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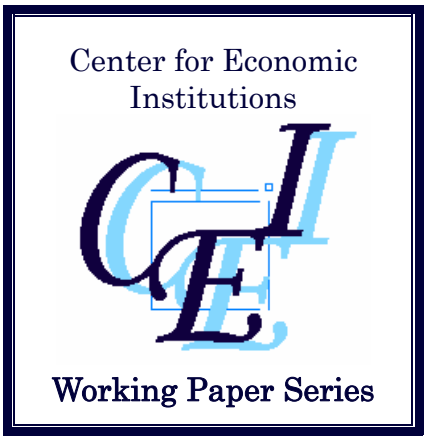

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A Survey on Intangible Capital

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ABSTRACT

This study provides a survey of topics related to intangible capital, including concepts, definitions, measurement issues, and classifications. It shows that despite the growing importance of intangible capital, we do not know enough about it and only have imperfect methods of measuring it. While at the macroeconomic level, measurement of intangibles is now available for many countries, definitional and measurement issues pose a greater problem at the microeconomic level. This study points out that researchers not only have to confront data deficiencies but also need to grapple with conceptual issues. Finally, it also provides brief surveys of studies dealing with particular detailed topics. Many of these studies prove the existence of intangible capital at the microeconomic level as well as at macroeconomic level.

JEL Classification Numbers: L23, O47

1. Introduction

Why does an economy grow (or why not)? Why does this company (or country) perform better than that? Or expressed in more commonly used terms, where does competitiveness come from? What is the main value driver in this age?

The literature on economic growth would answer these questions using similar concepts but a different expression: technological progress. In this literature, sustainable growth in the long run is possible only as a result of technological progress. In the productivity literature, a substantial part of technological progress is captured by what is labeled total factor productivity (TFP), which is the "residual" that remains once increases in conventional inputs have been taken account of. However, because TFP is simply the residual, it has also been called the "measure of our ignorance" (Abramovitz, 1956) since we do not know much about what is included in the measure. Nevertheless, as research on productivity and economic growth have continued, there is a growing consensus among scholars that the residual includes the contribution of intangible assets[1] such as R&D activity and human capital. In fact, there is a growing recognition among economists that today, intangible assets are more important than tangible assets as sources of competitiveness, sustainable growth, business success, and so on.

In the earlier stage of its industrialization, an economy grows as a result of increases in factor inputs - a process that can be observed in many developing countries. But once the growth opportunities from increases in conventional factor inputs are exploited, the only way to sustain economic growth is the continued accumulation of intangibles, because their availability is unlimited. After all, in the long run, economic activity (especially growth) can be sustained only with intellectual inputs, because physical resources are finite.[2]

In the modern economy, almost anyone can gain access to tangible capital, so that any competitive advantage based on tangible capital alone is soon eroded. In contrast, intangibles are often not as accessible as tangible capital. Wal-Mart or Dell Computer are not superior to their competitors because they possess better machines.

Academic studies that show the importance of including investment in, and the output of, intangible assets in national growth accounting include Corrado, Hulten, and Sichel (2006), McGrattan and Prescott (2005a, 2005b), and Fukao et al. (2007), who provide evidence that excluding intangibles distorts estimates of TFP, GDP growth, the value of corporate equity, and labor hours at the macroeconomic level.

There is a vast literature pointing out the importance of various types of intangible assets in a microeconomic sense as well as in a macroeconomic sense. For example, countless studies have

[1] In this survey, the terms "intangible assets" and "intangibles" are used interchangeably.
[2] Griliches (1994).

examined the role of research and development (R&D) and patents,[3] and innovation as a wider concept has been a central issue of much research. Another central aspect in this context is human capital,[4] while organizational capital is an issue that has received attention only more recently.

Intangible assets play an important role in a wide range of areas. However, the study of intangibles faces various challenges, because of their inherent characteristics, that is, they are intangible and difficult to conceptualize and measure. Against this background, the purpose of this survey is to provide an overview of the literature on intangible capital.

The following sections therefore attempt to provide a definition of intangible assets, discuss the measurement issues involved, consider the classification of various types of intangible assets, review the results of previous studies, and consider open issues which need to be researched in the future.

2. Definition

It is not easy to define intangible assets in a few words. One of the reasons lies in their intangibility, which makes it difficult to conceptualize and measure them. Another reason is that what is meant by intangible assets and what is or is not covered by them differs from author to author, study to study, project to project.

The *New Paradigm Initiative* launched by the Value Measurement and Reporting Collaborative (VMRC), for example, reported that it found and catalogued more than 80 value and performance measurement approaches.[5] Each of them has its own definition and covers different aspects of intangibles.

Nevertheless, it is possible to classify such definitions according to certain criteria. Here, definitions will be classified from two distinct angles. The first is the identifiability. Studies using this criterion define and limit intangibles as distinct factors with clearly indentified terms such as R&D and intellectual property, while other studies depict and analyze intangibles in terms of their function.

The second criterion is that, from what point of view intangible capital is captured and defined. The following are some typical definitions using this criterion.

EU (2003: 17) defines intangible asset as "*non-physical sources of expected future benefits*," while Lev (2001: 5) definitions them as a "*claim to future benefits that does not have a physical or financial embodiment*." And Corrado, Hulten, and Sichel (2006: 9) define investment in intangible assets as "*any use of resources that reduces current consumption in order to increase consumption in the future*."

