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CLASSIFICATION OF KNOWLEDGE-INTENSIVE ORGANIZATIONS

by

EDWARD J. MARQUART

A DISSERTATION

Submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy  
in  
The Department of Industrial and Systems Engineering & Engineering Management  
to  
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of  
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Title Classification of Knowledge-Intensive Organizations

Managing knowledge workers in knowledge-intensive organizations has become important because knowledge itself is emerging as a primary sustainable competitive advantage. This dissertation traces the development of two important items related to knowledge-intensive organizations. First, it documents a careful study of the literature which allows for the construction of a Knowledge-Intensity Continuum. This continuum then forms the basis for the development of a Knowledge-Intensity Assessment survey instrument which allows an organization to be placed along this continuum.

A cross-section of research, consulting, and manufacturing organizations was surveyed using this instrument. The findings provided evidence that supports the validity of the Knowledge-Intensity Continuum. Additionally, onsite interviews provided evidence that the Knowledge-Intensity Assessment survey can be used as a tool to locate any organization on this continuum. Using this survey to clearly identify knowledge-intensive organizations will allow for further research into effective management systems for knowledge workers in these organizations.

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## Chapter I

### INTRODUCTION

#### A. Background

##### 1. Historical Perspective

The 20th century was dominated economically by organizations that utilized raw materials, labor, and capital to produce a physical product (Drucker 1994). These labor and capital-intensive organizations developed management practices that are still widely used today (Amar 2002; Jelinek and Litterer 1995). However, the last quarter of the 20th century saw the emergence of a new kind of organization which utilizes knowledge as a raw material (Galbraith 1967; Bell 1973; Drucker 1994). These knowledge-intensive organizations employ a new class of workers called knowledge workers, whose products are their ideas (Amar 2002; Hedberg 1990).

##### 2. Knowledge-Intensive Organizations

Starbuck (1992) introduced the concept of knowledge-intensive organizations. He suggested these are organizations where knowledge is more important than other inputs. Knowledge-intensive organizations consider the knowledge of their employees, gained through education, practice, and experience, to be the company's primary competitive asset (Winch and Schneider 1993).

Amar (2002) stated the study of knowledge-intensive organizations is in its infancy and is still evolving. Unlike more traditional businesses, knowledge-intensive organizations rely on knowledge workers to develop and maintain competitive advantage. Competition among knowledge-intensive organizations is based largely on innovation. Knowledge-intensive organizations cannot survive by making small improvements, but must be able to make substantial changes in a timely manner to remain competitive in the new economy (Amar 2002). In summary, knowledge-intensive organizations are those that use knowledge as their raw material to produce products which usually exhibit creativity and innovation.

### 3. Management of Knowledge Workers in Knowledge-Intensive Organizations

According to Amar (2002) the main theme of managing knowledge organizations should be how to help employees think, research, and apply knowledge (i.e., how to create and innovate). In order to foster innovation and maintain knowledge worker efficiency, an appropriate management system must be maintained (Reigle 2003). Knowledge workers require a different mind-set than traditional workers as they acquire and apply theoretical and analytical knowledge (Amar 2002). The management principles that were applied during the last several decades by traditional organizations need to be re-evaluated to take this into account (Amar 2002).

Jelinek and Litterer (1995) claim that yesterday's classical management techniques used in today's knowledge-intensive organizations are inappropriate management systems that stifle the progress of innovation. Meyer (1997) claims that knowledge workers respond best when organizations respect their professional status and identity, provide challenging work, and minimize management burden. The relationship between the organization and knowledge workers is radically different than with traditional workers (Drucker 1992). As Drucker explains, the difference is based primarily on the fact that the tools of production have shifted from management-owned machines for traditional organization, to employee owned knowledge.

Machine operators throughout history could be told what to do, how to do it, and how fast to do it. On the other hand, knowledge workers cannot be supervised in this manner. Loyalty can no longer be obtained through the paycheck. The organization must earn employee loyalty by providing exceptional opportunities to put their knowledge to work. The organization must attract the right people, hold, recognize, and reward them, thus serving and satisfying their employees (Drucker 1992; Takada 2003). While management must have considerable authority, its job in the knowledge-intensive organization is not to command, but to inspire (Drucker 1992). All of this raises the question as to whether management practices developed in the past for industrial workers in traditional organizations are appropriate for today's knowledge workers in knowledge-intensive organizations.

