



Intellectual capital in service- and product-oriented companies

Intellectual
capital

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Abstract

Purpose – As service companies are occupying an increasingly significant place as drivers of economic growth, there is a pressing need to understand their peculiarities in order to facilitate their effective management and governance. One important area in which this kind of understanding is lacking is intellectual capital (IC) and knowledge management. Although intellectual capital has become the key value driver for all types of organizations, there is a lack of systematic research on whether there are fundamental differences in the IC of service-oriented versus product-oriented companies. In an attempt to bridge this gap the paper aims to examine the main differences in IC stocks, creation, management and protection mechanisms between service-oriented and product-oriented companies.

Design/methodology/approach – The analysis is based on empirical evidence collected from 418 respondents representing HR and R&D functions in 335 Finnish companies.

Findings – The results demonstrate that service-oriented companies possess more human capital and renewal capital, and focus more on IC creation than product-oriented companies. In addition, IC protection is stronger in product-oriented companies. As companies move towards a service orientation they need to change their approach to IC stocks and management, and in this acknowledging the differences between a service and a product orientation is the first step.

Originality/value – The results presented in this study shed new light on the differences between service-oriented and product-oriented companies in terms of the possession, management, creation and protection of intellectual capital.

Keywords Intellectual capital, Services, Stocks, Surveys, Finland

Paper type Research paper

1. Introduction

Nowadays the creation of economic value is based largely on intangible resources and capabilities, i.e. intellectual capital (IC) (Drucker, 1993; Grant, 1996; Stewart, 1997; Sveiby, 1997; Edvinsson and Malone, 1997). Although this applies specifically to the production of goods in which underlying knowledge and innovations play a major role, it is also true that IC has an inherent role in the service sector. Services comprise an increasingly larger proportion of productive activities in industrialized countries – even to the extent that we are said to live in a service-based economy (Coombes and



Miles, 2000; von Stamm, 2003; Chesbrough and Spohrer, 2006). Thus, understanding the role and features of intellectual capital in the field is essential.

Although there is some debate over whether there is any point in trying to separate products and services in an environment in which they easily become intertwined (Vargo and Lusch, 2004; Edvardsson *et al.*, 2005; Rust and Chung, 2006; Hurmelinna-Laukkanen and Ritala, 2010), making certain distinctions seems to facilitate deeper analytical examination of services. The key characteristics of service activity as opposed to the manufacturing of products include the following (e.g. Fitzsimmons and Fitzsimmons, 2000; Chesbrough and Spohrer, 2006; Grönroos, 2006; Namasivayam and Denizci, 2006; Maula, 2007; Ritala *et al.*, 2009):

- close interaction between the supplier and the customer in co-producing the service;
- simultaneity of production and consumption (real-time production);
- the multi-faceted nature of the knowledge created and exchanged (heterogeneity);
- the combination of knowledge into useful systems;
- exchange as processes and experience points;
- the impossibility of storage (i.e. perishability);
- the exploitation of ICT and transparency; and
- intangibility.

In sum, these factors mean that service industries are heavily reliant on knowledge work, and the role of IC as a value driver is likely to be especially important in this sector. It could therefore be claimed that its role is different in service and non-service industries – even if there are bound to be variations depending on the type of service (Edvardsson *et al.*, 2005). For example, the manufacturing of products is often a highly automated activity (non-service oriented business), whereas providing consultancy services is labor-intensive, and requires real-time knowledge work (service-oriented business) (Nijssen *et al.*, 2006). Although both types of activity require highly specialized knowledge and skills, the latter is much more dependent on tacit knowledge, and on organizational as well as individual skills and capabilities. These differences matter in terms of possessing, managing, building, and protecting a firm's stock of IC.

However, there has been very little research on the particularities of IC in the service sector. Relatively few studies have focused on its components in specific areas: Engström *et al.* (2003) investigated the evaluation of IC in the hotel industry, Bontis and Fitz-enz (2002) examined human capital in financial service companies, Chang and Birkett (2004) studied the management of competence in a professional service firm; and Ordonez de Pablos (2004) looked at relational capital in the banking sector. There are even fewer studies examining IC in service industries more generally. Our literature review identified only three that have been published: Namasivayam and Denizci (2006) discuss the role of human capital as a part of the IC of service industries, Bontis *et al.* (2000) examine the build-up of IC in service vs non-service industries in Malaysian companies, and Lim and Dallimore (2004) focus on management attitudes towards IC in service companies. Even these sources lack explicit discussion on the distinct

characteristics that service provision might entail. There is thus a great need for studies clarifying the differences between service-oriented and non-service-oriented (i.e. product-oriented) firms with respect to the role of IC.