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[3] See, e.g., Griliches (1995).
[4] Rajan and Zingales (1998) and Garicano (2000) show the importance of it.
[5] Available online at the VMRC's New Paradigm Initiative website: <http://npi.valuemeasurement.net/Downloads/Rediscover.pdf>(accessed December 4, 2007).

EU (2003) uses the term "sources," which emphasizes where such assets are located no matter to whom they belong nor who paid for them. In other words, to whose production do the intangibles contribute? This will be labeled the "resource approach." In contrast, Lev defines intangibles as a "claim," which means the intangible assets belong to the person or company to whom the profit generated by the assets is paid. This will be called the "claim approach." Finally, Corrado, Hulten, and Sichel's (2006) emphasis on "investment" means that intangible assets should be measured from the point of the person or company who invests in the intangible. This will be called the "cost approach."

To understand the different definitions, consider the example of human capital. People invest money and time in their own education. In addition, during their employment, they are educated and trained by the firm. From the viewpoint of the EU (2003) definition, the human capital resides in the company and contributes to the company's production as long as these people are employed by the company. But according to Corrado, Hulten, and Sichel's (2006) definition, the human capital is separated into two parts: one part which results from employees' own investment in their education, and another part which results from the education provided by the firm. In this case, the human capital from the personal education is counted to be the employee's, whereas, that from the firm's education belongs to the firm.

Lev's (2001) definition provides a slightly different point of view. According to his definition, employees hold the claims for the human capital which is based on their own education. This part is similar to Corrado, Hulten, and Sichel's (2006) definition. But according to Lev's definition, employees in addition have the right to be paid for the skills which are derived from the education or training provided by the firm, since even after they leave the firm, employees keep those skills and, if using them with a new employer, are paid for them.

Some of the common points of the definitions are that intangible assets are: non-physical, non-financial,[6] and provide future benefit. "Non-physical" and "non-financial" assets cover a wide range of assets from relatively easily identifiable ones such as intellectual property and software to ones that are more difficult to identify (and hence measure) such as organizational and relational assets.

"Future benefit" means that the asset is expected to contribute future performance rather than to current performance, which is most different point from the "cost" concept, because conceptually cost is expenditure paid for current period performance. This means that intangibles are expected to release capital[7] services for more than one period.

Some researchers have examined the impact of managerial practices on firms' performance, but

[6] Although EU (2003) does not explicitly exclude financial assets in its definition, the framework employed clearly does.

[7] It is a matter of debate whether intangible assets should be treated as a form of capital. See EU (2003) for a more detailed discussion.

the “cost” and “investment” concepts are not always clearly distinguished. Most studies in this field, including this survey, agree that intangible assets should be treated as a form of capital, although some studies use the term “assets” instead of “capital.”

Here, this paper reviews some of the future benefits provided by intangible capital. More detailed research on such benefits is found in Young (1998).

2.1. Growth in knowledge

In modern economies, the focus of growth and competition has shifted from tangible to intangible assets, especially knowledge, giving rise to the term “the knowledge economy.” Not only do new entrants require knowledge to enter a particular field, but incumbent firms also have to invest in knowledge to remain competitive. Kariya (2005) points out that what really creates value is the intangible input (especially knowledge) attached to or embedded in goods, not the physical goods themselve, and that this phenomenon has a long history.

Neo-classical economic theory argues that economic growth and increases in productivity are largely attributable to technical change and increasing efficiency. Much of the technical progress may result from formal and informal R&D activities, as Griliches (1994) points out. Endogenous growth theory regards this growth of knowledge as a main factor for growth (Romer, 1990). One may observe that most enterprises (and even countries) are eager to discriminate their goods from others by differentiating them through ideas, knowledge, or services (organizational output).

Conceptually, “knowledge” can play two distinct roles. First, it can serve as an input factor that is directly used in production, for example in the form of technology resulting from R&D, in the form of software or a database used in the production of services, and so on. Second, knowledge contributes to the efficiency of production (but is not directly an input) by integrating the various inputs.[8] Most human resource management practices are an example.

2.2. First-mover advantage

Mueller (1997) identifies the first-mover advantage in detail. Tangible capital also generates this kind of advantage. But it is easy to imitate meaning that the advantage is not kept long. Intangible investment and the advantage from it are often firm-specific and hard to copy, because various intangible investments work together and interact in complex ways.

2.3. Non-rivalry and network effects

The “non-rivalry” of intangibles is one of the most characteristic aspects of intangible capital.

[8] An example of a study employing this approach to analyze organizational capital is that by Prescott and Visscher (1980).

Technology generated by R&D in a firm is used in a plant of the firm without excluding other plants of the firm from using the same technology. This opens the possibility of internal scale economies. In addition, many researchers have found that knowledge can generate positive externality effects with regard to knowledge in other areas, that is, there are spillovers of knowledge between different areas.

Network advantages arise when one's benefit from being part of a network increases with the number of other persons or enterprises who are connected to it. Put differently, networking leads to "snowball effects." Lev (2001) argues that investment in intangibles is key for this network effect. This effect is easily found in many web-based services, such as Google and Yahoo!.

