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# Intellectual capital and technological advances in knowledge society: How are these concepts related?

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The purpose of this paper is to examine the relationship between technological advances and intellectual capital improvement. Researches show that technological advances and intellectual capital have a strong relationship but this relationship has not been examined systematically. This paper reviews the important theoretical work in both streams of research, highlighting the fundamental similarities and differences. Models of intellectual capital are compared, and the distinction between social human and structural capital and customer capital is examined. The results support the view that technological advances have a positive impact on intellectual capital. Therefore, technological advances can improve intellectual capital in organizations.

**Key words:** Human capital, intellectual capital, technological advances.

## INTRODUCTION

Nsour (2001) reports that rapid technological advances in computational power and communication technologies are transforming the nature of knowledge, skills, talents, and the know-how of individuals in the workplace. Today's global information marketplace requires a different kind of worker, one with competencies, attitudes, and intellectual agility conducive to systemic and critical thinking within a technologically oriented environment. For public and private institutions in the Arab states region to succeed in the new economy, this translates into restructuring industrial age organizational structures, processes, and mindsets to utilize the wealth – creating potential of people [Nsour, 2001]. The intellectual capital (IC) of a nation (or a region of nations as is the case for this chapter) requires the articulation of a system of variables that helps to uncover and manage the invisible wealth of a country. Although the importance of knowledge as a strategic asset can be traced back to several thousands of years, it was the ancient Egyptian and Greek civilizations that represented the first evidence of the codification of knowledge for the purposes of

leveraging regional power with their implementations of national libraries and universities. More recently, Machlup (1962) was the first to coin the term "intellectual capital" and used it to emphasize the importance of general knowledge as essential to growth and development. Alfred Marshall says "knowledge is our most powerful engine of production; it enables us to subdue nature and . . . satisfy our wants" [World Bank, 1999]. However, "knowledge is often costly to create, and that is why much of it is created in industrial countries" [KFD, 1998]. The concept of IC was further expounded upon by management guru Peter Drucker (1993) in his description of post-capitalist society. Drucker (1993) highlights the importance and arrival of a society that is dominated by knowledge resources and a competitive landscape of IC allocation. By the end of the 1990s, references to IC in contemporary business publications were commonplace [Bontis, 1996, 1998, 1999]. IC management became the domain of the so-called CKO or Chief Knowledge Officer [Bontis, 2001a, 2001b, 2002b; Mitchell and Bontis, 2000]. In his groundbreaking cover story in Fortune Magazine,

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Stewart (1991) provided the main impetus for a new world of intellectual capitalists.