Our aim in this study is to bridge some of this gap in the extant knowledge through an empirical analysis of the main characteristics of IC in service-oriented versus product-oriented companies. We acknowledge the fact that some services may be as different from others as they are from products (Edvardsson *et al.*, 2005), but we chose to concentrate on comparing products and services in general instead of trying to pinpoint the finer distinctions. We therefore address the following key questions:

- What are the main differences between the IC stocks of service-oriented vs. product-oriented companies?
- How do IC creation, management, and protection mechanisms differ in service-oriented vs product-oriented companies?

Our analysis is based on a quantitative dataset of 335 Finnish firms of different size representing various service and non-service industries. Given that almost all industries, to some extent, generate (a proportion of) sales from services, we used a relative measure of service orientation (the relative contribution of services to the total amount of sales in each firm in the sample) rather than distinguishing between service- and product-oriented industries from the beginning. This helped us to avoid too much simplification with regard to the different industries. The ICT industry is a good example. Although many firms in the sector sell software (which could be considered a product), some offer it as a service over the internet, providing a tailored and constantly maintained commodity (Hurmelinna-Laukkanen and Ritala, 2010). Thus the way in which turnover is divided among the two sources of revenue provides suitable information for our purposes.

As Finland is a highly advanced and internationally competitive knowledge-based economy according to both international competitiveness surveys (World Economic Forum, 2006, 2007; World Bank, 2007) and international comparative IC studies (e.g. Andriessen and Stam, 2005; Bonfour, 2005; Stähle and Bounfour, 2008), we believe that the national setting of Finland enabled us to examine the crucial features concerning IC in companies and that our results could also provide an interesting benchmark for other countries.

2. The static and dynamic views on IC: stocks and activities

The key approaches to intellectual capital can be classified as the static and the dynamic. Whereas the focus in the static approach is on IC as a collection of stocks controlled by the firm, the dynamic approach concerns the activities through which it is created, managed and coordinated (Meritum Project, 2002; Kianto, 2007). This study makes use of both approaches in order to enhance understanding of the peculiarities of IC in service- and production-oriented companies. In the following, we shortly review both views on IC and suggest a framework that forms the basis for the empirical inquiry.

2.1 IC stocks

The literature on IC spans a multitude of classifications of intangibles, but the emerging standard in the research seems to be a division into three main categories,

most frequently labeled human capital, structural capital and relational capital (Bontis, 1998; Bontis *et al.*, 2000; Edvinsson and Malone, 1997; Roos *et al.*, 1998; Stewart, 1997; Sveiby, 1997; Meritum Project, 2002).

First, human capital comprises the knowledge, education, skills and characteristics of the members of the organization (see, e.g. Edvinsson and Malone, 1997; Meritum Project, 2002). It thus stands for the abilities of organizational actors to take skilful action and thereby produce value for the firm. Human capital is not owned or even controlled by the firm in the strict sense, since it can be said to walk out of the company door each night when the working hours end or as employees change jobs (e.g. Grant, 1996; Spender, 1996; Roos *et al.*, 1998). However, human capital is generally considered as the most significant element of IC: nothing can actually happen in the firm without it. In terms of requirements for human capital, service production tends to demand multi-faceted and complex knowledge to a greater extent than the production of tangible products, which leads us to propose that the role of human capital could be more crucial in services. Moreover, Namasivayam and Denizci (2006) suggest that service industries require more attention to be paid to employee characteristics (such as creativity and emotional intelligence), as these have a large impact on consumers' perceived value.

Second, structural capital of the organization is defined as the knowledge that stays in the firm when members of staff leave (e.g. Roos *et al.*, 1998; Meritum Project, 2002). The proneness to outbound leakage of knowledge makes it necessary to distribute individual employee knowledge and skills to the level of the whole organization through knowledge codification and transfer processes (Nonaka, 1994; Szulanski, 2003). Structural capital falls into two categories. It includes the outcomes and products of knowledge conversion, such as documents, databases, process descriptions, and the intellectual properties of the firm such as patents, copyrights, trade secrets, and trade and service marks. On the other hand, it includes infrastructural assets comprising the context in which the organizational activities take place. Thus, structural capital represents both the context and the outcome of human capital. As far as the differences between service- and production-oriented companies are concerned, one important feature of services is their real-time/one-off and perishable nature. In other words, they are mostly impossible to store and accumulate, unlike physical products. The impossibility of storage could imply that structural capital is somewhat more important for production-oriented companies. Then again, the exploitation of ICT is prevalent in services, and ICT systems could therefore be more prominent in service companies.