3. Approaches to the Measurement of Intangible Capital

In the previous section, different definitions and approaches were described. One of these is the investment approach,[9] which is the most common one in the macroeconomic measurement of intangible capital and measures the quantity of resources devoted to some specific area.

Another approach is the performance approach. This considers intangible capital as an input, inserts this into a production function, and then measures how intangibles contribute to production. An example of this approach is the study by Lev and Radhakrishnan (2003). However, this approach has some weaknesses. For example, to implement this approach, information on the stock of each type of intangible capital is required, but most of the data available are on flows, not stocks. Another potential problem is that we have to assume a specific functional form of the production function. Thus, this approach can measure the contribution of intangibles, but in general is not a way to measure the intangibles themselves.

A third approach is the market valuation approach. This is based on the assumption that the market values the intangibles of a firm efficiently, thus making it possible to estimate the value of the intangibles. But as in the case of the performance approach, the market valuation approach requires information on stocks. Another weak point is that it can be applied only to listed companies.

In addition to these three major approaches, other ones can be found that, for instance, use direct surveys or score boards to measure intangibles. The discussions on the classification of intangible capital and measurement methodologies introduced in the following section are based on the investment approach, because this approach is closest to the System of National Accounts.

4. Classification

[9] Some call this the cost approach. But as described above, cost is for the current period performance, therefore is used up in the current period. In this sense investment is more appropriate.

There are a considerable number of studies on intangible capital, each of which suggests its own framework for measuring intangibles at the macroeconomic or the microeconomic level. The following is just selection of concepts and by no means exhaustive.[10] The earliest works on the measurement of intangibles were subsidiary to national account, so that they were designed in a macroeconomic sense, but later were extended to be applied to the microeconomic level.

4.1. Macroeconomic Level

One of the earliest works on the macroeconomic measurement of intangibles is a 1987 internal OECD memo by Kaplan which includes four major areas: (1) R&D, (2) software, (3) training, and (4) marketing. This composition is still used for the "Investment in Knowledge" section of the *OECD Factbook*.

- Young (1998)

In 1992 and 1999, the OECD held a meeting on the measurement of intangibles. In the 1999 conference "Measuring Intangible Investment," a number of papers, both on theoretical and practical issues, were presented, including Young's and Vosselman's papers.

Young (1998) in his paper presented an interim statistical framework that further develops previous versions from 1992, 1994, and 1997. It includes of (1) computer-related assets, (2) production and technology, (3) human capital, (4) organization of the firm, (5) external assets (marketing and sales), and (6) industry-specific assets.[11] He provides concrete criteria and a checklist for situating intangibles in an investment framework. Each intangible investment is examined and classified into a corresponding conceptual category based on six criteria, that is, (a) who produces the goods which are used for the intangible investment, (b) what is the production activity (c) what is the investment product, (d) who invests, i.e., who pays for the investment, (e) what performance is improved with the investment, and (f) who owns the right to the intangible capital which is formed by the investment. As an example, consider a piece of software designed to control a machine manufactured by a machine tool company. The answer to the above questions then would be: (a) the software is developed by a software company for the machine tool company. (b) The production activity is the writing of software. (c) The investment product is the software. (d) The investor is the machine tool company. (e) The performance of the machine is improved. (f) The right to the software belongs to the machine tool company.

- Vosselman (1998)

[10] The purpose of this survey is to provide a conceptual overview, so that this section does not report the value of intangibles measured in each of the studies. See Jarboe (2007) for concrete measurement results.

[11] Young suggests that non-producing rights, such as milk quotas, be excluded.

Vosselman (1998) suggests a similar but slightly different framework. He categorizes intangible assets into two types, that is, core elements and supplementary categories. Core elements include (1) R&D, (2) education and training, (3) software, (4) marketing, (5) rights including licenses, brands, copyrights, and patents, and (6) mineral exploration. Other intangible investments are categorized into supplementary categories.

- Van Ark (2004)

Van Ark (2004) proposes a general framework which was developed based on Vosselman (1998) and Young (1998). This suggests that information and communication technology (ICT) capital is conceptually an intangible asset, but is classified as part of physical capital because software is already added to capital in the System of National Accounts. In addition, he distinguishes between narrowly-defined and more broadly-defined intangible capital, with the former including human capital and knowledge capital. More broadly-defined intangible capital consists of those aspects that help in the search process for new technologies, including organizational capital, the marketing of new products ("customer capital"), and social capital. Social capital refers to the features of social organization such as trust, norms, and networks. Although van Ark does not deal with social capital further, he includes it in the conceptual framework since he regards it as improving the efficiency of society.

- Corrado, Hulten and Sichel (2006)

Corrado, Hulten and Sichel (2006) equate intangible assets with "knowledge capital" and categorize them into three groups: (1) computerized information, (2) innovative property, and (3) economic competencies, mainly guided by the measurability and the purpose to expand the current accounting framework. Specifically, (1) computerized information consists of business investment in computer software, while (2) innovative property includes scientific and non-scientific R&D. According to their calculation, by the late 1990s, investment in non-scientific R&D was as large as that in scientific R&D. Finally, (3) investment in economic competencies includes spending on strategic planning, spending on redesigning or reconfiguring existing products in existing markets, investments to retain or gain market share, investments in brand names, and investment in firm-specific human capital and structural resources.

