with respect to the distribution of IC's components. HC was a number one priority in each of the case companies, reaching an average of 44% of IC as a whole. SC was assessed as covering one third (34%) of IC, and proportion remaining represented RC, on average 21%. In other research on IC, many basic assumptions are made, amongst them the idea that the percentages represented by HC, SC and RC are equal; Edvinsson & Malone (1997), for instance, do so (see Figure 6. in this thesis). On the other hand, Sveiby (1997) draws his balance sheet of a knowledge organisation in such a way that the competence of the personnel (HC) covers roughly half of intangible assets, external (RC) and internal (SC) structures being equal for the rest of intangible assets (see Figure 5. in this thesis). Both these visualisations must be considered highly descriptive, but to some extent they may represent the views of their creators. Given the range of this study, some kind of assessment was seen as relevant in order to be able to evaluate the role of physical activity and fitness patterns as well as WFP policy on IC at a general level.

Figure 56 demonstrates the relatively similar distribution of IC in the case companies. The origins of the assessments were, however, different. HC dominates IC in every case company; the requirements of competence, motivation and experience were similar, although the fields the companies are operating in differ markedly. In SC, requirements such as job satisfaction, company climate and work efficiency were dominant. RC was assessed as being less important in every case company for different reasons. In Cases A and B, the tight partnership with one to four customers facilitated the management and owners emphasis of HC and SC at the expense of RC. In Case C, which operates in global markets, the customers were "somewhere there" and other functions at the group

and conglomerate level took care of marketing, R&D and similar activities. The role of Case C was simply to act as a production plant. In Case D, on the other hand, in principle all Finnish citizens were "clients" of the office and in that respect Case D should operate strictly under ratified laws and official order, at the work unit level, thus RC was seen quite irrelevant. At the national level, however, management and the political "owners" found RC to be quite important in sharing the development of Case D's area at the political and expert level.

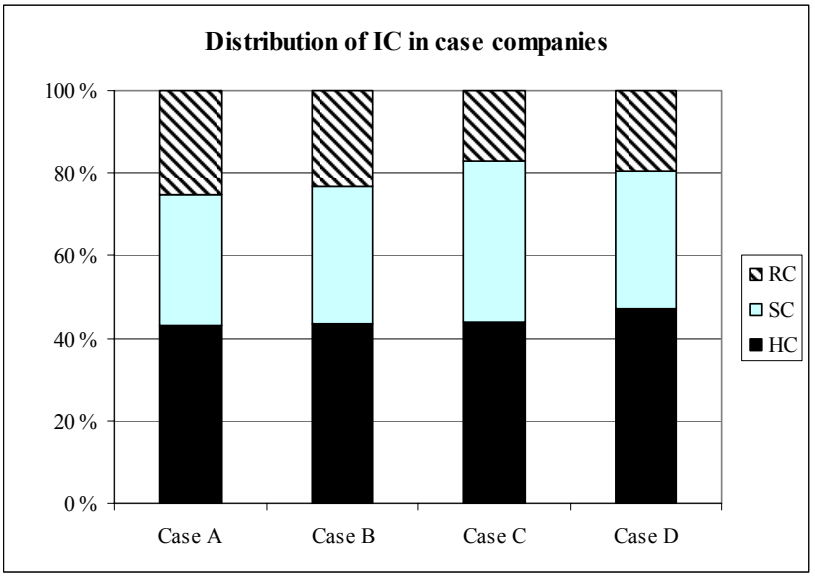


Figure 56. Distribution of IC components in case companies.

Thus, in interpreting the distribution of IC in the case companies with respect to physical activity and fitness patterns, the fundamental role of HC will emphasise individual physical activity habits, which in turn will improve health and work ability – or at least perceptions of those. The stable role of SC will, on the other hand, facilitate activities in the WFP which will improve company climate and "knowing people". In the IC framework, the relevance of physical activity and fitness patterns would appear to be less important with respect to RC.

When comparing the essential elements defined in the case companies, surprisingly little difference could be found. In HC, competence, experience and motivation were the basic elements found, in addition to the health and work ability indicators used constantly in the follow-up analyses. On the other hand, indicators such as efficiency of working processes, company climate and job satisfaction were basic indicators found in SC in all four case companies. Finally, in RC, customer work with some indicators was seen as important in all cases. These similarities discovered in the essential elements of IC serve to emphasise the role of physical activity and WFP as a common phenomenon in working life.

Based on the assessed essential elements of HC, SC and RC, specific indicators were chosen. To set priorities and to focus on most important elements, only three to five indicators per single IC component was chosen in each of the case companies. This was in line with recent guidelines at the European (Meritum 2001) and national level (Danish Ministry of Science, Technology and Innovation 2003). It was, however appreciated by the researcher that an additional type of IC measurement device would be necessary to follow-up faster changes in quartile periods.

### *8.2.3 Physical activity patterns*

In this study, the physical activity indicator (PAI) was 43.2% for females and 39.0% for males. These are slightly higher values than obtained in a survey in 2005 (Suomen Kuntoliikuntaliitto 2006), where the PAI for females was found to be 41% and for males 32%. The difference may be due to the fact that the companies involved in this study had been investing in WFP normally for years and that would have caused higher PAI values than among Finnish people in general.

The associations between physical activity patterns and certain wellness parameters were found to be relatively strong. In most analyses, the intensity of physical activity was more important in defining the output figures (for example perceived health and self-assessed work ability) than the amount of exercise. The intensity of physical activity was strengthened by activities in the WFP sports, such as ball games, gym exercise and music sports. This finding as a whole is in good agreement with the latest international consensus papers (US Department of Health and Human Services 1996, American College of Sports Medicine 1998, Kesäniemi *et al.* 2001), but do, however, emphasise the importance of the intensity more than the amount of physical activity.

### *8.2.4 Physical fitness*

In Finland, no population-based studies in physical fitness have been implemented since the early 1990's (Kujala *et al*. 1994 and Viljanen *et al*. 1991). These studies were the source for the calculations of fitness values and, through them, the Physical Fitness Indicator (PFI). In this study, the PFI reached an average of 55.4%, which is based on the average estimation of 3,0±0,3 for cardio-respiratory fitness and 3,4±0,7 for abdominal strength test. In both the formula and the assumptions a value of 3,0 would represent a population average. In this respect, findings in this study would implicate a slightly higher level of muscular fitness than was measured a decade ago. The increase in gym exercise (Suomen Kuntoliikuntaliitto 2006) at the population level seems to add weight to this finding. At the same time, research targeted at Finnish reservists (males aged 20 to 45 years) has shown a steady decrease in cardio-respiratory fitness in connection with increased overweight (Malmberg *et al*. 2004). This should be reflected in decreased cardio-respiratory fitness values in this study compared to those found in early 1990's. In this study, fitness-testing was implemented in companies supporting WFP, which, in line with the slightly higher PAI values discussed above, would also be reflected in higher values in cardio-respiratory fitness. On the other hand, one should allow for a slight overrepresentation of physically active employees in fitness testing, which in turn

would lead to better-than-average values in cardio-respiratory fitness. These limitations would not reduce the value of the PFI in the company context since physical fitness measured in companies will always have these characteristics.

#### *8.2.5 Perceived health and work ability estimations*

Concerning perceived health, a comparison with recent Finnish surveys (Health and functional capacity in Finland 2004) can be made. Although in this study the age groups were different to those in the survey, a general comparison can be made. In the nationwide survey, slightly higher perceived health figures were obtained in younger age groups compared to this study. In older age groups, the situation was, however, the reverse. As a whole, the figures were relatively similar. In self-assessed work ability estimations, several surveys have been carried out in recent years in Finland. The WAE figures obtained in this study were similar to those collected by Peltoniemi (2004) and Piirainen *et al*. (2003). Piirainen *et al*. (2003) found an average of 8,3 for WAE in Finnish employees in 2001 and 2003; in this study the average was found to be 8,2.

#### *8.2.6 Associations between physical activity patterns and wellness parameters*

The physical activity patterns are composed principally of the amount and intensity of exercise, both of which are implemented through different sports, occupational or commuting activities. In this group, the intensity of physical activity was found to be the main variable associating with perceived health, sick leave and self-assessed work ability. The findings were similar in the preliminary study with larger data (n=14 420) and with case studies with less data (n varied 91 – 233). In some aspects, the amount of physical activity was neglected (for example sick leave, see Formula 6). These findings are well in line with the most important reviews and consensus papers (US Department of Health and Human Services 1996, Kesäniemi *et al.* 2001, Booth *et al.* 2002); but focus more on intensity of exercise than on amount of exercise.

The mechanism behind the effects of the intensity of physical activity can be seen as two-fold. First, the intensity of activity *per se* will have positive effects on many functions of human body (US Department of Health and Human Services 1996, Booth *et al.* 2002). Second, the intensity of exercise will aid better fitness values (see Formulas 10, 11 and 12 in this study, and Blair *et al.* 2001).