Third, relational capital refers to the ability of an organization to interact in a positive manner with the external stakeholders and thereby to actualize the wealth-creation potential of human and structural capital. It includes resources related to the firm's external relationships, such as its connections with its customers, suppliers, partners, and the local community, and the knowledge embedded in these relationships (Sveiby, 1997; Edvinsson and Malone, 1997; Bontis, 1998). Generally it is considered that customer relationships are the crux of this type of capital, even though the increased prevalence of networking, such as collaborative R&D (Powell, 1998) and university-industry interaction (Hong *et al.*, 2007), emphasizes the role of other external parties in companies' value-creation capacities. It would seem that relational capital is potentially more significant for service- than for production-oriented companies in that

the former generally need to customize their customer offering to a greater extent in order to satisfy demand, and the typically closer interaction between the supplier and customer in co-producing the service poses larger demands in terms of mutual understanding and relationship quality (Tether and Tajar, 2008; Hurmelinna-Laukkanen and Ritala, 2010).

Fourth IC stock category, less frequently mentioned in extant research but yet particularly relevant in the context of services, is renewal capital, which comprises the resources related to organizational growth and long-term research and development (Bontis, 2004). It indicates how well the organization can respond to future challenges and to radical changes in the market (Edvinsson and Malone, 1997). As organizations have to survive in turbulently and unexpectedly changing environments, renewal capital has become “the new bottom line” of IC (Edvinsson, 2002). This dimension is closely linked to the balanced scorecard dimension of learning and renewal (Kaplan and Norton, 1992). Given the fact that the main mechanism for building new knowledge assets is learning (Argyris, 2002), renewal capital as an intangible asset, seen from a static perspective, could be characterized as the actualized learning capability of the firm. It thus represents how well the organization can utilize its human, structural and relational capital in order to foster continuous learning, innovation and development, and to sustain its competitiveness even in changing conditions. This suggestion is in line with the general literature on dynamic capabilities (e.g. Teece *et al.*, 1997; Eisenhardt and Martin, 2000). The ability to learn and to develop offerings according to changing customer demands might happen in faster cycles, more unexpectedly, and in smaller fractions with services than with products. This could imply that rapid learning, and therefore renewal capital, is more emphasized in service-oriented companies.

In sum, the IC stocks examined in this paper include human capital (employee skills and experience), structural capital (efficiency of internal functions), relational capital (firms’ external relationships) and renewal capital (skills for learning and development).

2.2 IC activities

The IC stocks of a company cannot really constitute notable advantages unless they are used (Penrose, 1959; also, e.g. Eisenhardt and Martin, 2000, on the need to use resources to create competitive advantages). Thus, in order to generate sustained value companies need to have the appropriate activities in place for creating, managing, and protecting them (Meritum Project, 2002). Whereas the static approach to IC discussed in the earlier section concentrates on evaluating the stocks of existing intangibles, the dynamic approach is mandatory in terms of understanding how these stocks are utilized in the daily activities of the firm for the purpose of value creation, how they are created, modified and rejuvenated, and how they are protected against imitation in the hands of competitors. Thus, the focus is not on the stocks of IC *per se*, but on the organizational activities and capabilities that leverage, develop, change and protect them. When considering IC activities, we focus specifically on IC creation, management and protection.

First, IC-creation activities include the organizational capabilities and processes that allow for continuous learning and innovation within the firm. In a turbulent environment in which IC stocks (should) evolve according to the changes from inside and outside the firm, activities for creating, modifying, developing and renewing them

are crucial for sustained competitiveness (Teece *et al.*, 1997; Eisenhardt and Martin, 2000; Kianto, 2007). There are differences between firms in such activities, depending on their intellectual capital in the form of process development, problem-solving skills, social interaction between different organizational actors, group learning, and innovation ability (Robinson and Kleiner, 1996; Stähle and Grönroos, 2000; Voelpel, 2002; Pöyhönen and Smedlund, 2004; Smedlund and Pöyhönen, 2005; Cegarra-Navarro and Rodrigo-Moya, 2005; Tidd *et al.*, 2005). Thus, the means by which intellectual capital is created can in itself be defined as a form of intellectual capital. Here it is especially important to understand the difference between the outcomes (e.g. improved employee competence as a part of human capital or number of patents as a part of structural capital) and the IC-creation activities as the tools for bringing about these outcomes. For some reason, however, learning and innovation capabilities have received very scant research attention in the field of IC (Kianto, 2008a). According to Namasivayam and Denizci (2006), creativity and flexibility improve value delivery to customers in service industries. Therefore, in the context of this study, it could be suggested that IC-creation activities are especially important for service-oriented firms.

Second, in addition to being created and modified, IC stocks need to be consciously managed if they are to deliver their optimal value. IC management comprises the strategic planning and implementation activities related to intangibles, and its explicit goal is the improvement of the companies' value-creation capacities (Wiig, 1997; Kujansivu, 2008; Marr, 2006). Several studies have shown that companies undertaking a systematic approach to IC management tend to obtain better results from knowledge-related production than those using a fragmented and haphazard style (Tayles *et al.*, 2007). As a concept, IC management is very close to the concept of knowledge management (e.g. Alavi and Leidner, 2001; Wiig, 1997; Stähle and Grönroos, 2000). Both approaches are emergent and lack widely accepted definitions, but as Kujansivu (2008) explains, whereas knowledge management only covers activities dealing with information and knowledge on the tactical and operational levels, IC management focuses on the strategic level and extends beyond information and knowledge to issues such as brands, customer relationships and business processes. In sum, IC management is a holistic concept referring to a set of various managerial activities carried out on different levels of an organization aimed at identifying, measuring, controlling and developing its intangible resources (Lönnqvist and Kujansivu, 2007; Kujansivu, 2008). As these activities would seem to be equally important for product- and service-oriented companies, and because there appears to be no previous literature on the topic, we do not expect to find differences in IC management activities.