They found that in the U.S., total business investment in intangibles was approximately one trillion dollars in 1999, roughly the same amount as investment in tangible capital at the time. Fukao et al. (2007) have used this framework to examine intangible investment in Japan.

4.2. Microeconomic Level

- Statements of Financial Accounting Standards

Statements of Financial Accounting Standards (SFAS) 141 and 142 break down intangibles into five main categories. However, according to current accounting rules in most countries, only a very limited range of intangibles can be counted at the company level, and intangibles in these categories are counted only in the case of intangibles acquired through mergers or acquisitions. Basically, this framework is for separating intangibles from goodwill.

- Intangibles Research Center at New York University

The Intangibles Research Center at New York University proposed an aggregated scheme for categorizing intangible assets. This categorization is based on the individual enterprise and clearly intended for reporting. The main items are: (1) goodwill, (2) other marketing capabilities including advertising, (3) leaseholds, (4) franchises, (5) licenses, (6) mineral rights, (7) customer equity, and (8) distribution relationships and agreements.

Some researchers have suggested concrete methods for measuring intangibles. Examples of such methods include the Balanced Scorecard, the Danish Intellectual Capital Statement, the Scandia Intellectual Capital Navigator, the Intellectual Assets Monitor, PricewaterhouseCoopers (PwC) ValueReporting, and the KPMG Value Explorer.[12]. Many of these have been developed by consulting firms for practical purpose to help managers and investors. Two are introduced here.

- Danish Intellectual Capital Statement

A number of Swedish and Danish enterprises have experimented with reporting intangible assets. Their main objective was to "tangibilize" accumulated intangible capabilities by quantifying and reporting them for individual enterprises. Mouritsen's (1997) report is an example of this classification. But this practice is said not to be consistent with the evidence on the information currently employed for the performance evaluation of enterprises.[13]

- Edvinsson and Malone (1997); Scandia Intellectual Capital Navigator

A well-known approach to classifying intangible assets is the Skandia Navigator developed by Edvinsson and Malone (1997). This has been used mainly for the disclosure of information and continues to be used for management consulting. They concentrate on four categories: (1) human capital, (2) customer capital, (3) innovation capital, and (4) process capital.

The EU has developed several versions of a framework which is intended to be used mainly in

[12] Jarboe (2007) surveys these methods in greater detail.
[13] See Amir and Lev (1996) and Kaplan and Norton (1992, 2001).

macroeconomic measurement but applicable to microeconomic reporting. Here are some of these versions.

- EUROSTAT (2001)

EUROSTAT identified ten classes of intangible assets in its *Second European Report on Science & Technology Indicators 1997*. In 2000, it proposed its Work Programme 2000 entitled "EPROS – The European Plan for Research in Official Statistics" and clarified its classification of intangibles, resulting in the Statistical Indicators for the New Economy (SINE).[14] This classification distinguishes intangibles in terms of four domains: (1) the technology domain, (2) the industry domain, (3) the economic domain, and (4) the social domain.

- MERITUM (2002)

The EU's MERITUM (Measuring Intangibles to Understand and Improve Innovation Management) project offers one of the most widely used frameworks and includes three main categories: (1) human capital, which is defined as the knowledge that employees take with them when they leave the firm at the end of the working day; (2) structural capital, which is defined as the knowledge that stays within the firm at the end of the working day; and (3) relational capital, which is defined as all resources linked to the external relationships of the firm, with customers, suppliers or partners.

- EU (2003)

This comprehensive report divides intangible assets into three categories in terms of measurability: (1) intellectual property which is clearly identifiable and can be legally protected"] (2) separately identifiable intangible assets such as market knowledge and trade secrets, and (3) non-separable intangible assets such as management expertise. This categorization was designed mainly for microeconomic measurement and reporting.

5. Do Intangibles Yield Future Benefits?

The definitions of intangibles in Section 2 describe intangibles as non-physical sources of expected *future* benefits rather than *current* benefits. For this purpose, intangible assets should survive the current period and be found to yield to future benefits.

Here, however, a big hurdle needs to be overcome, namely the lack of a detailed understanding of the range of intangible investments. It is relatively easy to determine how long tangible capital

[14] Available online at the Statistic activities related to the intangible economy website: <http://www.ll-a.fr/intangibles/statistics.htm>(accessed December 4, 2007).

survives and provides its capital service. This is done by checking the second-hand market price of a particular investment good or by confirming the relationship between the asset and production in operation. In contrast, intangible capital is usually not (or hardly) traded in the market. Even though the investment in intangibles is observed, there is no way to measure how much is in operation in the next period.

To obtain evidence on the relationship between intangibles and future benefits, it appears that two main approaches have been employed, that is, observing the relationship between (1) intangible investment and a company's share price (which is thought of as a proxy for the sum of discounted future cash flows), and (2) intangible investment and future performance (e.g. production, productivity, ROA, etc). Griliches (1995) labeled these approaches as (1) the performance approach and (2) the productivity approach. Although some other methods have also been developed, they are not used very often.