### *8.3 Some issues of discussion*

#### *8.3.1 WFP in the frameworks of behavioural modification and social cognitive theory*

Behavioural modification (BM) (Bandura 1969, McAlister *et al.* 1982) and social cognitive theory (SCT) (Bandura 1986) were chosen as basic theoretical frameworks for analysing WFP in the case companies. In evaluating the steps of BM, several common features could be found:

(1) In the case companies, no knowledge about the benefits of physical activity is given, only 'information' of WFP services. The distinction that I wish to make here is that knowledge implies understanding of the issue and how it works, whereas information requires only that one knows that it exists and when it happens. (In the Finnish language this situation is interesting as actually the same common word ["tieto"] is used to mean both "information" and "knowledge". If one wishes to express the knowledge aspect of an issue, he/she has to use a more artificial word ["tietämys"], which is not in everyday use.) No knowledge of, for example, the health benefits of physical activity is given. *"They presume that we all know!"* said employee E7 in Case D. This would presumably reflect the situation at a wider level, too; employers are interpreting physical activity as being each employee's own private matter, and thus each employee should be responsible for obtaining the necessary knowledge about physical activity.

(2) The responsibility for active persuasion was usually shifted to voluntary WFP activators, no obvious roles for management and occupational health care could be found in the analyses. The idea of including this variety of persuasion in the employee-superior discussions was put forward by one employee in Case B. This would appear to be a proper way to develop persuasion in the WFP.

(3) Some teaching of sport-specific skills has been arranged, and employees would prefer more of this kind of activity.

(4) Social support is mainly a kind of "unofficial" or "tacit" support between colleagues and co-workers. No support was found from management and superiors.

(5) Facilities for the WFP and active commuting were usually excellent. Active employees had 10-20 different sports to choose from!

(6) Organising the WFP was seen as unclear; in many case companies there were several operating levels in the WFP which was slightly confusing for employees. In Case A and Case B, there were sport club functions at both the conglomerate and company level, there were activities provided by MWA groups and there were activities in connection with occupational health care. In Case C, the personnel club, Team in Shape programme and occupational health care formed a combination of services which was not quite clear even for the occupational health care nurse. In Case D, organisation in relation to the WFP was simplified at the beginning of 2005. The results of that change will be seen only in the future.

The results of the analyses on the motivational aspects behind engaging in physical activity emphasise the importance of knowledge in promoting such activity. In the preliminary study (in a survey-type questionnaire), several analyses confirmed the importance of "basic motives" such as "physical activity is healthy", "I want to improve my physical fitness", "physical activity is fun", and "I want to relax with physical activity" in enhancing the physical activity level. Other more "serious" motives had less influence. On the other hand, analyses of the interviews of employees and management highlighted physical activity as a source of general wellbeing, health, as well as mental aspects, such as stress control and relaxation. Sharing knowledge would be one way to strengthen these motives. The new framework presented by Savola (2006) could create

a steady model for motivating employees to take up a more active lifestyle. In his [Finnish] article, Savola applies the principles of cognitive constructivism (Bruner 1985, Mayer 1992) in the promotion of physical activity.

In the framework of SCT, the role of occupational health care (OHC) can be examined more closely. In the case companies of this study, the role of OHC changes from case to case, being strongest in Case A, where physical fitness testing was implemented as a part of the regular OHC examination. In Case B, the role of OHC in WFP was active after April 2003 when Case B changed its health care producer. Before that (from 2001), the attitude of OHC practitioners was even negative towards this study and to some extent towards physical activity as well. In Case C, the OHC nurse has, as a member of the Fitness team, been actively involved in planning and developing the WFP. On the other hand, she felt that her expertise was not sufficiently taken into consideration in developing. In Case D, in 2003 and 2004, OHC had a consultative role in the WFP as a member of the local MWA group. In 2005, this connection was removed and as far as the researcher was informed, no collaboration between OHC and WFP exists.

OHC's role as a guiding expert in the WFP (in a maintaining of work ability framework) is weak because of lack of proper reporting. As M4 (of Case D) stated in his e-mail to the researcher: *"Well, it is like that, I don't get any reports from occupational health care, they send them direct to the head office. Our company nurse would know better - or then you have to call the company doctor in head office, they will know better than I know. In our follow-up files I can find some kind of sick leave percentage, but nothing else."*

To conclude: based on the results obtained from all four case companies, the role of OHC in the WFP from an organisational perspective is minor. Discussions of physical activity and, to some extent, physical fitness testing (Case A) form part of OHC examinations at the individual level, but no company-level results are given to companies. Most of the knowledge gained in the course of discussions can be described as tacit knowledge, which only OHC practitioners know but which is of no value for the company. Promotion of physical activity with fitness testing would develop OHC's importance in the SCT framework. In addition, systematic reporting of employees' physical activity and fitness patterns should be a constant element in OHC's services. The indicators (PAI, WFPI, PFI) developed in this study would serve this purpose well.

In the frameworks of BM and SCT, conclusions and steps to begin developing the WFP would be rather easy to make. The first and most fundamental point is that management should take strict responsibility for the WFP and employees' physical activity habits. This would lead to proper investment in terms of finance and, to some extent, use of working hours for motivational lectures and teaching skills, for instance. The employees' physical activity habits as a part of general wellbeing or a work ability framework (or perhaps their entire career!) would be a natural issue in employee-superior discussions. The organisation around the WFP needs to be clear and effective, experts (such as experts in WFP, occupational health care, etc) need to have a guiding and developing role, while voluntary WFP activators could operate in their own work units mainly by informing colleagues. Professional internal communication through printed material and inter- or intranet services would complement the experts' work. The role of managers

and superiors would be exact; they have the responsibility for supporting employees' wellbeing by motivation and acting as examples at WFP events.

### *8.3.2 Wellness paradigm*

In this study, WFPs were seen as a part of Intellectual Capital. In an other definition, a WFP could be positioned as a part of maintaining of work ability (MWA) in the Finnish way (see, e.g,. Ilmarinen *et al*. 1997). In Europe, and to some extent in other continents as well, a Worksite Health Promotion or Wellness approach would be a natural framework for a WFP (Shephard 1996, Chapman 2003). In Finnish MWA practices, the work ability index (WAI) has been a widely used tool to measure the level of work ability or wellness. On the other hand, absenteeism has also been used, especially in governmental proceedings and guidelines to estimate the costs and level of wellness (see, e.g., the US Department of Health and Human Services 1996, Kelly 1999, The Canadian Council on Integrated Healthcare 2002, Department of Health, Physical Activity, Health Improvement and Prevention 2004). To reflect the levels of wellness better, it would be more useful to utilise the factors behind absenteeism (or even early retirement). In this study, the Physical Activity Indicator (PAI) and to some extent the Health Factor (HF) could be reliable and feasible tools to evaluate wellness at least for analysis at the corporate level.

In Case A, the PAI was interpreted as acting as a sensible measure for overall work load; when the PAI was at its lowest the work load was at its highest (during the follow-up period). The PAI could be used as a part of the wellness questionnaire to evaluate not only the level of physical activity, but also in parallel with other measures the overall workload of employees. That said, the HF also seemed to be very accurate in predicting employees' health status. The statistically significant, although quite low, correlation between the HF and sick leave days would suggest the use of both measures in predicting employees' health.

In the preliminary study, the intensity of physical activity was seen to influence sick leave to some extent. In terms of physical activity groups, the enhancement of physical activity to a proper level (physical activity for health or fitness-sports) would mean a decrease of sick leave days by 1,3 to 2,6 days a year. As an example, this would mean that a company of PAI of 40% initially and 60% at the end of a promotion period would experience a decrease in sick leave days of 5-8%. This drop would be in the range of 0,2-0,3% of the personnel expenses calculated using Finnish standard figures that estimate the cost of a sick leave day at €200-300. Expressed as figures for working time, the drop of 5-8% in sick leave days would mean an increase of 0,2% in work time. These two estimations show the minor influence of physical activity changes on sick leave, at least when one takes into consideration that such a change in the PAI (from 40% to 60%) would be relatively hard to achieve. In Case C, such a change occurred between 1999 and 2001, but in the other case companies the fluctuations in the PAI were relatively small.

*8.3.3 WFP policy as a part of Intellectual Capital*

WFP policy has an essential role in building up WFPs as mediators to improve SC. A WFP is in a way "inside SC", it is part of SC. Differences in WFP policies would thus influence the role a WFP will have in building or supporting SC. In Case A, the WFP policy was managed as one of the most important parts of the "personnel card" in the company's Balance Score Card measure. This gives a stable position for the WFP. Operationally, the WFP is guided alongside the MWA (maintaining of work ability) group. The collaboration with occupational health care in fitness testing was already discussed in the previous chapter. In everyday WFP activities, employees see the role of the WFP as a challenge to get know other people in Case A. Friends and training companions made through WFP activities will definitely strengthen internal relations as a part of SC. One essential part in building SC with a WFP is that employees respect WFP investments at a very high level. This is the case also in other case companies, too.