Third, IC needs to be protected against harmful imitation in order to improve the chances of generating profit based on it: if it can be copied by others at no cost, the increasing competition will erode the revenue streams (Hurmelinna-Laukkanen and Ritala, 2010). Thus, finding the right forms of protection is a major concern for managers. In this companies can rely on intellectual property rights (IPRs), secrecy, contracting, employment legislation, HRM practices, technical means of concealment, lead-time, and tacitness (Hurmelinna-Laukkanen and Puumalainen, 2007). The nature of IC protection is bound to be different in product- vs service-oriented sectors (see, e.g. Hurmelinna-Laukkanen and Ritala, 2010). Given that services are very much dependent on IC, even to the extent that they may actually consist of it (consider, for example, knowledge-intensive business services, i.e. KIBS), the approach to preventing

imitation needs to be slightly different than in relation to products that are more technical and concrete in nature. In particular, the relevant role of personnel in services may yield differences. Prior research has suggested that the appropriability of services (i.e. the strength of protection for providing higher revenues) is quite weak in general (de Jong *et al.*, 2003), mostly due to the fact that IPRs such as patents, copyrights and design are not always applicable (Miles *et al.*, 2000; Dolfsma, 2005). As Hurmelinna-Laukkanen and Ritala (2010) note, “even if it is ‘intellectual’ property rights that we talk about, the developments covered by such rights are considered to be relatively material and concrete”. Besides, it may be that it is not only achieving IPR protection, but also monitoring the rights and executing them that are more challenging in relation to services (Andersen and Howells, 1998). Of the IPRs, trademarks may, in practice, be the only effective protection means for services, although other mechanisms may provide just as much of the necessary coverage and control. For example, although it is easy to assume that IPR protection is stronger in product- than in service-oriented firms (for the above-mentioned reasons), HRM and labor legislation may be useful forms of protection in service companies. All in all, it could be assumed that quite a wide range of protection mechanisms are in use regardless of the orientation of the firm – it is just the emphases that differ.

Figure 1 summarizes the IC stocks and activities examined in this paper. The framework echoes the argument of Robinson and Kleiner (1996) that in measuring IC one should be careful to differentiate, but yet account separately for IC as outcomes and end products on the one hand, and tools and the practices used for producing the intangible outcomes on the other. We also draw on the Meritum Project (2002) guidelines and the works of Stähle (Stähle and Grönroos, 2000; Stähle *et al.*, 2003) and Pöyhönen/Kianto (e.g. Pöyhönen, 2004; Pöyhönen *et al.*, 2004; Kianto, 2007, 2008a) recommending the inclusion of the dynamic, activity- and practice-related perspective to complement the more normatively used static view in order to gain a holistic understanding of IC.

3. Data collection, variables and methods

3.1 Survey data

The data for the study was collected in Finland in 2008-2009 by means of two structured survey questionnaires. We used the key-informant technique – the aim being to reach

IC STOCKS			
Human capital	Structural capital	Relational capital	Renewal capital
IC ACTIVITIES			
IC creation	IC management	IC protection	

Figure 1.
Elements of intellectual
capital addressed in this
research

two informants per firm. One of the surveys was directed at HR specialists and managers, and the other at R&D professionals. The questionnaires comprised partially similar questions (basic information and general matters) but most of them were different. The initial population for both surveys comprised a cross-industry sample of Finnish companies with at least 100 employees. The Amadeus database was used to identify the companies. All the eligible firms were contacted by telephone, and were asked if they were willing to participate. The inclusion criterion was the independent strategic possibility in the respondent firm to engage in human resource management (HRM) or research and development (R&D). A certain number of firms and branches were therefore excluded. Confidentiality was emphasized and a summary of the results was promised to the respondents. The HR questionnaire generated 205 responses from the 747 eligible firms (27.4 percent), and the R&D questionnaire 213 responses from the 570 eligible firms (37.4 percent). Of the total number of responses 83 came from within the same firm, resulting in an eventual dataset of 335 different firms.