#### 4. Knowledge Management

The question about the appropriateness of traditional management practices for knowledge-intensive organizations has become more urgent because of the increasing prominence of knowledge management and information technologies (Gold, Malhotra, and Segars 2001; Child 1987; Malhorta 1998). One of the most significant changes affecting business in the 1990s is the development of a new economy (Daley 2000). Management of knowledge is important because knowledge itself has become, perhaps, the primary sustainable competitive advantage in the new economy (Drucker 1994; Keyser 2004). Bixler (2000) believes the information-based economy places a premium on knowledge. This is because the accelerating pace at which new information is becoming available requires that knowledge be created from this information at an equal pace, since information is the precursor to knowledge.

The dynamic nature of the new marketplace creates an incentive to use knowledge assets as a means of creating value through innovation of products and services that is sustainable over time (Gold, Malhotra, and Segars 2001; Child 1987; Malhorta 1998). A steady flow of up-to-date organizational knowledge is essential for sustained success in dynamic

environments (Meyer 1997). However, organizational knowledge depreciates much faster than hard organizational assets (Keyser 2004). Therefore, knowledge workers must constantly improve their knowledge to remain competitive. The velocity and dynamic nature of the new marketplace creates an incentive to develop new organization structures that will recognize, create, transform, and distribute knowledge as required for knowledge-intensive organization success.

One of the chief components of knowledge management is information technology (Bixler 2000). Amar (2002) suggests that computers, information technology, and the most recent scientific and specialized knowledge are the primary tools used in the operations of knowledge-intensive organizations. Moreover, the knowledge management framework suggested by Bixler (2000) seeks the synergistic combination of the innovative capacity of knowledge workers and the data or information processing capacity of information technologies.

Computer-based technology is the least deterministic (i.e., decisions and actions are based more on free choice) and the most flexible technology to affect the work place since the beginning of the industrial revolution (Walton 1985). Despite this, many knowledge management projects become only information management projects that yield some consolidation of data but little in the way of creativity or innovation in products and services (Gold, Malhotra, and Segars 2001). The Information Technology (IT) industry represents between eight and nine percent (approximately 900 billion dollars) of the United States economy (Henry and Dalton 2003). These IT resources are often wasted because many knowledge management projects merely provide consolidation of data, and little in terms of new products and services.

Amar (2002) suggests that the management practices that work best in knowledge-intensive organizations are different from those in traditional organizations. Levin (1999)

claims that using an appropriate management system is one key to successful knowledge management systems. Such a system can unleash greater innovation among knowledge workers to better sustain the company's competitive advantage. Therefore, the failure of many knowledge management projects could be the result of outdated management systems which hinder the creative process of the knowledge workers.

Levin's (1999) theoretical framework for successful knowledge management is grounded on what people in knowledge-intensive organizations actually do. Leaders of organizations that are knowledge-intensive need to become aware of the amount of knowledge work that is being performed within their organizations in order to determine the appropriate management system for their business environment. Using an appropriate management system should make it easier to retain knowledge workers, implement technology, and promote innovation to help insure long-term success (Reigle 2003). It is likely that management techniques expressly tailored for knowledge workers in knowledge-intensive organizations have not been adequately developed, in part, because there exists no standard method for determining the degree to which an organization is knowledge intensive.

#### B. Research Objective

The objective of this research is to develop an accurate and reliable method for quantitatively measuring the knowledge intensity of an organization. To accomplish this objective, this research will develop and validate a Knowledge-Intensity Continuum construct and a Knowledge-Intensity Assessment survey instrument that measures the degree of knowledge intensity in any organization to locate the organization on the continuum. Together, the knowledge-intensity construct and the validated survey instrument will enable more substantial empirical research of knowledge-intensive organizations to proceed. An

understanding of an organization's knowledge intensity is necessary to enable studies that seek to determine the most appropriate management systems for knowledge-intensive organizations.

### C. Research Significance

Conceptual work in the area of managing knowledge in organizations has outpaced empirical research (Argote, McEvily, and Reagans 2003). Recent dissertations that address the management of knowledge-intensive organizations contain only individual case studies (Brennan 1994; Schultze 1997; Levin 1999). No cross-sectional studies (across many organizations) were found that collected empirical data to identify the characteristics of management systems in knowledge-intensive organizations. Further, no survey instrument was found that identified and classified knowledge-intensive organizations. Such an instrument is a prerequisite for the needed cross-sectional study to empirically determine the characteristics of management systems in knowledge-intensive organizations.

This research adds to the body of knowledge in two ways: first, by providing a knowledge-intensity construct, and second, by providing a validated survey instrument to quantitatively determine the knowledge intensity of an organization. It is expected that the construct and survey instrument will be important tools in subsequent studies to reassess management principles developed during the last several decades of the industrial age. In addition, this research could be used to help develop new management practices and principles specifically tailored for knowledge workers in knowledge-intensive organizations.