5.1. R&D expenditure and enterprise performance

There is a large body of research that has examined the relationship between R&D expenditure and enterprise performance and has confirmed that this relationship is positive.[15] Discussed here is just a small fraction of that large body of literature.

A review of the literature is provided by Hall (2000), who points out that the stock market values R&D expenditure at multiples of between 2.5 and 8, and that this relation differs across firms and time. Griliches (1995) attributes this difference to complex effects such as technology opportunity, demand, and competition. He also suggests that private sector returns to R&D may be up to twice the rate of return to tangible investment, that a significant premium is found for basic research, and that a premium is found for enterprise-funded R&D compared to government-funded R&D. Meanwhile, Sougiannis (1994), examining the relationship between R&D activity on the one hand and profitability and firm value on the other, found that a one-dollar increase in R&D expenditure leads to a two-dollar increase in profits over a seven-year period, and that a one dollar increase in R&D expenditure produces a five-dollar increase in market value suggesting that investors place a high value on R&D investment. Finally, a host of other studies, including those by Lev and Sougiannis (1996), Chambers, Jennings, and Thompson (2002), Lev, Sarath, and Sougiannis (2005), and Penman and Zhang (2002) found that current stock returns and stock prices are associated with both annual net R&D investment and estimated R&D capital.

[15] Examples are Ben Zion (1978, 1984), Griliches (1981), Hirschey (1982), Hirschey and Weygandt (1985), Connolly, Hirsch and Hirschey (1986), Jaffe (1986), Bublitz and Ettredge (1989), Hall and Hayashi (1989), Chan, Martin and Kensinger (1990), Connolly and Hirschey (1990), Griliches, Hall and Pakes (1991), Hall (1993a, 1993b), Megna and Klock (1993), Chauvin and Hirschey (1994), Sougiannis (1994), White (1995), Lev and Sougiannis (1996), and Aboody and Lev (1998).

5.2. Intangibles other than R&D and enterprise value

Another issue concerns the relationship between intangibles other than R&D and enterprise value. The number of studies examining this subject is relatively small when compared with the vast literature on the effects of R&D. However, such studies do exist and have, for example, looked at purchased goodwill,[16] customer satisfaction measures,[17] brands, licenses,[18] and advertising expenditure.[19] These studies indicate that such intangibles also contribute to enterprise value. Hirschey and Weygandt (1985), for instance, suggest that advertising can have long-lived effects in the case of non-durable goods. Larcker and Ittner (1996) found that customer satisfaction measures are value-relevant, suggesting that non-financial measures of customer satisfaction are necessary to forecast future performance. And McCarthy and Schneider (1996) found evidence that identifiable intangibles such as brands and licenses are valued as assets by the stock market.

Studies also show that markets tend to view innovative activities as adding to enterprise value, as is shown by the impact of new product announcements on capital market returns (see, e.g., Chaney, Devinney, and Winer (1991). Bayru, Erickson and Jacobson (2001) show that product innovations significantly increase profits but that this increases do not persist. Geroski (1995) found that the benefits of first-mover advantage are less long-lived than innovations due to the speed of competitive entry into the market.

In another study, Amir and Lev (1996) found that in the cellular industry, sales, general and administrative expenses are valued as assets by stock market investors. They also found other measures of value-relevant assets, such as the population of the company's potential subscribers and the penetration ratio of subscribers to the population of potential subscribers in the cellular industry. As this brief overview illustrates, there are a large number of studies that have examined, and confirmed, the value-relevance of various kinds of non-R&D intangibles.

5.3. Organization Capital

Organization capital (which some studies refer to as "organizational structure" instead) may be the most intangible asset of a firm and it is difficult to find a clear consensus on the definition and scope of the term. Lev and Radhakrishnan (2003), for example, argue that there exists no operational way to measure organization capital. This lies mainly in the very nature of organization capital, since there is no market for it, so that it is not valued, traded, or measured.

Another aspect is that the concept and significance of organization capital is completely different at the enterprise level than it is at the macroeconomic level. Corrado, Hulten, and Sichel

[16] See Clinch (1995).
[17] See Ittner and Larcker (1998).
[18] See McCarthy and Schneider (1996).
[19] See Netter (1982), Hirschey (1982), Hirschey and Weygandt (1985), Bublitz and Ettredge (1989), Hirschey and Spencer (1992), and Chauvin and Hirschey (1994).

(2006) in their study, for example, used the revenues of the management consulting industry and the value of executives' time as a proxy for organizational structure, indicating that they conceptualize organizational capital as cost-based and close to managerial ability. Atkeson and Kehoe (2002), in contrast, define organization capital as based on plant-specific productivity and age and as acquired through learning-by-doing. However, most studies on organization capital define it as actual workplace practices at the plant or business line level, or sometimes a specific production process level.

The different definitions raise the question: what, then, should be included? Some researchers include certain managerial practices, while others do not. Black and Lynch (2005), for instance, divide organization capital into three components: workforce training, employee voice, and work design. However, whereas they exclude employment security and recruitment and selection systems, Kruse and Blasi (1998) consider these to be important components of high performance work practices. Organization capital is highly heterogeneous across workplaces and industries and it is therefore difficult to systematize. The remainder of this section provides a brief overview of the research in this field, concentrating largely on studies from a microeconomic perspective.