3.2 Measures

The firms were divided into to classes in terms of their product or service orientation. The respondents were asked to assess the relative amount of products and services in their sales for 2007 (total of 100 percent). In order to distinguish product- and service-oriented companies we coded those reporting that at least 75 percent of their turnover came from the product category as “product oriented”, and respectively those with at least 75 percent of their turnover from services as “service oriented”. Including all the eligible answers, this resulted in 121 product-oriented companies and 48 service-oriented companies from the HR questionnaire, and 127 product-oriented companies and 51 service-oriented companies from the R&D questionnaire. In terms of our sample, this approach to defining service-oriented companies particularly useful. While there are traditional service industries included such as banking, consulting and education, many firms in the sample represent industries can be either product- or service-oriented. For example, ICT firms can offer either services or products as their main offering. Furthermore, since the sample is cross-industrial by nature, the individual industry categories in the sample are rather scantily represented, making it difficult to make statistical comparisons between industries. Concerning these reasons, the service-orientation, rather than the industry *per se*, is the focus of our analysis.

The survey questionnaire directed towards HR professionals was used to collect measures for evaluating the intellectual stocks of human capital, structural capital, relational capital and renewal capital, as well as of the intellectual-capital management and creation mechanisms. Correspondingly, the questionnaire directed towards R&D professionals was used to collect the variables pertaining to the protection of intellectual capital. The usage of a different questionnaire for the protection mechanisms follows key-informant logic: the R&D specialist/manager is the most likely person to give reliable information on issues concerning intellectual capital protection, whereas the HR specialist is better qualified to answer other questions.

With regard to intellectual capital stocks, we first carried out an exploratory factor analysis using varimax rotation in order to assure that the different IC stocks can be utilized as separate constructs in the analysis. Four factors emerged that corresponded to the theoretical categorization of human capital, structural capital, relational capital and renewal capital (see Appendix). The variables measuring IC stocks were developed

with the help of earlier literature. First, human capital was measured with questions concerning skills and competences, as well as creativity, problem-solving skills, and motivation (Edvinsson and Malone, 1997; Bontis, 1998; Meritum Project, 2002; Kianto, 2008b). Second, following the definition of structural capital as the infrastructure of as well as the outcome of firm's IC (see, e.g. Bontis, 1998; Kianto, 2008b), questions were asked about the information systems, availability of documents, and inter-function knowledge flow. Third, relational capital was assessed with questions concerning firm's linkages and collaboration with external parties and customers (see, e.g. Bontis, 1998; Kianto, 2008b). Finally, renewal capital was assessed with questions concerning learning outcomes of the firm (Edmondson, 1999; Kale *et al.*, 2000; Garcia-Morales and Llorens-Montes, 2006; Kianto, 2008b). We further tested the reliability of these four constructs, and the Cronbach's Alpha was above the acceptable threshold level of 0.70 (see Nunnally, 1978) for all categories.

The variables concerning intellectual capital management and creation mechanisms (adapted and modified from Kianto, 2008b) were also examined through exploratory factor analysis using varimax rotation. IC management was loaded onto a single factor, with questions covering both strategic planning and strategy implementation related to intangibles. Variables concerning IC creation were loaded onto two separate factors, the first one representing the strategic side of IC creation (including questions regarding company-level creative planning and learning activities) and the second one focusing more on the personnel level (including questions regarding employee-related activities in learning and IC creation). The Cronbach's Alpha for all these constructs was above the level of 0.70, except for strategic side of IC creation with an Alpha of 0.65. However, we believe that distinguishing between strategic and personnel-related sides is useful, and we thus retained the construct as reported in the Appendix.

Finally, we analyzed IC protection mechanisms utilizing the examples of the Yale (Levin *et al.*, 1987) and Carnegie Mellon (Cohen *et al.*, 2000) surveys, and the later applications (e.g. Hurmelinna-Laukkanen and Puumalainen, 2007). The perceived strength of the various mechanisms of IC protection was assessed on the following question: "during the last three years, how well have the following mechanisms protected your innovations (products, services, processes) from imitation by competitors?" A list of 25 different mechanisms followed, and the respondents rated the significance of each one on a seven-point scale. The variables were subjected to exploratory factor analysis (using varimax rotation) in order to distinguish between the different types of mechanisms. With the help of factor analysis, a total of seven mechanisms in line with the theoretical considerations were identified, namely IPRs, contracts, labor legislation, human resource management, secrecy, lead-time and tacitness (see the Appendix). The reliability for all of these constructs was above the level of 0.70.

3.3 Methods of analysis

In order to address the research questions, the statistical difference in means was tested for each construct in terms of service- and product-oriented companies. We tested the constructs for the mean differences between the two types of company by means of an independent samples *t*-test. Improvement in the normality of the distribution for several of the variables was achieved through logarithm transformation (reported in the tables in the next section). The overall results are reported in the following.

4. Results and discussion

Tables I-III report the results of the empirical investigation. Table I distinguishes between different stocks of intellectual capital, namely human, structural, relational and renewal. Human and renewal capital turned out to be higher for service-oriented than for product-oriented firms. There is a similar difference with regard to relational capital, although it does not quite reach statistical significance. The difference tends towards the opposite direction for structural capital, although not to a significant extent.