In Case B, the WFP policy was slightly lighter than in Case A. WFP activities are organised properly as a part of Case B's MWA activities, but further enthusiasm in management is missing. Things are acceptable, but not excellent. Joint exercises and team sports will strengthen SC in Case B as well.

In Case C, the WFP can be seen to be an essential (even fundamental) element in building SC. From 1995, WFP activities in the form of regular exercise and WFP festivals have brought employees, both white and blue collar together. A stylish internal communication material with booklets, brochures and posters has also had an impact on SC. Activity in regular WFP activities and events have been extraordinarily high in Case C over the years. In addition to the active people, employees more passive regarding WFP activities are also proud of Case C's WFP. As employee E6, said *"It's important to see that the employer takes care of us employees – although I'm not personally active in this respect."* Further, the CEO of Case C stressed the role of WFP: *"For me personally, company sports are actually the only way of getting to know our people, it is a value in itself for me as a manager to be with our employees. In this industry, you can't underestimate the importance of the picture the employees are getting from you."* And further, *"In corporate sports, it is important that people do things together, they plan and sport together. That's essential for our company spirit."*

As discussed earlier, in Case D, the WFP policy is based on financial support of the voluntary WFP club. In the sense of building SC, a voluntary club is "out there - somewhere". This interpretation is the researcher's and underlines the importance of the management's role in building SC. A voluntary club will facilitate voluntary activities, which to some extent will have an effect on SC as well.

*8.3.4 Characteristics of an IC-supporting Worksite Fitness Program*

The main characteristics of a good WFP policy were defined in Chapter 7.1.1, where long-term planning and investment, the commitment of the management group, cooperation between experts in the fields of occupational health care, maintaining of work ability and WFPs, and professional internal communication by different media and the WFP activator network were emphasised. Traditionally, the goal for a WFP has been to

develop (or at least support) employees' physical activity patterns. This should be the first dimension, with the goal of activating more employees to be physically active enough. This will guarantee positive effects on physical activity and thus strengthen the Human Capital of a company. At the company level, the focus should be on actions carried out according to the principles of Behaviour Modification. That should elicit some educational and motivational action to improve employees' knowledge and thus the basis for motivation. The results presented in Figure 25, Figure 26 and Table 20 will emphasise the meaning of "just normal" motives for physical activity. At the individual level, the regularity and intensity of physical activity should be considered. The proper intensity will strengthen the positive effects of physical activity on health, wellbeing and work ability. Services in a WFP should include qualitative sports services and individual activation (activating) processes. Professional internal communication is essential for a successful WFP.

The second dimension of a WFP should focus on company climate and employee satisfaction, thus supporting the company's Structural Capital. Activities such as WFP events and campaign media are strictly related to management and HRD activities. Goals can be set for a good participation rate and feedback from the events. A possible third dimension of a WFP would be in B2B areas development of customer know-how and loyalty. WFP events serve as a good tool for these goals.

### *8.4 Positioning a WFP in an IC framework*

In this section, an overview of the associations between physical activity and fitness patterns as well as WFP policy are drawn. Based on the results obtained and conclusions drawn, the associations between physical activity and fitness patterns and WFP policy in the framework of IC are be presented in Figure 57.

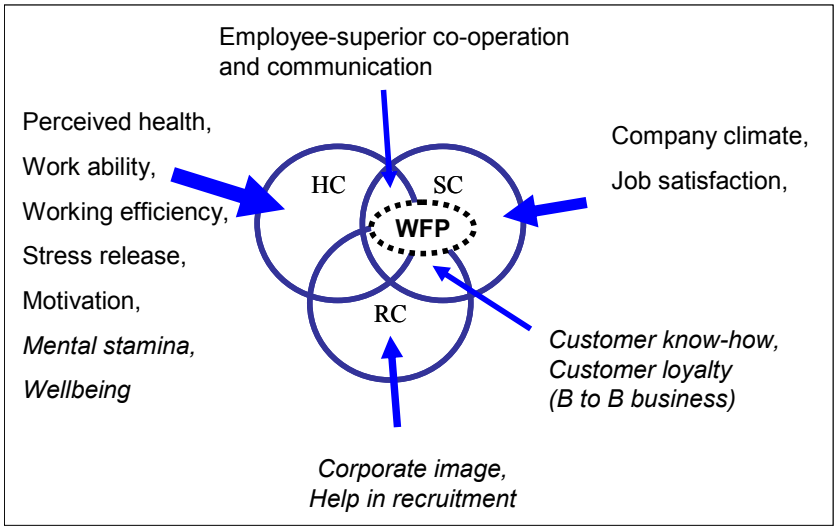


Figure 57. The main findings of the associations between physical activity and WFP and Intellectual Capital. Findings printed in *italics* are based on qualitative study.

In Figure 57 the main findings regarding the importance of individual physical activity habits are shown to influence Human Capital (on the left in the figure). Better perceived health and work ability, proper mental stamina and working efficiency at work, stress release and good motivation are all outputs of a qualitatively proper physical activity regimen. Other effects presented in the figure are associations between WFP and IC.

In Figure 57 WFPs are depicted as a part of IC. According to the researcher's interpretation, a WFP is mostly part of SC: Organising and implementing WFPs are to a large extent functions of SC. A WFP will, however influence and interact also with HC and RC.

In positioning WFPs as a part of IC, a more thorough analysis of the roles and inputs of management in Case A and Case B were carried out. In accordance with the principles of discourse analysis (Potter 2004, Alvesson & Kärreman 2000), further analyses were carried out. Case A and Case B both operate in the same business field and many elements concerning their WFP are the same. Both had personnel club functions and conglomerate WFP services in use. That said, as discussed earlier, in Case A the position of the WFP was much stronger than in Case B. In Case A, the WFP (or more precisely, physical condition) was part of the personnel card in the company's BSC and in Case A the promotion of physical activity was integrated as a part of the regular medical examination done by occupational health care. The reason for this can be found "in the management box". In Case A, both the CEO and the manager responsible for the WFP (M3) were actively and enthusiastically contributing to the development of the WFP. The CEO said: *"I see sport for all as very important, competitive sport is too much. Health-enhancing physical activity is essential for a company in our business. These issues I have emphasised in my speeches and writing for the staff during recent years"*. M3 said of his own physical activity paradigm *"Physical activity is a matter of life and death for me, without activity I'd actually be an invalid. For sure, that's true; I wouldn't be here without physical activity"*

In Case B, in contrast, the CEO stated: *"Our job is sitting in front of a computer all day long, you have to have some counterbalance to maintain your work ability. In our company, the average age is around 42-44 years, but we have two distinct subgroups, 'the youngsters' and the '50+ year-old people'. For young people, physical activity is important in building the foundations for their life and work; for the 50+ people it (physical activity) is very important in maintaining their work ability up to retirement – at 65 years of age!"* The CEO continues speaking on the role of the WFP: "*With our WFP we try to activate people regarding sports, but whether our actions are adequate, I don't know. Usually, a WFP will activate people already active; activating those not active is a big challenge. I'm not sure if we pay 10% of some swimming ticket will that activate those people."* Still, the manager responsible for WFP M2 said: *"Supporting the WFP is self evident, there's no option not to support it. We want people to turn their attention to physical activity and fitness and we as an employer want our people to be physically active in many ways. We give opportunities; you can't force anyone to participate. 'Don't do as I do, do as the organisation provides you opportunities to do'*". "You can't force anyone to participate" is true, but from one point of view of management, it is even resigned. In an organisation, you definitely can find ways to activate employees to

develop a more active way of living. To conclude the discourses on Case A and Case B, the attitude of management is essential in positioning a WFP as a real functioning part of IC.

### *8.5 Answers to the research questions*

This study brought up several finding that can be utilised in answering the research questions posed. In interpreting the results and conclusions made in this thesis, serious attention has to be paid to the (superb) quality of the case companies participating in the study. In many ways, all four case companies were in an excellent position with respect to WFPs; they were all mid-sized companies situated in one location, their financial situation was stable and the facilities for their WFP were excellent.

*Q 1. What is the connection of the company-specific fitness policy on Intellectual Capital?*

The main elements in an effective WFP policy are long-term, steady investment in both sport facilities and on motivational and communicational activities. Strong motives and the persistence of active management are indispensable in the realisation of these elements. In this study, several findings underline the importance of WFP policy on Intellectual Capital.

In the case companies, the role and commitment of management varied to some extent. In those case companies where management had better motivation to promote the WFP, the activities were wider and more connected to the official actions of the company. In Cases A and C, the WFP was operationally tightly connected to occupational health care. The outcome of such collaboration varied between Case A and C, but principally the co-operation offered employees clear support in developing their physical activity. This in turn will support the companies' Human Capital.