## BACKGROUND AND PREVIOUS LITERATURE

### Defining intellectual capital

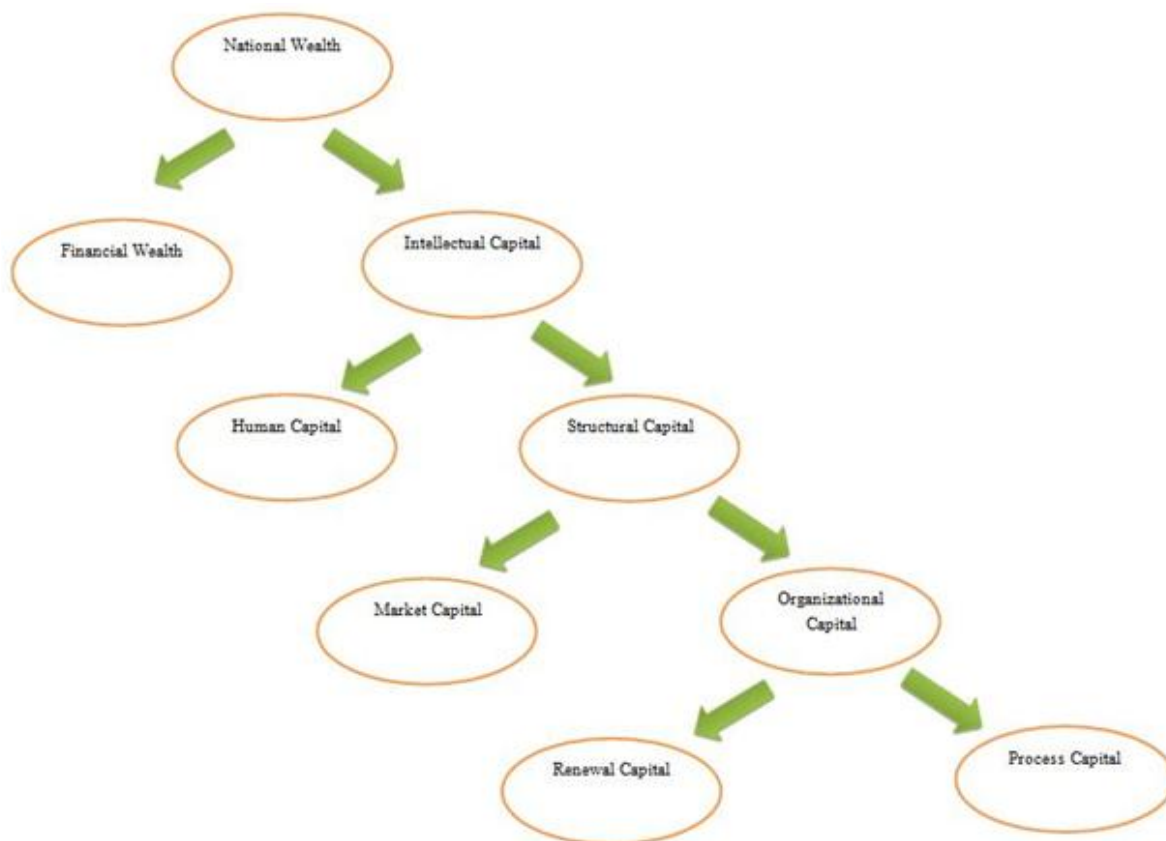
In broad terms, "intellectual capital" can be defined as the intellectual, or knowledge-based, resources of an organization. It encompasses both resources that exist at a particular point in time (a stock of IC) and the more fluid way these resources are used and interact with other resources (both intellectual and physical) to further the organization's goals (a flow concept) [Ricceri, 2008]. IC is therefore an intangible asset, but not all IC is captured within existing accounting definitions of intangible assets (in other words, accounting intangible assets are a subset of IC) [Petty and Guthrie, 2000]. While some knowledge-based resources, such as patents, trademarks and brands, may be incorporated in financial accounts through mandatory accounting regulations, many others are not (such as the organization's reputation, the morale of its staff, etc.). Following an accounting-based definition, some have argued that a corporation's IC can be defined as the difference between the value of its tangible net assets and its market capitalization. Yet even this is problematic, as the market value often fluctuates for reasons that have little to do with the company's operations - such as changes in overall market sentiment [Garcia-Ayuso, 2003; Mouritsen, 2003; Petty and Guthrie, 2000]. Furthermore, such a broad definition does not help in the recognition or identification of individual elements of IC. Without such recognition or identification, it is difficult to know what IC issues companies are, and should be addressing in their corporate reporting strategies, nor can content analysis classifications be developed to identify and analyze the ICDs that companies are making. In addressing these issues, several more detailed IC categorization schemes have been developed and used. Sveiby (1988, 1997, 2002) proposed a measurement scheme termed the Intellectual Assets Monitor, which includes three categories: internal structure, external structure and employee competence. The business navigator of Skandia (Edvinsson, 1997; Edvinsson and Malone, 1997) includes five aspects: financial, renewal and development, customer, process, and human focus. Another measurement approach is the Balanced Scorecard [Kaplan and Norton, 1992; 1996]. This analyzes a company's IC from four perspectives: financial, customer, business process, and learning and growth. A helpful comparison of these schemes can be found in Guthrie and Petty (2000b). Brooking (1996) also suggests that the analysis of a company's IC should include four elements: market assets, human assets, intellectual property right assets, and infrastructure assets. Finally, Roos et al. (1997) propose that IC consists of human

capital, business process capital, business renewal and development capital, and customer relationship capital.

## LITERATURE REVIEW

Much of the current academic literature on IC theory and its accompanying frameworks, constructs and measures stems from an accounting and financial perspective, focusing on the firm level of analysis [8,9,10]. Theorists soon extrapolated the initial conceptual level to also include nations. Malhotra (2001) argues that leaders of national economies are trying to find reliable ways for measuring knowledge assets to understand how they relate to future performance. The expectation from finding a reliable measure of knowledge assets is that such measures can help governments better manage the intangible resources that increasingly determine the success of their economies. The key to determining these success factors is an understanding of relationships and synergistic modulations that can augment the value of each subcomponent of IC [21]. Approaching economic development from a knowledge perspective—that is, adopting policies to increase a nation's intellectual wealth—can improve people's lives in a myriad of ways besides higher incomes [42]. The IC of a nation includes the hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources for wealth creation. These hidden values are the roots for nourishment and the cultivation of future well-being. For this purpose, it is essential to have a mapping system to describe the IC of nations and to systematically account and follow the evolution of such IC development. The system used to capture the statistics and describe the constructs of national IC can be presented in the shape of a modified IC navigator for nations. This framework consists of five value-creating fields, each focusing on an individual sphere of interest. Figure 1 is a modified version of the IC tree described by Edvinsson and Malone (1997). The following constructs have been transformed from a firm level to a national level perspective: market value is now national wealth, financial capital is now financial wealth, customer capital is now market capital, and innovation capital is now renewal capital. The remaining constructs are labeled the same (Figure 1).