Some researchers focus on a very specific homogeneous production process and a thorough review of this field is provided by Ichniowski and Shaw (2003). Their review and previous studies (Ichniowski and Shaw, 1999, 2000, 2003) investigate the impact of innovative human resource management practices such as flexible job definitions, cross-training, and work teams on performance in a narrowly defined production process (mainly in the steel industry), and obtain results confirming a strong positive relationship.[20]

Further evidence on the same relationship is found in more cross-sectional research. Black and Lynch (2001, 2005), and Bresnahan, Brynjolfsson, and Hitt (2002) found a correlation between human resource management systems and business performance. Black and Lynch (2005) estimate that changes in organization capital may account for approximately 30 percent of output growth in manufacturing over the period 1993–1996 and 89 percent of TFP growth.[21]

Another topic in this research area is the impact of organization capital on wages. The evidence is somewhat mixed. Osterman (2000) and Cappelli and Cater (2000) found no impact on wages of non-manufacturing workers, whereas Black, Lynch, and Krivelyova (2004) and Cappelli and Neumark (2001) found that organization capital increases the wages of workers and supervisors in the manufacturing sector.

On the other hand, organization capital does appear to have a prominent impact on labor

[20] See also Ichniowski, Shaw and Prennushi (1995), Arthur (1994), and Kelley (1996) for more research along these lines.

[21] However, they also highlight that this may include technological change.

demand. A clear association of reduced demand for unskilled labor with a variety of measures on organization capital has been found in studies such as those by Bresnahan, Brynjolfsson, and Hill (2002), Osterman (2000), and Caroli and Van Reenen (2001). Many researchers suggest that skill-biased technological and organizational change is the main cause.

Some researchers have focused on the complementarities between IT capital (or investment) and organization capital or managerial practices. Bresnahan, Brynjolfsson, and Hill (2002), and Caroli and Van Reenen (2001), for example, found a correlation between IT capital and workplace practices, while Kanamori and Motohashi (2006) found that both centralization and decentralization have a substantial productivity effect on IT for firms that changed their decision making structure, and the negative impact on productivity was more marked for firms that conducted radical changes of decision rights.

Kandel and Lazear (1992), Lazear and Rosen (1981), Lazear (1989) and Baker, Gibbons and Murphy (1994, 2002) document that to reduce the problems arising from incentive pay schemes, some additional managerial practices are essential because of their complementarity. Boning, Ichniowski and Shaw (2001), Jensen and Meckling (1992), Che and Yoo (2001), Aoki (1988), and Carmichael and MacLeod (1993) find that multiple workplace practices work complementarily to elicit worker ideas. Studies in this field often shows that a single practice such as an incentive pay scheme or decentralized decision making does not work well by itself, thus highlighting the importance of complementarity. Such synergistic effects should be taken into account when measuring the total impact of different types of organization capital. In this context, some researchers have suggested that the existence of complementarities may be one reason why not all enterprises benefit equally from investment in IT or particular workplace practices, and accordingly, why not all enterprise invest in IT or adopt innovative management practices.[22]

6. Future Research Tasks

Much effort has been devoted to the study of intangible assets, so that our understanding has improved considerably. However, some issues remain unresolved and require further investigation. The following is a list of some of the major outstanding issues.

6.1. Aggregation problems

The first outstanding is aggregation problems. The problem arises partly from the heterogeneity of intangibles. How should managerial knowledge be added to scientific knowledge

[22] The literature highlights two possible reasons why some firms may fail to make these types of investments. The first is that such investments simply cost too much. And the second is that some types of complementary organization capital are more firm-specific than others.

generated by R&D? How should intellectual property related to patents be added to custom capital? Some intangibles may be measured only in a qualitative way. This is a problem regarding how the intangibles are horizontally summed up.

Another problem arises when macroeconomic (industry) level data are constructed by summing up the microeconomic values. Some investments are only carried out for rent-seeking. If this is the case, summing up such rent-seeking investment at the microeconomic level is not equivalent to the macroeconomic input.[23] This problem thus concerns how intangibles are vertically aggregated.

6.2. Depreciation of intangible capital

If intangibles are treated as capital, the perpetual inventory method may be applied to construct the stock of the intangibles. However, little is known about the depreciation pattern of intangibles. Moreover, intangible capital depreciates not only internally, but also externally. The appearance of a new technology may lead to the depreciation of an old technology at an irregular and unexpected speed. How and how much intangibles depreciate (or, put differently, how fast they become obsolete) is just "assumed" in most studies. One exception is Goto and Suzuki (1989), who use survey data based on responses from those directly involved in R&D activity.

6.3. Human capital

Firm specific human capital should be counted as intangible capital which belongs to the company. The general skills embodied in a person can leave the company when that person leaves the firm. In most cases, the costs involved in training a person through on-the-job and off-the-job training are not observed. What is more, human capital which is firm specific should be separated from other general skills. However, in practice, it is difficult to measure human capital, especially at the micro level.

6.4. The relationship between intangibles

Many researchers have found that there are clear complementarities between tangible and intangible investment. However, there has been little research, and hence little is known, on the interaction and complementarities between different intangibles. The relationship between intangibles must be much more complicated than the one between tangibles and intangibles. The literature on this relationship topic suggests that because of such interaction, the contribution of intangible capital as a whole is greater than the sum of the contributions of individual intangible capital items alone.