In Case C, a distinct part of WFP policy was strong internal communication, which was implemented through professional internal marketing (brochures, personnel magazines and posters) and a tight employee activator network. These activities resulted in a steady increase in WFPI and WFPE; they also positively affected Case C's company climate. This can be seen as relatively strong support for Case C's Structural Capital. Based on the interviews of employees, management and owners in all case companies, WFPs can be conceptually positioned as a part of Structural Capital.

A permanent, long lasting WFP policy will offer employees, and customers to some extent, too, an opportunity to tighten their commitment to the company. This will strengthen the Relation Capital of a company.

*Q 2. What are the associations and interactions of the employees' activity in the Worksite Fitness Program on Intellectual Capital?*

The findings of this study indicate that the results of WFP activity will be realised through two different routes: by supporting the quality of individual physical activity and by collectiveness through joint activities. The quality of physical activity (exercise)

means activities such as gym training, music sports and ball games. These activities will strengthen the connections between physical activity and perceived health, sick leave reduction and work ability, thus supporting Human Capital.

Activity in WFP services on a regular basis or at events will mainly support elements in Structural Capital. In cross-sectional settings, employees active in a WFP felt the company climate, job satisfaction and employee-superior relationship were all better than employees not active in a WFP. Activity in a WFP supported better working efficiency and a higher energy level at work, thus enhancing HC. In the follow-up setting, WFP activity correlated positively with the HC indicator 'staff training' in Case B.

More qualitative analyses confirmed the importance of WFPs in Relational Capital. In B2B areas joint WFP events were seen to strengthen customer know-how and loyalty. In Case C. operating in basic industry WFP was seen to support company image locally.

*Q 3: What are the associations and interactions of Physical Activity Patterns on Intellectual Capital??*

The results of this study strongly indicate that there are positive associations between physical activity patterns and human elements of Human Capital. In cross-sectional analyses, the quality of physical activity supports perceived health, reduction of sick leave, self-assessed work ability estimations, stress control and working efficiency at work. The follow-up results show same patterns concerning perceived health and work ability. In some follow-up settings, the physical activity changes were in line with changes of the competence indicator. In addition to this, in some cross-sectional settings, active employees were more motivated and committed to their employer than their less active colleagues.

Changes in physical activity correlated positively with some indicators of Structural Capital ('on schedule' and 'productivity of system work'). In a cross-sectional setting, evidence was obtained that physically more active employees had better job satisfaction than their less active colleagues. With respect to Relational Capital, fewer findings were obtained. In two case companies, changes in physical activity correlated positively with the project feedback indicator, although in the other company changes in physical fitness correlated negatively with same indicator.

On the whole, physical activity played a relatively important role in supporting Human Capital. The evidence was strongest in human indicators such as perceived health and self-assessed work ability estimations.

*Q 4. What are the associations and interactions of Physical Fitness on Intellectual Capital?*

In the preliminary study, a correlation analysis of 49 companies' level of physical activity revealed a negative correlation with sick leave and a positive correlation with self-assessed work ability estimations. In case company D, the individual level of cardiorespiratory fitness also correlated negatively with sick leave. These findings were in line with findings concerning the importance of physical activity and confirmed the role of

physical lifestyle in health- and work ability related indicators as a part of Human Capital.

In follow-up settings, relatively contradictory results were obtained. In Case A, changes in physical fitness correlated with the SC indicator 'on schedule', while in Case B, changes in fitness correlated negatively with the SC indicator 'productivity of system work' and the RC indicators 'customer benefit index' and 'project feedback'.

On the whole, the contribution of physical fitness to Intellectual Capital was smaller than the contribution of physical activity. This may have been caused by methodological issues; data collection on physical activity is far simpler than data collection on physical fitness and thus the quantity of data on physical activity patterns was much greater. Another explanation may be that physical activity in its various forms is more important to IC than physical fitness.

*Q 5. What are the indicators for measuring and managing the Worksite Fitness Program and Physical Activity and Fitness Patterns in an Intellectual Capital framework?*

In the preliminary study of this thesis, indicators for physical activity and fitness patterns were created. Based on the statistical analyses and estimations of validity, reliability and feasibility, it can be concluded that the indicators 'physical activity indicator (PAI), 'worksite fitness program indicator' (WFPI), 'worksite fitness program event indicator' (WFPE) and 'physical fitness indicator' (PFI) will all fulfil the requirements set. These indicators are good tools in measuring and managing WFP in company level.

### *8.6 Suggestions for future research*

This study generated several proposals for future research. First of all, studies of WFPs in an IC framework (or more generally in a Human Resource framework) should be carried out in order to discover more evidence regarding the effects and interactions of WFPs in organisations. Methodologically, research in follow-up settings with reliable measures such as PAI and WFPI together with some WFP service feedback measures would serve these purposes. A larger number of case companies from different business areas and of different sizes, as well as from different countries would similarly strengthen knowledge in this field.

Financial analyses of the wider effects of WFPs and physical activity and fitness in general would be one direction for future studies. Until recently, the effects of WFPs have been studied mainly in the disciplines of sports medicine and physiology with certain health-related financial measures. The results of this study indicate wider financial benefits may accrue, although for studying those benefits, a standardized (or at least common) view of the financial values of different issues in IC should be put forward.

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**Appendix 1. Physical Activity Barometer**

The next questions are connected to your personal wellbeing. We hope that you answer the questions as promptly as possible. With the questionnaire we want to find new ideas for promoting employee wellness. The answers are used for statistical analysis only, and no personal results are derived. Analysis and applications are made by Finnish Sport for All Association.

1. Background

Gender
- ☐ female
- ☐ male

How old are You?
- ☐ under 30 years
- ☐ 30 - 39 years
- ☐ 40 - 49 years
- ☐ 50 – 59 years
- ☐ over 60 years

Business unit

_____

Nature of your job
- ☐ Physical work (blue collar)
- ☐ Officework (white collar)

GENERAL PHYSICAL ACTIVITY

2. How often do you take part in physical activity, and how long is a fitness session on an average?

The frequency of physical activity
- ☐ at least four times a week
- ☐ on average three times a week
- ☐ on average two times a week
- ☐ on average once a week
- ☐ once, twice a month
- ☐ less than that
- ☐ not at all

Duration of physical activity (min),
- ☐ under 20 min
- ☐ 20 - 40 min
- ☐ 40 - 60 min
- ☐ 60 - 90 min
- ☐ 90 - 120 min
- ☐ ovar 120 min

What is the intensity of your physical activity
- ☐ I don't take part in physical activity
- ☐ light and restful (no higher breathing or sweating)
- ☐ moderate (some higher breathing and sweating)
- ☐ vigorous (heavy breathing and sweating)

COMMUTING ACTIVITY

3. How often do you walk (cycle, rollerskate, etc) to your work, what is the duration of that walk and how intense is your commuting activity?

| Commuting by walking or cycling | summertime | wintertime |
|---|---|---|
| Every day, five times a week | ☐ | ☐ |
| Three to four times a week | ☐ | ☐ |
| One or two times a week | ☐ | ☐ |
| Once or twice a month | ☐ | ☐ |
| Not at all | ☐ | ☐ |

The duration of commuting activity per day (back and forth)

- ☐ under 20 min
- ☐ 20 - 40 min
- ☐ 40 - 60 min
- ☐ 60 - 90 min
- ☐ 90 - 120 min
- ☐ over 120 min

What is the intensity of your commuting activity

- ☐ I don't have any commuting activity
- ☐ light and restful (no higher breathing or sweating)
- ☐ moderate (some higher breathing and sweating)
- ☐ vigorous (heavy breathing and sweating)

EVENT SPESIFIC PHYSICAL ACTIVITY

4. What are the specific sport events that you currently take part in regularly? And what are the events you plan to take part in in the future? List all the events you take part in in the different seasons during the year.

| Events I take part in regularly | Events I plan to take part in regularly in the future |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

5. Height and weight

Write your height and weight on the lines below.

height _____ cm  weight _____ kg

MOTIVES FOR PHYSICAL ACTIVITY

6. What are your motives for physical activity – why do you exercise. Please give your personal estimation of the importance of the motives below. Number 1 means "extremely important" and 5 "not at all important". Give an answer for all of the motives.

| | extremely important | important | neutral | a little important | not at all important |
|---|---|---|---|---|---|
| I want to improve my physical fitness | 1 | 2 | 3 | 4 | 5 |
| I want to lose weight | 1 | 2 | 3 | 4 | 5 |
| I want to relax with physical activity | 1 | 2 | 3 | 4 | 5 |
| Physical activity is healthy | 1 | 2 | 3 | 4 | 5 |
| I practise physical activity for social reasons | 1 | 2 | 3 | 4 | 5 |
| I want to increase my stress tolerance | 1 | 2 | 3 | 4 | 5 |
| I'm healing shoulder symptoms | 1 | 2 | 3 | 4 | 5 |
| Physical activity is fun! | 1 | 2 | 3 | 4 | 5 |
| I want to compete with others | 1 | 2 | 3 | 4 | 5 |
| I want to tone my body | 1 | 2 | 3 | 4 | 5 |
| I practise physical activity to improve my mental stamina at work | 1 | 2 | 3 | 4 | 5 |