Although much of the history of IC literature spans only a decade, the national view of this phenomenon is in its infancy. There have been only two countries that have examined their IC development: Sweden (Rembe, 1999) and Israel (Pasher, 1999) prior to the Arab initiative established by the United Nations. This chapter signifies the first attempt to measure and benchmark IC development across several nations. Sweden and Israel plan to revisit their numerical assessments every couple of years which is important due to the benefits of longitudinal trending. Furthermore, the IC development



**Figure 1.** IC of nations. Source: Modification of Edvinsson and Malone (1997).

reports of both countries have provided a sound springboard for the advancement of other national programs such as foreign investment (Sweden) and government funding allocations (Israel).

### Intangible resources in the strategic literature

The work of Porter (1980, 1985, 1990) has contributed to the definition and implementation of an interesting analytical framework from which to consider competitiveness. The concept of competitive advantage is at the heart of such a development, on the basis of an analysis of the dynamic of competitive forces within market structures. However, Porter's model of the 1980s is now largely challenged by new approaches to competitiveness, especially those focusing on resources (mainly those of intangible nature), as a main source for competitive advantage. Indeed, as underlined elsewhere (Bounfour, 2000), during recent years different approaches have been developed focusing on the corporate intangible resources, competences, and capabilities, as the main lever of creating competitive advantage. In opposition to Porter's view, these approaches, taking into account the fact that the differences of performance are more

important within individual industries than between industries, consider that such differences are to be attributed to the type of combination of resources, mainly intangibles, developed by firms, than to industry structures. The strategic approach developed includes different analyses that explicitly stress the importance of intangible resources (assets) as a lever for competitive advantage. Within this approach, we can include different types of works:

- Approaches based on resources (the resource-based view) [Barney, 1991; Collis, 1991; Penrose, 1959; Wenerfelt, 1984, 1989; Dierickx and Cool, 1989; Grant, 1991; 1996; Itami and Roehl, 1987; Itami, 1989; Peteraf, 1993] and intangible resources [Bounfour, 1998a, 1998b, 1998c, 1999, 1995; Hall, 1993; Lev, 2001];
- Approaches based on core competences [Prahalad and Hamel, 1990];
- Approaches based on knowledge creation dynamics [Nonaka, 1994; Nonaka and Takeuchi, 1995];
- Approaches based on competences as "organizational routines" [KFD, 1998; Winter, 1987];
- Approaches based on IC management and reporting [Brooking, 1996; Dierickx and Cool, 1989; Edvinsson and Malone, 1997; IFAC, 1998; Stewart, 1997; Sveiby, 1997].

**Table 1.** The indices of human capital (Chen et al., 2004).

Employees' competence	Strategic leadership of the management
	Qualities of the employees
	Learning ability of the employees
	Efficiency of employee training
	The employees' ability to participate in policy making and management
Employees' attitude	Training of key technical and managerial employees
	Identification with corporate values
	Satisfaction degree
	Employees' turnover rate
Employees' creativity	Employees' average serviceable life
	Employee's creative ability
	Income on employees' original ideas

All of these approaches can be considered as contributions to the foundation of a strategic paradigm for intangibles.

### Human capital

Human capital presents the individual tacit knowledge embedded in the mind of the employees. Human capital is important as the foundational source of innovation, strategic renewal of a company and the company can thus realize and create value in the knowledge-based economy. Human capital can be defined as a combination of employee's competence, attitude and creativity (Table 1).

Employees' competence is the hard part of IC. It includes employee's knowledge, skills, talents, and knack, of which knowledge and skill are uppermost. Knowledge, which consists of technical knowledge and academic knowledge, is obtained mainly through school education and is thus theoretical. Skills, the employee's capability of accomplishing practical assignments, are obtained primarily through practice, especially the tacit skills that cannot be literally expressed, even though it can also be developed through school education. Employees' attitude is the soft part of IC, including their motivation for work and satisfaction from work. It is regarded as the prerequisite for employees to give full play to their competence. Employees' creativity enables them to use their knowledge elastically and to make innovations continuously. It is therefore one of the key factors in developing the IC of an enterprise [Chen et al., 2004].