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[23] Accumulating series of rent-seeking investment may be also problematic.

7. Concluding Remarks

Interest in the role of intangible capital is not new and studies mentioning it go back as far as the 1950s. Examples are those by Abramovits (1956) and Kendrick (1956), who pointed out the measurement problem arising from the omission of intangible capital in their research on productivity. However, the explicit and systemic debate on this issue does not have long history.

Recent research on this topic has led to a growing consensus on this topic and vastly improved our understanding. Many researchers have started to measure intangible capital at the macroeconomic level, where information is relatively rich when compared with the microeconomic level. Some scholars have gone even further and have succeeded in measuring the effects of intangible capital on growth, productivity, competitiveness, and so on.

However, at the micro-level, there are more difficult issues to be addressed such as the complex relationship between different kinds of unobservable intangible capital. This survey suggested that it is difficult to draw a line as to what is or is not to be counted as a capital. Therefore, at this level, what remains to be done is to categorize intangible capital and understand its role in the production (or value creating) process. Only once such fundamental issues have been addressed is it useful to turn to measurement issues. Many studies show that the value of intangible capital is usually greater than the aggregated value summed up from the bottom.

There is a great variety of intangible capital. Therefore, there also remain many things to be done to clarify the relationships between the various types of intangibles. If, as Yang and Brynjolfsson (2001) suggest, intangible investment is a better value-driver than other ordinary key inputs, then understanding these things is of great importance, not only for the field of economics, but for the economy itself.

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Table 1. Classification of Intangibles, Young (1998)

1. Computer-related
Software
Large databases
Other computer services
2. Production and technology
R&D
Design and engineering
New quality control systems
Patents and licenses
Know-how
3. Human resources
Organized training
Learning by doing
Activities to improve health and motivation of the workforce
Remuneration for innovative ideas
4. Organization of the firm
New methods of organization of the firm as a whole
Setting up networks
New working methods in administration and finance
5. External – Marketing and sales
Market research
Advertising
Brands
Name and symbol of the firm
Customer list, subscribers' list, potential customer list
Product certification, quality certificates
Goodwill
6. Industry specific
Mineral exploration
Entertainment, literary, artistic originals
Milk quotas

Table 2. Classification of Intangibles, Vosselman (1998)

1. Core elements
Research and experimental development
Education and training
Software
Marketing
Rights, such as licenses, brands, copyrights, patents
Mineral exploration
2. Supplementary categories
Development of the organization
Engineering and design
Constructions and use of databases
Remuneration for innovative ideas
Other human resource development (training excluded)

Table 3. Classification of Intangibles, Van Ark (2004)

1. ICT capital
Hardware
Telecommunication infrastructure
Software
2. Human capital
Formal education
Company training
Experience
3. Knowledge capital
Research and development and patents
Licenses, brands, copyrights
Other technological innovations
Mineral exploration
4. Organizational capital
Engineering design
Organization design
Construction and use of databases
Remuneration of innovative ideas
5. Marketing of New Products (“Customer Capital”)
6. Social Capital

Table 4. Classification of Intangibles, Corrado, Hulten, and Sichel (2006)

1. Computerized information
Computer software
Computerized databases
2. Scientific and creative property
Science and engineering R&D
Mineral exploration
Copyright and license costs
Other product development, design, and research expenses
3. Economic competencies
Brand equity
Firm-specific human capital
Organizational structure

Table 5. Financial Accounting Standards Board (FASB) List of Intangibles

1. Marketing-related intangible assets
Trademarks, trade names
Service marks, collective marks, certification marks
Trade dress (unique color, shape, or package design)
Newspaper mastheads
Internet domain names
Noncompetition agreements
2. Customer-related intangible assets
Customer lists
Order or production backlog
Customer contracts and related customer relationships
Noncontractual customer relationships
3. Artistic-related intangible assets
Plays, operas, ballets
Books, magazines, newspapers, other literary works
Musical works such as compositions, song lyrics, advertising jingles
Pictures, photographs
Video and audiovisual material, including motion pictures, music videos, television programs
4. Contract-based intangible assets
Licensing, royalty, standstill agreements
Advertising, construction, management, service, or supply contracts
Lease agreements
Construction permits
Franchise agreements
Operating and broadcasting rights
Use rights, such as drilling, water, air, mineral, timber cutting, and route authorities
Servicing contracts, such as mortgage servicing contracts
Employment contracts
5. Technology-based intangible assets
Patented technology
Computer software and mask works
Unpatented technology
Database, including title plants
Trade secrets, such as secret formulas, processes, and recipes

Table 6. Classification of Intangibles, Intangibles Research Center (New York University)

1. Goodwill
   - Advantageous relationships with government and covenants not to compete
   - Intellectual capital:
     - Trade secrets, internally generated computer software, drawings, other proprietary technology
     - Intellectual property including patents, tradenames, trademarks, copyrights existing pursuant to legal system
   - Brand equity
   - Brands attracting market share
2. Other marketing capabilities including advertising
   - Structural capital
   - Assembled workforce of employees, training and employee contract relations
   - Leadership
   - Organizational innovation capacity (to commercialization stage)
   - Organizational learning capacity
3. Leaseholds
4. Franchises
5. Licenses
6. Mineral rights
7. Customer equity
   - Customer database
   - Customer loyalty and satisfaction
8. Distribution relationships and agreements