WORKSITE FITNESS PROGRAM (WFP) ACTIVITIES

7. Your employer financially supports worksite fitness program (WFP) activities. In what WFP activities have you taken part regularly?

| Regular sport event or WFP activity | How many times a week? |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

How many times a week in total do you have WFP activities _____ times a week

8. Which WFP happenings do you take part and how often?

| Sports happenings | How often have you taken part? |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

SELF-ESTIMATION OF HEALTH

9. How would you describe your health?

- ☐ good
- ☐ fairly good
- ☐ average
- ☐ fairly poor
- ☐ poor

10. How would you compare your health with the people your age and gender?

- ☐ clearly better
- ☐ better
- ☐ as good
- ☐ worse
- ☐ much worse

| | |
|---|---|
| 11. Has there been changes in your health during last five years?<br>☐ got much better<br>☐ got better<br>☐ stayed the same<br>☐ got worse<br>☐ got clearly worse | 12. How interested are your generally in your health?<br>☐ very much<br>☐ much<br>☐ to some extent<br>☐ little<br>☐ not at all |
| 13. How important is your health to you?<br>☐ very important<br>☐ quite important<br>☐ can not say<br>☐ to some extent important<br>☐ not at all important | 14. How much do you think you can influence your own health?<br>☐ very much<br>☐ much<br>☐ to some extent<br>☐ little<br>☐ not at all |
| 15. Do you have pain in your neck and shoulder region?<br>☐ constantly<br>☐ often<br>☐ some times<br>☐ rarely<br>☐ never | 16. Does possible neck- or shoulderpain harm your work or leisure time?<br>☐ harms work often<br>☐ harms work some times<br>☐ does not harm work<br><br>☐ harms leisure time often<br>☐ harms leisure time some times<br>☐ does not harm leisure time |
| 17. Do you have pain in your back?<br>☐ constantly<br>☐ often<br>☐ some times<br>☐ rarely<br>☐ never | 18. Does the possible back pain harm your work or leisure time?<br>☐ harms work often<br>☐ harms work some times<br>☐ does not harm work<br><br>☐ harms leisure time often<br>☐ harms leisure time some times<br>☐ does not harm leisure time |

SICKLEAVES AND WORK ABILITY ESTIMATIONS

19. How many sick leave days did you have during the last year? What was the cause of the sick leave?

sick leave _____ days in last year
_____ days of flu and other minor causes
_____ days of back and other
_____ days of cardiovascular deceases (heart problems, blood pressure, etc)

20. Estimate your current work ability compared with the lifetime best so that 10 = the best work ability You ever have had and 0 = inability to work at the moment. Circle your estmation.

| inability to work | | | | | | | | | best work ability ever | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Thank you for answering! Mail the questionnaire in envelope enclosed.

**Appendix 2. Semi-structured interview on Physical Activity, Physical Fitness, Worksite Fitness Program and Intellectual Capital in case companies**

Interview at __/__ 200__

Name
Position in case company

Presentation and assessment of Intellectual Capital (by researcher)

Intellectual capital is the combination of the human capital, internal and external structures of an organisation. IC can be visualised according to Figure 1.

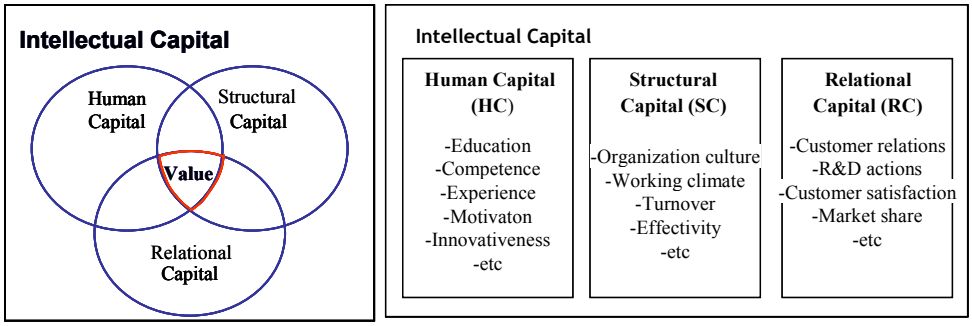


Figure 1. General structure of Intellectual Capital (left) and examples of capabilities of different parts of IC (right).

Human capital is defined as the knowledge that employees take with them when they leave the firm. It includes the knowledge, skills, experiences and abilities of people. Some of this knowledge is unique to the individual, some may be generic. Examples are innovation capacity, creativity, know-how and previous experience, teamwork capacity, employee flexibility, tolerance for ambiguity, motivation, satisfaction, learning capacity, loyalty, formal training and education.

Internal structures are defined as the knowledge that stays within the firm at the end of the working day. It comprises the organisational routines, procedures, systems, cultures, databases, etc. Examples are organisational flexibility, a documentation service, the existence of a knowledge centre, the general use of Information Technology, organisational learning capacity, etc.

External structures are defined as all resources linked to the external relationships of the firm, with customers, suppliers or R&D partners. It comprises that part of Human and Structural Capital involved with the company's relations with stakeholders (investors, creditors, customers, suppliers, etc.), plus the perceptions that they hold about the company. Examples of this category are image, customer loyalty, customer satisfaction, links with suppliers, commercial power, negotiating capacity with financial entities, environmental activities, etc.

Assessment of IC in case company

According to this presentation, which of the three components of IC is the most important in this (case) company, which is of secondary importance and which is least important?

And further: "what are the most important element (or phenomena) in Human Capital (and Structural and Relational Capital)? Can you describe them according to your knowledge and experience of this company?"

Framework and chronological schema of the study (by researcher)

The setup and schema of the study is presented in Figure 2.

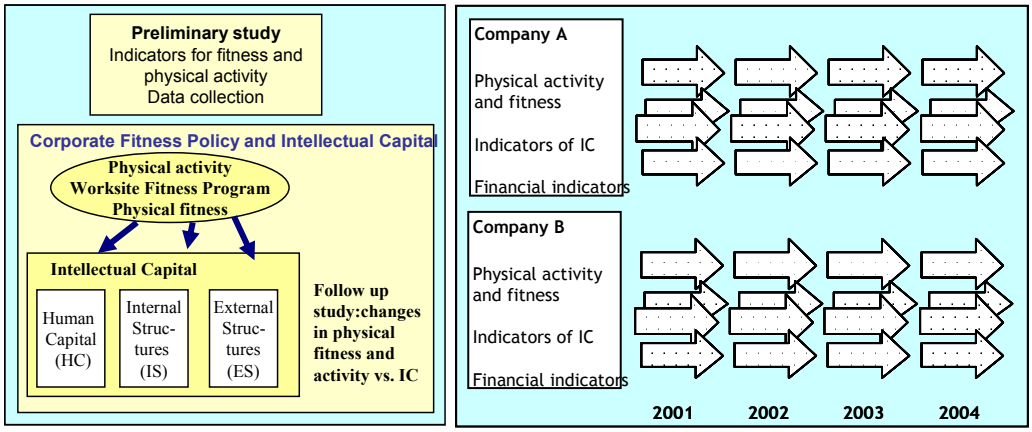


Figure 2. Framework and chronological schema of the sudy.

Physical activity and fitness

Physical activity at the moment

How often are you physically active? (take part in fitness-sport, commuting activity, houseworks, etc)

_____ times/week, _____ minutes/session

- ☐ I don't have any physical activity
- ☐ light and restful (no higher expiration or sweating)
- ☐ moderate (some higher expiration and sweating)
- ☐ vigorous (heavy expiration and sweating)

Role of physical activity and fitness

What is the role of physical activity for you personally?
How do you exercise physical activity (alone, with friends, with work mates, with family)?
What is the role of physical activity for worksite and work?
What is the role of physical fitness for you personally?
What is its meaning for work?

Continuing with IC

You assessed earlier xx, xxx and xxx are the most essential elements of IC in your company. How can these be influenced and developed?

And what would be the role of physical activity and worksite fitness program in this development?

Continuing with physical activity

What is the meaning of physical activity for work effectiveness?
And what about physical fitness in this regard?

What is the meaning of physical activity for innovativeness?
And what about physical fitness in this regard?

Role of the worksite fitness program

(The role of worksite fitness program was investigated at several different levels in a company and in connection to stakeholders also)

**You own people** (closest people to you at worksite)
Do you have a WFP and if you have, what kind?
- No WFP
- Yes, we have WFP
- Regular sport spesific exercises
- Events, what kind?