These findings are relatively easy to understand: the importance of human capital is more pronounced among service firms that rely on personnel to generate and produce the services. This is in line with Edvardsson and Olsson's (1996) notion that "it is not the service itself that is produced but the pre-requisites for the service". The finding also makes sense in light of the fact that human resource accounting (Hermanson, 1964) as an approach to the measurement and reporting of human capital has mostly been developed and used in the context of service companies, in which human capital comprises a significant proportion of the organizational value (Bontis *et al.*, 1999).

Likewise, renewal capital is needed in producing successful new services. As Nijssen *et al.* (2006, p. 242) note, "new services go hand in hand with modifications of the service delivery process and changes in frontline employees' skills." Thus, learning

Orientation		Human capital	Structural capital	Relational capital	Renewal capital ^a
Product-oriented	Mean	5.29	4.88	5.54	4.76
	<i>n</i>	94	119	109	115
	Std deviation	0.65	0.94	0.74	0.97
Service-oriented	Mean	5.57	4.68	5.76	5.06
	<i>n</i>	39	44	42	43
	Std deviation	0.82	1.08	0.76	0.96
	Mean difference	-0.28	0.20	-0.22	-0.30
	Sig. (two-tailed)	0.038	0.240	0.103	0.097

Table I.
Intellectual capital stocks **Note:** ^a Logarithm

Orientation		IC management ^a	IC creation – strategy ^a	IC creation – personnel
Product-oriented	Mean	4.22	4.79	4.93
	<i>n</i>	118	121	121
	Std deviation	1.09	0.98	0.92
Service-oriented	Mean	4.53	5.10	5.13
	<i>n</i>	44	46	46
	Std deviation	1.17	0.98	0.99
	Mean difference	-0.31	-0.31	-0.20
	Sig. (two-tailed)	0.170	0.078	0.228

Table II.
IC management and creation mechanisms **Note:** ^a Logarithm

Orientation		IPR	Contract	Labor	HRM	Secrecy ^a	Lead time	Tacitness ^a
Product-oriented	Mean	3.22	4.57	2.93	4.64	4.09	4.84	3.82
	<i>n</i>	120	122	119	122	120	121	123
	Std deviation	1.67	1.50	1.44	1.40	1.59	1.27	1.36
Service-oriented	Mean	2.35	4.91	3.33	4.21	4.00	4.58	3.43
	<i>n</i>	37	39	40	41	37	40	41
	Std deviation	1.39	1.57	1.67	1.57	1.86	1.45	1.43
	Mean difference	0.87	-0.34	-0.40	0.43	0.09	0.26	0.39
	Sig. (two-tailed)	0.005	0.220	0.149	0.101	0.545	0.286	0.082

Note: ^a Logarithm

Table III.
IC protection mechanisms

and acquiring new information is of great relevance. As for the other – although statistically insignificant – differences, structural capital surely could be considered more important for product-oriented firms, and given the need for collaboration with other organizations – most notably customers – relational capital should matter to service-oriented firms. Nevertheless, both are needed in present-day markets regardless of the orientation, and thus it is not really surprising that no differences emerged.

With regard to the activities conducted around IC, Table II illustrates the differences in terms of mechanisms for the management and creation of intellectual capital. Our analyses show that there are differences between product- and service-oriented firms in IC creation – especially on the strategic dimension.

Continuous improvement is necessary and comes quite naturally to service firms (Hipp and Grupp, 2005). This calls for learning from mistakes, thinking outside the box, and acknowledging alternative ways of proceeding. In particular, co-production with customers and real-time production create the potential for doing this efficiently. Thus, our finding seems to be quite well justified. Our results show a more significant difference for IC creation on the strategic than on the personnel level, which is understandable given the type of businesses in which service and product firms are involved. Both types of firms surely need to develop IC among their personnel, but service-oriented firms need a stronger strategic focus on its creation than product-oriented firms. This is because services are more intangible by nature, and this should be considered on the strategic level when the business and revenue logic of the firm are determined.

Finally, Table III shows the results concerning various intellectual-capital protection mechanisms. Of those examined, only IPRs and tacitness turned out to be notably different among product- and service-oriented firms: both are stronger among the former. However, HRM also comes quite close to being significant at the 10 percent level, showing a higher mean for product-oriented than for service-oriented firms. Interestingly, labor legislation, although not to a statistically significant extent, shows the opposite order of strength between product- and service-oriented firms.

The differences in terms of IPRs are attributable to the fact that – as discussed above – IPRs are largely targeted on more technology-oriented fields, and do not easily cover services. On the other hand, the higher strength of tacitness among product firms is quite interesting: it could be assumed that it would be of high relevance among service providers as a protection mechanism. However, it also creates challenges in terms of efficient communication with customers (and within the service-producing firm), which might limit its usefulness and create the pressure to codify knowledge. In any case, a product orientation may mean that some of the knowledge becomes embedded in the machinery and production processes, and some resides within the employees. Thus, the level of tacitness may increase.