### Structural capital

Structural capital deals with the system and structure of

an enterprise. It is the business routines. An enterprise with strong structural capital will create favorable conditions to utilize human capital and allow human capital to realize its fullest potential, and then to boost its innovation capital and customer capital. In detail, structural capital can be classified into company culture, organizational structure, organizational learning, operational process, and information system (Table 2).

A company's culture is the values, faith and behavior criteria approved and shared by all the staff. Values are what a company regards as the most important to its business, employees and customers. Faith refers to an employee's attitude towards him/herself, his/her company and customers. Meanwhile behavioral criteria are the unwritten rules emphasizing such matters as employees' appearance and cooperation with one another. Company culture under the guidance of a favorable managing philosophy is a valuable asset. Only under the strong culture can a company give full play to its employees' competence and motivate them to serve the company and customer heart and soul. Organizational structure is the power and responsibility structure formed in the managing process. This power and responsibility structure can find expression in the policy-making structure, the leading structure, the controlling structure and the information structure. Organizational competence is the result of the perennial learning and accumulating, and it is becoming one of the most important core competences of a company. It is affirmed that in the twenty-first century the only way for a successful company to maintain its competitive excellence is to be quicker in learning than its competitors [Chen et al., 2004]. The operational process, which ensures a company to complete its various operational tasks, is the most effective of working methods and processes after a long-term accumulation and deposition. The information system includes the storage, disposal and transmission of the inner information of a company. A favorable information system enables a company to

**Table 2.** The indices of structural capital (Chen et al., 2004).

Corporate culture	Construction of company's culture Employee's identification with company's perspective
Organizational structure	Clarification of relationship among authority, responsibility and benefit Validity of enterprise controlling system
Organizational learning	Construction and utilization of inner information net Construction and utilization of company repository
Operation process	Business process period Product quality level Corporate operating efficiency
Information system	Mutual support and cooperation between employees Availability of enterprise information Share of knowledge

**Table 3.** The indices of customer capital (Chen et al., 2004).

Basic marketing capability	Construction and utilization of the customer database Customer service capability Identifying ability of customer's needs
Market intensity	Market share Market potential Unit sales to customer Brand and trademark reputation Construction of sales channel
Customer loyalty	Customer satisfaction
Customer loyalty	Customer complaint Customer outflow Investment on customer relationship

quicken the flow of the inner information, heighten the operational efficiency, and hasten learning within the company.

### Customer capital

Customer capital, an essential part of IC, is the value embedded in the marketing channels and relationships that an enterprise develops by conducting business. Compared with human capital and structural capital, it more directly affects the realization of company value and is increasingly becoming the critical factor. Fornell, a professor of Michigan University, found that the satisfaction of customers could maintain the business

relationship, decrease the elasticity of product price and improve company prestige [Fornell, 1992]. In this study, customer capital is classified into basic marketing capability, market intensity and customer's loyalty (Table 3).

The basic marketing capability is the ground work for a company to manage its human capital. To increase market intensity and customer's loyalty, a company should first enhance its basic marketing capability, such as the serving capability, and the capability of collecting and utilizing customers' data. Market intensity, the ultimate expression of customer capital, refers to the current state of market building and its potential. Customer loyalty is playing a more and more important role in today's heated competition. A company without loyal

customers will have to resort to various sales promotions to allure new customers who are sometimes unprofitable to the company. Accordingly, the company should make great efforts to improve the quality of product and service pertaining to the current and future needs of customers, and to enhance customer satisfaction and thereupon customer loyalty [Chen et al., 2004].

### **Intellectual capital in the new Internet economy**

The new economy has shifted away from one based on traditional manufacturing to one propelled by knowledge. This shift is perhaps most evident in high tech firms. We use Intel to illustrate that business success is driven by the ability to use intellectual capital to maintain and extend competitive advantage and bring huge returns to shareholders. For instance, Intel has over \$10 billion (bn) of sales through the Web and has cut data flow between trading partners from three weeks to 48 h, while reducing inventory by 70 per cent [Shah, 2000]. The major forces driving this transition are:

1. Technological changes in materials handling, information processing and biotechnology. E-commerce is beginning to revolutionize the way business is conducted and no one is certain of what will be the consequences. The Internet service provider business is growing at 100-200 percent a year in emerging countries and Intel's goal is to get in at the bottom and grow with them [Richey, 1999].
2. Trade liberalization represented by agreements such as NAFTA and the European Free Trade Agreement and expansion of the WTO. This has resulted in greater mobility of professionals and created a very competitive market for human capital.
3. Globalization of production systems and the goal to establish one dominant industry standard until the next strategic inflection point (Grove, 1996) for any new technology. Intel has captured 80 per cent of the world's micro-processor market with its 8086 micro-processor that has become the global standard for both home and business uses.