How would you estimate the importance of WFP in respect of…

| | very important | | neutral | slightly important | not at all important |
|---|---|---|---|---|---|
| Working climate | 5 | 4 | 3 | 2 | 1 |
| Fluency of work | 5 | 4 | 3 | 2 | 1 |
| Exchange of information | 5 | 4 | 3 | 2 | 1 |
| Commitment to employer | 5 | 4 | 3 | 2 | 1 |

**You team or work unit**

Do you have WFP and if you have, what kind?

- No WFP
- Yes, we have WFP
- Regular sport spesific exercises
- Events, what kind?

How would you estimate the importance of WFP in respect of…

| | very important | important | neutral | slightly important | not at all important |
|---|---|---|---|---|---|
| Working climate | 5 | 4 | 3 | 2 | 1 |
| Fluency of work | 5 | 4 | 3 | 2 | 1 |
| Exchange of information | 5 | 4 | 3 | 2 | 1 |
| Commitment to employer | 5 | 4 | 3 | 2 | 1 |

**Company**

Do you have WFP and if you have, what kind?

- No WFP
- Yes, we have WFP
- Regular sport spesific exercises
- Events, what kind?

How would you estimate the importance of WFP in respect of…

| | very important | important | neutral | slightly important | not at all important |
|---|---|---|---|---|---|
| Working climate | 5 | 4 | 3 | 2 | 1 |
| Fluency of work | 5 | 4 | 3 | 2 | 1 |
| Exchange of information | 5 | 4 | 3 | 2 | 1 |
| Commitment to employer | 5 | 4 | 3 | 2 | 1 |

WFP-group

Do you take part in WFP-group regularly or occasionally?

- No, I don’t take part in WFP
- Yes, I take part in WFP
- Regular sport spesific exercises
- Events, what kind?

How would you estimate the importance of WFP in respect of…

| | very important | important | neutral | slightly important | not at all important |
|---|---|---|---|---|---|
| Working climate | 5 | 4 | 3 | 2 | 1 |
| Fluency of work | 5 | 4 | 3 | 2 | 1 |
| Exchange of information | 5 | 4 | 3 | 2 | 1 |
| Commitment to employer | 5 | 4 | 3 | 2 | 1 |

Stakeholders
Do you have WFP and if you have, what kind?
- No WFP
- Yes, we have WFP
- Regular sport spesific exercises
- Events, what kind?

How would you estimate the importance of WFP in respect of…

| | very important | important | neutral | slightly important | not at all important |
|---|---|---|---|---|---|
| Co-operative climate | 5 | 4 | 3 | 2 | 1 |
| Fluency of co-operation | 5 | 4 | 3 | 2 | 1 |
| Exchange of information | 5 | 4 | 3 | 2 | 1 |
| Commitment to co-operation | 5 | 4 | 3 | 2 | 1 |

Customers
Do you have WFP and if you have, what kind?
- No WFP
- Yes, we have WFP
- Regular sport spesific exercises
- Events, what kind?

How would you estimate the importance of WFP in respect of…

| | very important | important | neutral | slightly important | not at all important |
|---|---|---|---|---|---|
| Co-operative climate | 5 | 4 | 3 | 2 | 1 |
| Fluency of co-operation | 5 | 4 | 3 | 2 | 1 |
| Exchange of information | 5 | 4 | 3 | 2 | 1 |
| Commitment to co-operation | 5 | 4 | 3 | 2 | 1 |

Finally
Estimate the value of WFP in your company's Human Resource framework.

Importance of investments in WFP. Scale: 5 extremely important, 4 very important, 3 relatively important, 2 slightly important, 1 not at all important

Why it is worth while invest in WFP?

How would you prioritise the WFP-investments
investment in activating or motivating to start physical activity
investment in physical activity services
reward people for physical activity (and / or good fitness)

**Appendix 3. Psycho-social factors at work and worksite**

Background

Gender
☐ female
☐ male

Age group
☐ under 30 y
☐ 30 - 39 y
☐ 40 - 49 y
☐ over 50 y

| ORGANISATIONAL CULTURE | Very seldom or never | Rather seldom | Some-times | Rather often | Very often or always |
|---|---|---|---|---|---|
| 1. Is there sufficient communication between staff and management in your department? | 1 | 2 | 3 | 4 | 5 |
| 2. If needed, can you get support and help with your work from your immediate superior? ... | 1 | 2 | 3 | 4 | 5 |
| WHAT IS THE CLIMATE LIKE IN YOUR WORK UNIT? | Very little or not at all | Rather little | Some-what | Rather much | Very much |
| 3. Encouraging and supportive. | 1 | 2 | 3 | 4 | 5 |
| MASTERY OF WORK | Never | Rather seldon | Some-times | Rather often | Very often |
| 4. How often do you feel stress because of unfinished job? | 1 | 2 | 3 | 4 | 5 |
| 5. How often you have problems to carry on your job? | 1 | 2 | 3 | 4 | 5 |
| 6. How often you feel you have a good working efficiency? | 1 | 2 | 3 | 4 | 5 |
| COMMITMENT AND JOB SATISFACTION | Disagree totally | Disagree to some extent | Indiffe rent | Agree to some extent | Agree totally |
| 7. This organisation really inspires me to give my very best work performance | 1 | 2 | 3 | 4 | 5 |
| | Very unsatis-fied | Rather unsatis-fied | Indiffe rent | Rather satis-fied | Very satis-fied |
| 8. How satisfied are you at your present job? | 1 | 2 | 3 | 4 | 5 |

Questions of physical activity:

9. How often are you physically active? (take part in fitness-sport, commuting activity, houseworks, etc)

_____ times/week, _____ minutes/session

What is the intensity of your physical activity

☐ I don't have any physical activity
☐ light and restful (no higher breathing or sweating)
☐ moderate (some higher breathing and sweating)
☐ vigorous (heavy breathing and sweating)

10. Your employer financially supports worksite fitness program activities. In what kind of WFP activities have you taken part?

| | yes | no |
|---|---|---|
| taking part in WFP activities regularly (weekly) | ☐ | ☐ |
| taking part in WFP events | ☐ | ☐ |

11. How would you describe your health? (Only in Case D.)

- ☐ good
- ☐ fairly good
- ☐ average
- ☐ fairly poor
- ☐ poor

## *Appendix 4. Results of the physical activity and fitness characteristics in case companies*

Table A-1. Main results of fitness testing protocol in Case A during 1999-2004. In table the amount of tested persons and average results of different measurements and questionnaires are presented. BMI=body mass index, APA=total amount of physical activity (minutes/week), HEPA=physical activity for health, PAI=Physical Activity Indicator, WFPI=Worksite Fitness Program Indicator, Abd=abdominal muscle test, $VO_2$=cardio-respiratory fitness, TFV=Total Fitness Value and PFI= Physical Fitness Indicator, WAE=work ability estimation.

| Year | n | male | female | Age | weight | height | BMI | Fat-% |
|---|---|---|---|---|---|---|---|---|
| | | | | (years) | kg | cm | | |
| 1999 | 31 | 18 | 13 | 42,2 | 74,3 | 172,3 | 24,9 | 25,4 |
| 2000 | 34 | 20 | 14 | 43,2 | 74,6 | 173,5 | 24,7 | 24,1 |
| 2001 | 32 | 24 | 8 | 42,8 | 79,5 | 175,4 | 25,8 | 25,5 |
| 2002 | 41 | 19 | 22 | 42,9 | 72,7 | 171 | 24,8 | 25,7 |
| 2003 | 29 | 17 | 12 | 40,9 | 76,3 | 175,8 | 24,5 | 24,1 |
| 2004 | 38 | 21 | 17 | 44,6 | 75 | 172,6 | 25 | 25,7 |
| | | Physical activity groups (%) | | | | | | |
| year | APA | passive | act. lifestyle | HEPA | fitness-sport | PAI | WFPI | |
| 1999 | 167 | 19 | 39 | 13 | 29 | 42 | 16 | |
| 2000 | 151 | 21 | 44 | 26 | 9 | 35 | 64 | |
| 2001 | 117 | 34 | 41 | 16 | 9 | 25 | 52 | |
| 2002 | 130 | 20 | 56 | 15 | 10 | 24 | 63 | |
| 2003 | 165 | 17 | 52 | 21 | 10 | 31 | 52 | |
| 2004 | 195 | 5 | 61 | 32 | 3 | 34 | 53 | |
| year | Abd's | ABD. | | $VO_2$ | | | Sick leaves | |
| | (reps/30") | est. | $VO_2$ | est. | TFV | PFI | (d/y) | WAE |
| 1999 | 15,8 | 3,4 | 36,8 | 2,9 | 3,1 | 65 | 4,6 | 8,4 |
| 2000 | 17,5 | 3,5 | 34,3 | 2,4 | 3 | 41 | 4,8 | 8,3 |
| 2001 | 16,1 | 3,1 | 34,2 | 2,2 | 2,6 | 38 | 3,1 | 8,2 |
| 2002 | 17,3 | 3,9 | 33,3 | 2,2 | 3 | 44 | 4,2 | 8,3 |
| 2003 | 17,1 | 3,1 | 37,8 | 3 | 2,9 | 41 | 3,4 | 8,3 |
| 2004 | 17,3 | 4,2 | 35,5 | 2,8 | 3,4 | 58 | 3,3 | 8,4 |

The results in table A-1. show reasonable low level of physical activity (PAI), good level of activity in WFP (WFPI) and average to low-average level of physical fitness (PFI).