Table 7. Classification of Intangibles, 10 Swedish and Danish Companies

1. Intellectual capital components Individual capital Competence, skills, relevant knowledge possessed by employees (company value taken home at closing each day) Structural capital Value of procedures, technologies, routines, systems infrastructure stored in manuals, method guides, produce concepts, information systems, goodwill (company value left when employees go home)
2. Resources Human resources Customers Technology Processes

Figure 1. Classification of Intangibles, Devinsson-Malone (1997), Skandia Navigator

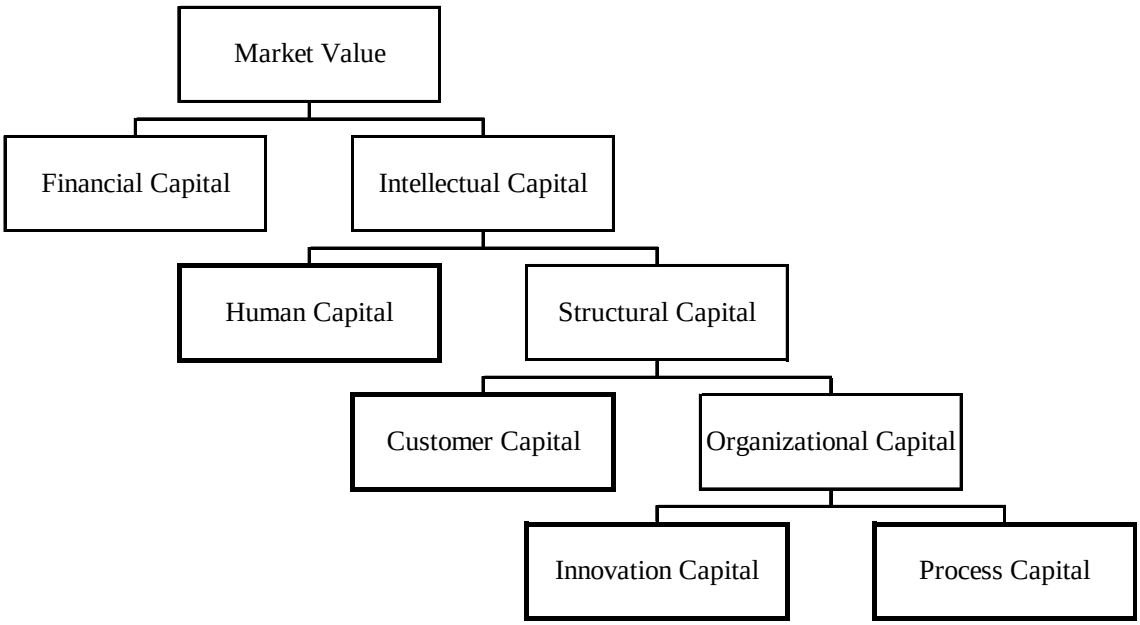

Table 8. Classification of Intangibles, EUROSTAT (1997)

1. R&D
2. Acquisition of intellectual property rights - patenting and licensing
3. Acquisition of industrial property rights
4. Advertising and other marketing
5. Acquisition and processing of information
6. Acquisition of software
7. Reorganization of management of an organization
8. Reorganization of the accounting system of an enterprise
9. Means devoted to dealing with changes in legal, fiscal, social and economic government policies
10. Other investments in innovation of products or processes of the enterprise

Table 9. Classification of Intangibles, EUROSTAT (2001)

1. Technology domain
Information technology and communications (ICT) infrastructure
Internet infrastructure
Digitization
Virtualization
Multimedia
Internet users
Internet penetration
2. Industry domain
ICT production and trade indicators
Knowledge capital indicators
Industry performance indicators
Inter-enterprise alliances indicators
New business organizational types indicators
3. Economy domain
Production indicators
Economic performance indicators
Foreign trade indicators
Foreign investment indicators
Internet economy indicators
Business indicators
Deregulation indicators
Information production and diffusion indicators
Price and wage indicators
4. Social domain
Economic and social demography indicators
Lifelong learning/training indicators
Living standards and lifestyles indicators
Cultural indicators
Social inequality indicators
Technology penetration indicators
Internet penetration indicators
Time use

Table 10. Classification of Intangibles, MERITUM (2002)

1. Human capital E.g.: knowledge, skills, experiences and abilities of people.
2. Structural capital E.g.: organizational routines, procedures, systems, cultures, databases, etc.
3. Relational capital E.g.: 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.

Table 11. Classification of Intangibles, EU (2003)

1. Intellectual property
Intangible assets with legal or contractual rights including
Patents
Trademarks
Designs
Licenses
Copyrights
Film rights
Mastheads
2. Separately identifiable intangible assets
Information systems
Networks
Administrative structures and process
Market and technical knowledge
Human capital (if embodied in a codified form)
Brands
Intangibles embodied in capital equipment
Trade secrets
Internally generated software
Drawings
3. Goodwill (non-separable intangible assets)
Prior intangible investment embodied in organizations
Management expertise
Geographic position
Monopoly market niche