We have seen a revolution in the worldwide political landscape, the rise of intense international competition, faster product development cycles, and explosive growth in the service sector. Complexity and the pace of change are fuelled mostly by knowledge and this has generated strong interest in intellectual capital. Ambition plus personality combined to create a new economy culture in which conspicuous production (Lewis, 1989) replaces conspicuous consumption and paranoia replaces moderation as the moulder of corporate strategy. The leading global firms are increasingly dependent on the rapid production and distribution of knowledge and the need for single global standards for new technological innovations.

For example, instead of changing fibre cables and digging up urban infrastructures every five or ten years Intel aims to establish one common infrastructure in which the chips and software are continually updated, thus saving billions of dollars [Foremski, 1999]. Physical products and services are simply the exterior packaging of knowledge. In the new economy ideas and knowledge become the principal raw materials, and production is driven by diverse teams, empowered by technology. Successful firms are those that can produce and apply knowledge. They can consolidate corporate wide knowledge, skills and abilities faster than competitors through rapid organizational learning. A common proverb is knowledge is power. However, from a new economy corporate perspective, real power flows from both conditional and unconditional knowledge sharing. A corporation is strategically vulnerable if too few of its employees possess adequate workplace knowledge. Perhaps a major reason for our interest in IC is the fear that key individuals can walk into the arms of competition taking valuable knowledge with them. This fear has led Intel to repeatedly sue both its former employees and their new employers for stealing secrets about Intel's new product innovations.

### **Unconditional knowledge sharing**

In the early 1980s Intel began engaging in co-operative ventures. In 1982 IBM took a 12 per cent stake in Intel but agreed not to increase its stake beyond 30 per cent or to involve itself in daily operations. Intel's strategy has been to secure its position in the market place through second outsourcing with tight contractual controls over its proprietary assets. Intel agreed to this IBM alliance because it was cash poor during this recessionary period, urgently needing funds to launch new products. IBM was willing to finance Intel because it did not wish to remain hostage to Japanese micro-processing firms. The Japanese had recently dominated the production of televisions and Americans did not want to see a repeat of this invasion in the computer industry. Intel became a reliable US second source for IBM for both memory and micro-processor chips. The US Justice Department looked the other way despite the fact that the two dominant US producers of chips were colluding [Business Week, 1983a].

### **Conditional knowledge sharing**

Intel's current policy of second sourcing is basically one of quid pro quo. Intel demands that any firm receiving Intel's proprietary technology by becoming a second source supplier to OEMs reciprocate by giving Intel proprietary information about their products. Traditionally OEMs such as IBM or Gateway did not want to rely solely

on a single chip provider. They wanted to avoid becoming totally dependent on Intel to prevent Intel from having too much pricing power in the distribution channel. Before 1990 the OBMs were the leaders in the distribution channel and had enough market power to force Intel to share its proprietary chip technology with rival chip producers without reciprocity [Grove, 1996].

## Conclusion

Intellectual capital is increasingly recognized as an important strategic asset for sustainable corporate competitive advantages. Our study provides evidence that investors place higher value on firms with better intellectual capital efficiency, and that firm with better intellectual capital efficiency yield greater profitability and revenue growth in both the current and the following years. Therefore, entering a knowledge area, organizations will need to become more adaptable and flexible in order to enhance intellectual capital and capture opportunities in the dynamic environment. Traditional understanding of technological advances fails to capture the essence of organizational development in the face of new challenges and demands and therefore, was not able to improve intellectual capital in organizations. Our results underline the importance of organic structure in improving intellectual capital and enhancing firm profitability and revenue growth. In fact, technological advances with characteristics such as flexibility and interactiveness helps employees and managers to transfer and share knowledge across the organization and increase the sustaining competitive advantages. Technological advances can also help managers to establish vertical information systems, instead of processing information through the existing hierarchical channels.

We conclude with a call for more research in order to develop a fuller understanding of the interaction between intellectual capital and technological advances. Our discussion here suggests that organic structure leads to new capabilities for the firm and has improved the intellectual capital by enhancing teamwork, decentralization of power and control and a higher level of informality.

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