The main results of the fitness testing protocol are presented in table 1.

Table B-1. Main results of fitness testing protocol in Case B during 2001-2004. In table the amount of tested persons and average results of different measurements and questionnaires are presented. BMI=body mass index, APA=total amount of physical activity, PAI=Physical Activity Indicator, PAI3=Physical Activity Indicator with criteria of at least three times a week, WFPI=Worksite Fitness Program Indicator, TFV=Total Fitness Value and PFI= Physical Fitness Indicator., WAE=work ability estimation, Abd's = mean of abdominals test (repetitions in 30 seconds), Abd.est. = estimation of the results of abdominal test.

| year | n | % of staff | male | female | Age (years) | Weight (kg) | Height (cm) | BMI | Fat-% |
|---|---|---|---|---|---|---|---|---|---|
| 2001 | 62 | 36,0 | 22 | 40 | 43,5 | 70,4 | 168,6 | 24,7 | 25,5 |
| 2002 | 52 | 30,6 | 21 | 31 | 44,0 | 72,1 | 168,9 | 25,2 | 27,4 |
| 2003 | 45 | 25,0 | 17 | 28 | 45,9 | 73,6 | 170,5 | 25,3 | 27,0 |
| 2004 | 42 | 23,6 | 13 | 29 | 44,2 | 72,5 | 170,0 | 25,2 | 28,2 |
| | | Physical Activity Groups | | | | | | | |
| year | APA | passive | active lifestyle | physical activity for health | fitness-sports | PAI | WFPI | PAI3 | |
| 2001 | 152 | 10 | 66 | 16 | 8 | 24,2 | 62,9 | 40,3 | |
| 2002 | 136 | 12 | 62 | 15 | 12 | 26,9 | 57,7 | 51,9 | |
| 2003 | 173 | 11 | 64 | 20 | 4 | 24,4 | 44,4 | 57,8 | |
| 2004 | 183 | 7 | 60 | 24 | 10 | 33,3 | 50,0 | 59,5 | |
| | Abd's | Abd. est. | $VO_2$ | Estim. $VO_2$ | TFV | PFI | Sick leaves | WAE | |
| year | Mean | Mean | Mean | Mean | Mean | % | Mean | Mean | |
| 2001 | 16,3 | 4,2 | 36,1 | 3,0 | 3,6 | 75,8 | 3,8 | 8,4 | |
| 2002 | 18,0 | 4,2 | 36,6 | 2,5 | 3,3 | 73,1 | 3,7 | 8,5 | |
| 2003 | 18,2 | 4,8 | 36,3 | 3,2 | 4,0 | 73,3 | 5,2 | 8,3 | |
| 2004 | 16,9 | 4,5 | 34,6 | 2,8 | 3,6 | 66,7 | 3,7 | 8,5 | |

The results in table B-1. show reasonable low level of physical activity (PAI), good level of activity in WFP (WFPI) and average to good level of physical fitness (PFI).

The main results of the physical activity questionnaires are presented in table C-1.

Table C-1. Main results of physical activity questionnaires in Case C during 1995-2004. In table the amount of answered employees and distributions and average results of questionnaires are presented.

| Year | n | response rate | male | female | under 30y | 30-39y | 40-49y | 50-59y | over 60y | blue collar | white collar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) |
| 1995 | 95 | 45,2 | 66,3 | 33,7 | 24,2 | 27,4 | 36,8 | 11,6 | 0,0 | 51,6 | 48,4 |
| 1999 | 220 | 77,2 | 71,0 | 29,0 | 33,6 | 35,9 | 18,2 | 12,3 | 0,0 | 54,2 | 45,8 |
| 2001 | 60 | 76,9 | 66,1 | 33,9 | 26,7 | 36,7 | 25,0 | 11,7 | 0,0 | 40,7 | 59,3 |
| 2002 | 68 | 85,0 | 59,4 | 40,6 | 30,9 | 36,8 | 14,7 | 17,6 | 0,0 | 36,8 | 63,2 |
| 2003 | 193 | 74,2 | 80,3 | 19,7 | 23,3 | 38,9 | 20,7 | 16,6 | 0,5 | 57,5 | 42,5 |
| 2004 | 224 | 80,0 | 68,7 | 31,3 | 21,4 | 38,4 | 24,1 | 15,2 | 0,9 | 37,7 | 62,3 |

| Year | PA freq | WFP freq | CPA freq | APA | WFPI | pass. | act.ls | hepa | fs | PAI |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (%) | (%) | (%) | (%) | |
| 1995 | 1,9 | 0,9 | - | 116 | 25,2 | 50,5 | 26,3 | 13,7 | 9,5 | 23,2 |
| 1999 | 2,6 | 1,7 | 1,1 | 158 | 37,6 | 17,2 | 40,7 | 25,3 | 16,7 | 42,1 |
| 2001 | 3,1 | 1,9 | 1,4 | 206 | 43,5 | 9,7 | 29,0 | 40,3 | 21,0 | 61,3 |
| 2002 | 2,8 | 1,3 | 1,1 | 169 | 44,9 | 15,9 | 37,7 | 30,4 | 15,9 | 46,4 |
| 2003 | 2,7 | 1,8 | 1,1 | 175 | 46,6 | 17,6 | 35,8 | 28,0 | 18,7 | 46,6 |
| 2004 | 2,4 | 1,1 | 0,9 | 160 | 51,1 | 20,3 | 41,0 | 22,0 | 16,7 | 38,8 |

| Year | smokers | Sick leave | flu | MSD | CVD | WAE | Health | WFPE |
|---|---|---|---|---|---|---|---|---|
| | (%) | (days/year) | | | | | factor | |
| 1995 | 24,2 | 6,9 | | | | | 9,9 | 31 |
| 1999 | 26,8 | 7,9 | 3,5 | 4,4 | 0,1 | 8,2 | 10,1 | 44 |
| 2001 | 23,3 | 6,6 | 2,7 | 3,5 | 0 | 8,5 | 10,3 | 47 |
| 2002 | 14,5 | 5 | 2,9 | 1,7 | 0 | 8,4 | 10,3 | 52 |
| 2003 | 26 | 8,5 | 2,9 | 4,1 | 0,4 | 8 | 10,1 | 55 |
| 2004 | 24,7 | 7,9 | 2,7 | 3,1 | 0,1 | 8,1 | 10,3 | 62 |

APA=total amount of physical activity, PAI=Physical Activity Indicator, WFPI=Worksite Fitness Program Indicator, PA freq = frequency of leisure time physical activity (times / week), WFP freq = frequency of WFP-activity (times / week), CPA freq = frequency of commuting physical activity (times / week), APA = total amount of physical activity (minutes / week), pass. = passive, act.ls. = active lifestyle, heap = physical activity for health, fs = fitness-sport activity group, MSD = musculo-skeletal disiorders, CVD = cardiovascular diseases, WAE = work ability estimation (scale 0-10), WFPE = Worksite Fitness Program Events activity.

The results in table C-1. show reasonable low level of physical activity (PAI), good level of activity in WFP (WFPI) and average to low-average level of physical fitness (PFI).

Table D-1. Main results of fitness testing protocol in Case D during 2003-05. In table the amount of tested persons and average results of different measurements and questionnaires are presented. BMI=body mass index, PAI=Physical Activity Indicator, WFPI=Worksite Fitness Program Indicator, TFV=Total Fitness Value and PFI= Physical Fitness Indicator, WAE=Work Ability Estimation, APA=total amount of physical activity, HEPA = physical activity for health.