Although they do not quite reach statistical significance, the differences in several other protection mechanisms are also interesting to analyze, especially in the varying differences in HRM and labor legislation between the product- and service-oriented firms. With regard to labor legislation, the need to keep key skilled employees within the service-producing firm is easy to understand. However, the higher value of HRM as an IC protection mechanism for product-oriented firms is harder to grasp. It may be, of course, that personnel turnover is not always altogether harmful for service firms: new

ideas may be fostered with the acquisition of new people with new skills. In addition, there may be something at play regarding the relative strength of HRM and labor legislation that our study has not completely captured. For example, product-oriented firms may find it more difficult to apply legal means than HRM-related means in controlling the movement of personnel. This is clearly an area for further research. It is particularly relevant given that of the protection mechanisms, HRM seems to be among the highest ranking (particularly among product-oriented firms). In general (although not statistically tested), it seems that contracts and lead-time, together with HRM, are the strongest forms of protection: lead-time seems to be slightly more important than any other form for product-oriented firms, and contracts for service-oriented firms.

5. Conclusions

In an attempt to respond to the need for more information on intellectual capital (IC) in service- and product-oriented firms and fields of business, we have discussed both the static and the dynamic approach to IC, and have provided some empirical evidence of the differences between service- and product-oriented companies in this context.

With regard to our first research question we found that different emphases were placed on IC stocks – human capital and renewal capital in particular – among the firms we compared: both forms of intellectual capital seem to be stronger among service firms. These findings are logical given the personnel-intensive nature of many services, and support the suggestions made in the earlier research on the subject (e.g. Bontis *et al.*, 1999). Furthermore, also relational capital seems to receive higher values in the service-oriented firms (although without statistically significant difference), showing that service-oriented firms are dependent on external stakeholders and especially the customers. This is in line with earlier research suggesting that collaborative and open innovation practices are especially relevant in the context of service development (Ritala *et al.*, 2009).

We also found differences with regard to IC creation and protection, providing answers to our second research question. In terms of IC creation, we found that the strategic side of it is more pronounced in service-oriented than in product-oriented companies. Personnel-related IC creation, however, was at quite similar level in both types of companies. Strategic focus on IC creation among service-oriented companies can be seen as a sign of the pronounced role of intangibles at the fundamental business strategy level in service-related businesses. With respect to IC protection mechanisms, IPRs and tacitness were found to be stronger among the product-oriented than among the service-oriented firms. This suggests that product-oriented firms are better able to utilize IPRs effectively, and that they can – unlike many service-oriented firms, efficiently embed relevant knowledge in the production and manufacturing processes. In addition, some differences (even though not statistically significant) emerged in the ranking of other protection mechanisms, which further supports the idea that service- and product-oriented firms indeed differ in the composition of their IC protection. These differences are likely to be at least partially due to the different roles of IC stocks, but the attributes of services vs. products may also have a role.

The analyses conducted in this study provide a starting point for future studies. More sophisticated analyses will follow, but so far we have been able to establish that differences do exist, and we strongly believe that acknowledging these differences is relevant in building, maintaining, and managing the IC stocks of companies in a

successful manner. As far as future research avenues are concerned, we have certain suggestions. Namasivayam and Denizci (2006) found that in services the notion of co-production and the fact that all value to the consumer is transferred through frontline employees place the emphasis in the measurement of human capital on a specific set of factors. They consequently suggest that human-capital metrics for service industries should be modified to suit their specific value-creation and delivery characteristics. Akin to this rationale, it might be that service-oriented companies would mostly benefit from a specific set of IC metrics, rather unlike those suited to production-oriented companies. We found in this study that the IC categories in themselves, of both the static and dynamic variety, seemed to generate meaningful data for both types of companies. However, in order to make the metrics more relevant to organizations (cf. Marr, 2006), it might be useful to further develop industry-specific indicators. This is one potential area for future research. Another area for future research is to further improve and develop the metrics used in this study to capture better the differences in static and dynamic IC between service- and product-oriented companies, since significant statistical differences were not reached for all the IC categories in this study. Furthermore, interesting research could also be conducted on the differences in levels of service-orientation in different industries.

In terms of practical implications, it can be said that as many companies are reorganizing themselves to become “solution providers” or more service-oriented companies in general, they need to accordingly change their approach towards different stocks of IC – and IC management, creation and protection: The found differences clearly support this. Within the new product/service balance, traditional product-oriented management models do not necessarily apply as well as before. In particular, the role of personnel’s skills is pronounced, together with the capability to efficiently and continuously create new intellectual capital. Future studies linking the alignment of service-/product-orientation to static and dynamic elements of IC and performance of the companies likely reveal more on the issue, but already acknowledging the differences is a good starting point for finding appropriate approaches and making viable managerial choices.