| | | male | female | particip. | age | BMI | abd's | WTI |
|---|---|---|---|---|---|---|---|---|
| | | (n) | (n) | % of staff | | | | |
| | | n | n | % | mean | mean | mean | mean |
| Test-1 | 2003 | 6 | 50 | 51,4 | 44,5 | 24,8 | 20,1 | 97,4 |
| | 2004 | 4 | 38 | 38,2 | 45,9 | 24,4 | 20,3 | 102,2 |
| | 2005 | 7 | 45 | 43,0 | 44,1 | 25,2 | 17,9 | 99,1 |
| Test-2 | 2003 | 10 | 56 | 82,5 | 46,0 | 25,1 | 17,8 | 88,4 |
| | 2004 | 5 | 24 | 35,4 | 44,8 | | | |
| | 2005 | 5 | 20 | 30,5 | 46,2 | | | |
| Control-1 | 2003 | 5 | 37 | 48,8 | 40,9 | 23,7 | 18 | 93,6 |
| | 2005 | 3 | 33 | 37,9 | 40,3 | | | |
| Control-2 | 2003 | 6 | 29 | 24,1 | 40,9 | 23,7 | 17,6 | 100,5 |
| | 2005 | 6 | 13 | 13,0 | 43,9 | | | |

| | | Est. | Est. | TFV | PFI | sick | WAE | |
|---|---|---|---|---|---|---|---|---|
| | | abd's | WT | | | leaves | | |
| | | mean | mean | mean | % | days/year | mean | |
| Test-1 | 2003 | 4,0 | 2,7 | 3,1 | 66,1 | 3,4 | 8,3 | |
| | 2004 | 4,6 | 3,1 | 3,9 | 85,7 | 4,1 | 8,3 | |
| | 2005 | 3,9 | 2,9 | 3,5 | 71,2 | 3,6 | 8,3 | |
| Test-2 | 2003 | 3,9 | 2,3 | 3,0 | 56,1 | 6,5 | 8,1 | |
| Control-1 | 2003 | 3,7 | 2,6 | 3,0 | 54,8 | 2,0 | 8,6 | |
| Control-2 | 2003 | 4,5 | 3,0 | 3,8 | 77,1 | 5,7 | 8,5 | |
| | | APA | passive | ctive lifesty | HEPA | fitness-sports | PAI | WFPI |
| | | min/week | % | % | % | % | % | % |
| Test-1 | 2003 | 170,2 | 12,5 | 53,6 | 33,9 | 0 | 33,9 | 64,3 |
| | 2004 | 178,1 | 9,5 | 59,5 | 26,2 | 4,8 | 31 | 57,1 |
| | 2005 | 202,5 | 3,8 | 61,5 | 28,8 | 5,8 | 34,6 | 63,5 |
| Test-2 | 2003 | 116,4 | 18,2 | 63,6 | 18,2 | 0 | 18,2 | 33,3 |
| Control-1 | 2003 | 189,3 | 11,9 | 54,8 | 31 | 2,4 | 33,3 | 52,4 |
| Control-2 | 2003 | 155,4 | 17,1 | 31,4 | 45,7 | 5,7 | 51,4 | 57,1 |

The results in table D-1. show reasonable low level of physical activity (PAI), good level of activity in WFP (WFPI) and average to average to high level of physical fitness (PFI).

Table D-2. Main results of fitness testing protocol in Case D in male and female in different age groups. In table the amount of tested persons and average results of different measurements and questionnaires are presented. For abbreviations see table D-1.

| | | n | age | BMI | abd's | WTI | Estim. abd's | Estim. WTI | TFV | PFI |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | Mean | Mean | Mean | Mean | Mean | Mean | % |
| male | under 40y | 22 | 33,4 | 25,7 | 21,1 | 85,7 | 3,3 | 2 | 2,7 | 38,9 |
| | over 40y | 16 | 50 | 27,8 | 15,8 | 81,2 | 3 | 2,1 | 2,5 | 21,4 |
| female | under 30y | 29 | 25,1 | 22,3 | 19,1 | 94,6 | 3,5 | 2,6 | 3,1 | 55,2 |
| | 30-39y | 52 | 35 | 24,3 | 18,6 | 92,9 | 3,6 | 2,5 | 3,1 | 55,8 |
| | 40-49y | 50 | 44 | 23,7 | 16,9 | 98,7 | 4 | 2,9 | 3,5 | 68 |
| | 50-59y | 76 | 54,7 | 24,9 | 18,7 | 97 | 4,6 | 2,8 | 3,8 | 76,3 |
| | | | | | Physical Activity Group | | | | | |
| | | Sick leaves | WAE | APA | P | AL | HEPA | FS | PAI | WFPI |
| | | Mean | Mean | Mean | % | % | % | % | % | % |
| male | under 40y | 4,7 | 8,5 | 154 | 17 | 56 | 17 | 11 | 28 | 50 |
| | over 40y | 2 | 8,3 | 158 | 29 | 50 | 14 | 7 | 21 | 36 |
| female | under 30y | 2,9 | 8,8 | 239 | 0 | 41 | 52 | 7 | 59 | 62 |
| | 30-39y | 7,4 | 8,5 | 140 | 13 | 63 | 23 | 0 | 23 | 52 |
| | 40-49y | 3,5 | 8,3 | 158 | 20 | 38 | 40 | 2 | 42 | 54 |
| | 50-59y | 4,6 | 8,1 | 146 | 7 | 67 | 26 | 0 | 26 | 49 |

Table D-2 demonstrates the differences between male and female; female were more active and in better shape. The difference in PFI was statistically significant (Pearsson Chi-Square test value 14,29, $p<0,001$).

## *Appendix 5. Indicators of IC in case companies*

Case A.

| **Indicator** | **Formula** |
|---|---|
| **Human capital** | |
| Work Ability Estimation (WAE) | Mean of self-estimation of work ability on a scale 0-10, where 10=best work ability and 0=unable to work |
| Education (%) | Percentage of training from total working time. Includes time for all staff development, orientation, mentor-activity, internal and external |
| High level competence % | Competence of employees is estimated during employee-superior discussion on a scale 1 to 5 (basic skills to developing expert). Indicator in company level is calculated as a percentage of those reaching level 3-5 from all staff. |
| **Structural Capital** | |
| On schedule | Average of time spent in all projects during year, calculated with formula: (time spent in project / planned time) x 100, unit is %. |
| Staff turnover | Yearly turnover of the staff, % of employees. |
| Customer work distribution | Time spent in customer work, % of all yearly work time |
| | |
| **Relational Capital** | |
| Customer value index | Customer satisfaction index of main client (20-30 persons a year), mean on the scale of 1-5. |
| | |
| Project feedback | Mean of feedback (scale 1-5) on developmental projects. |
| Maintenance feedback | Mean of feedback (scale 1-5) on maintaining work. |

Case B.

| **Human Capital** | |
|---|---|
| Job career | Average duration of work career in permanent employees. |
| Competence in project management (CPM) | Competence of employees is estimated during employee-superior discussion on a scale 1 to 5 (basic skills to developing expert). Indicator in company level is calculated: CPM=3xn_level3+4xn_level4+5xn_level5, where n=amount of employees in different levels. |
| Competence in maintaining work (CMW) | Competence of employees is estimated during employee-superior discussion on a scale 1 to 5 (basic skills to developing expert). Indicator in company level is calculated: CMW=3xn_level3+4xn_level4+5xn_level5, where n=amount of employees in different levels. |
| Staff training | Percentage of training from total working time. Includes time for all staff development, orientation, mentor-activity, internal and external training. |
| **Structural Capital** | |
| Time spent in projects | Average of time spent in all projects during year, calculated with formula: (time spent in project / planned time) x 100, unit |
| Productivity of system work | Work amount of a project (h) / amount of done ”function points (ftp)”, value is h / ftp. The ftp are calculated by project managers with special software. |
| Customer work | Time spent in customer work, % of all yearly work time |
| **Relational Capital** | |
| Customer benefit | Feedback index got from yearly interviews of customers management. Mean of scale 1-5. |
| Project feedback | Mean of feedback (scale 1-5) on developmental projects. |
| Maintaining feedback | Mean of feedback (scale 1-5) on maintaining work. |

Case C.

| **Human Capital** | |
|---|---|
| Work ability | Mean self assessed of work ability estimation of 0 to 10, collected with Physical Activity Questionnaires |
| Health factor | Mean of calculated Health Factor (range 3-15), collected with Physical Activity Questionnaires |
| Sick leaves | Mean of self-reported sick leave days / year, collected with Physical Activity Questionnaires |
| **Structural Capital** | |
| Waste | % of the raw material that has been wasted during production. |
| Efficiency | Effective production time (%) compared to the total time in use. |
| **Relational Capital** | |
| Complaints (%) | Refunds paid to the customers because of quality (e.g.) failures, % of total sales. |

Case D.

| **Human Capital** | |
|---|---|
| Staff training | % of whole working time spent in official staff training in year, from |
| | administrative payroll database |
| Competence self-estimation | Employee survey, Likert scale 4=poor, 10=excellent of self-estimation of competence in present job, mean of answers |
| Job career | Mean duration (years) of job career in permanent employees. |
| **Structural Capital** | |
| Job satisfaction | Employee survey, Likert scale 1=very unsatisfied, 5= very satisfied, % of answers in “very satisfied” and “satisfied” categories |
| Social relationships | Employee survey, Likert scale 4=poor, 10=excellent of social functions at worksite, mean of answers |
| Satisfaction to management | Employee survey, Likert scale 1=very unsatisfied, 5= very satisfied, % of answers in “very satisfied” and “satisfied” categories |
| Process time | Mean time (days) to finish two most important customer processes. |
| **Relational Capital** | |
| Service feedback | Customer survey, Likert scale 4=poor, 10=excellent of service got, mean of answers |

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