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Construct items and Cronbach alphas	Theoretical references
<p><i>Structural capital (Cronbach Alpha 0.72)</i> The different units and functions (e.g. R&D, marketing and production) understand each other well Our company has a lot of useful information in documents and databases Previously created solutions and documents are easily available Our company employs effective and functional information systems</p>	Kianto (2008b); Bontis (1998)
<p><i>Relational capital (Cronbach Alpha 0.76)</i> We get a lot of important information from external collaboration partners We collaborate extensively with external parties (e.g. customers and suppliers) to develop new solutions Customer feedback guides our activities We are well aware of our customers' needs Our company's services bring added value to our customers Our customer relationships are typically long</p>	Kianto (2008b); Bontis (1998)
<p><i>Human capital (Cronbach Alpha 0.81)</i> Our employees are good at cooperative problem-solving Cooperation within the company goes well Our employees are highly skilled in their tasks Our employees are widely regarded as the best in our sector There are great shortcomings in the expertise of our employees (R) Our employees are clever and creative Our employees truly try their best to perform well</p>	Kianto (2008b); Bontis (1998)
<p><i>Renewal capital (Cronbach Alpha 0.89)</i> The company has learnt and acquired a lot of new and important information People have acquired many important skills and capabilities Things that we have learnt have improved the performance of the organization Our company can be characterized as a learning organization</p>	Kale <i>et al.</i> (2000); Edmondson (1999); Garcia-Morales and Llorens-Montes (2006)
<p><i>IC management (Cronbach Alpha 0.88)</i> Our company utilizes many projects and practices to enhance the sharing of knowledge between employees (e.g. discussions, mentoring, job rotation) Our company employs many practices to enhance the sharing of knowledge with external parties (e.g. meetings, conferences, seminars etc.) We have a clear strategy to develop the company's skills and knowledge We have a clear understanding of what information and knowledge is the most relevant for achieving the company's goals Our company employs many programs and projects to increase the employees' knowledge and skills The company's knowledge capital is systematically assessed</p>	Kianto (2008b)

(continued)

Table AI.
 Items used to measure the variables

Construct items and Cronbach alphas	Theoretical references
<i>IC creation – strategy (Cronbach Alpha 0.65)</i>	
We aim to learn from trial and error as a source of new knowledge	Kianto (2008b)
This company encourages challenging the established ways and practices	
When planning and making decisions, we look at things from many perspectives	
<i>IC creation – personnel (Cronbach Alpha 0.84)</i>	
Our employees learn many important skills by cooperating with each other	Kianto (2008b)
Our employees learn many important things by discussing with each other	
Our employees learn many important skills by observing each other's work methods	
We make effective use of employee feedback and improvement suggestions	
<i>IC protection: IPRs (Cronbach Alpha 0.72)</i>	
Patents	Levin <i>et al.</i> (1987); Cohen <i>et al.</i> (2000)
Copyright	
Trademark	
<i>IC protection: contracts (Cronbach Alpha 0.75)</i>	
Long-term collaboration contracts	Hurmelinna-Laukkanen and Puumalainen (2007)
Non-disclosure/confidentiality agreements	
<i>IC protection: labor legislation (Cronbach Alpha 0.80)</i>	
Inter-firm contracts on not recruiting personnel from each other	Hurmelinna-Laukkanen and Puumalainen (2007)
Employees' non-competition agreements	
The legal loyalty obligation of employees	
<i>IC protection: human resource management (Cronbach Alpha 0.76)</i>	
Making personnel committed to the firm (e.g. by offering perks)	Hurmelinna-Laukkanen and Puumalainen (2007)
Small personnel turnover/minimizing it	
<i>IC protection: secrecy (Cronbach Alpha 0.71)</i>	
Using passwords	Davis (2001)
Restricting access to meetings and the firm's premises	
<i>IC protection: lead time (Cronbach Alpha 0.80)</i>	
Getting to the markets first with a new product or service	Lieberman and Montgomery (1988); Saviotti (1998)
Continuous improvements in products/services/processes	
Keeping ahead of competitors	
<i>IC protection: tacitness (Cronbach Alpha 0.89)</i>	
The fact that it is difficult for customers to switch providers	Zander and Kogut (1995)
Complexity of the product/service/process	
The fact that it is very hard to teach knowledge related to the product/service/process	

Construct items and Cronbach alphas	Theoretical references
<p>The fact that it is very hard to understand the features of the product/service/process by observing/examining it</p> <p>The fact that knowledge related to the product/service/process may not be usable in other environments</p> <p>The fact that it is not possible to document knowledge related to the product/service/process</p> <p>The fact that core knowledge related to the product/service/process is embedded in routines</p>	

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