The essence of competing in the new economy is to realize sustained economic value from the organization's knowledge assets. How well an individual, an organization, an industry, or even a country does in acquiring and applying knowledge will become the key competitive factor of the future (Drucker 1994). The Knowledge-Intensity Continuum construct and the Knowledge-Intensity Assessment survey instrument developed in this dissertation can be

used to better understand knowledge-intensive organizations. This should allow for the development of more effective management systems so these organizations can better compete in the new economy.

D. Summary

Knowledge is emerging as the basis of competitive advantage for many organizations. Proper management of knowledge-intensive organizations is the key to their success in the new economy. Knowledge-intensive organizations require different management techniques than traditional labor-intensive or capital-intensive organizations. In order for further study of the management systems of knowledge-intensive organizations to continue, a reliable method of determining what organizations fall into that category needs to be developed.

## Chapter II

### LITERATURE REVIEW

#### A. Introduction

A review of the literature is presented that is relevant to knowledge-intensive organizations, including definitions, identification criteria, knowledge-worker roles, and knowledge organization types. The purpose of this chapter is to provide the theoretical foundation from which to develop a construct and a validated survey instrument for identifying and classifying knowledge-intensive organizations.

#### B. Definitions and Details

##### 1. Knowledge

Webster (1988, 669) defines *knowledge* as "familiarity, awareness, or comprehension acquired by experience, association, or study." However, the concept of knowledge is complex and needs to be considered beyond such a basic definition. Ackoff (1989) defines knowledge in the Knowledge Hierarchy as information with meaning. Drucker (1988) defined knowledge as information that changes something or somebody - either by becoming grounds for action, or by making an individual (or an organization) capable of different or more effective action. Alvesson (1993) defines knowledge as a basis for competence and applications, as well as that of craftsmanship. O'Dell and Grayson (1998) define knowledge as information in action. All of these definitions of knowledge are consistent. If people gain a familiarity, awareness, or

comprehension as suggested by Webster (1988), then they have gained information which now has meaning as suggested by Ackoff (1989). Clearly, having gained this information people have been changed to the extent that they are now capable of actions which were previously outside their realm of knowledge as suggested by Drucker (1988), and O'dell and Grayson (1998).

Explicit and tacit are two primary forms of knowledge (Polanyi 1966). Nonaka and Takeuchi, (1995) provide extensive descriptions of these two forms. Explicit knowledge is formal or codified knowledge. It can be documented, archived, and stored in electronic databases or libraries. In some organizations, this often becomes embedded as documents, routines, processes, practices, and norms (Davenport and Prusak 1998). On the other hand, tacit knowledge is informal or personal knowledge. This knowledge is often transferred between individuals within an organization. It is a fluid mix of experience, value, contextual information, and expert insight. It provides a framework for evaluating and incorporating new experiences (Davenport and Prusak 1998).

As suggested by Ackoff (1989), another useful representation of knowledge is the Knowledge Hierarchy shown in Figure 2.1. Facts and observations are the *data* forming the broad base of a pyramid related to an understanding of knowledge. Data by itself has no significance; it simply exists. If this *data* is given context, it becomes *information*. Information is data that has been given relational connections. If this *information* has meaning, i.e., it is important for a particular reason, it becomes *knowledge*. Finally, if insight is gained from this *knowledge*, it becomes *wisdom*, which represents the top of the pyramid. The insight comes from gaining an understanding of the relevant principles.

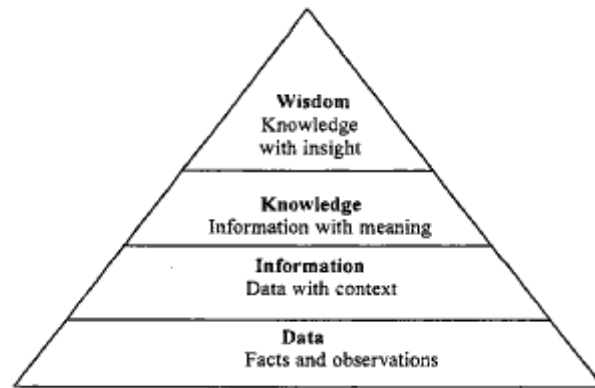


Figure 2.1 Knowledge Hierarchy (Ackoff 1989)

This way of looking at knowledge might be better understood by considering the following example. A set of names is data. A set of addresses is data. A set of statistics about age, occupation, and income level is data. By themselves, each of these represents only a collection of unrelated items. However, if these are entered into a database connecting the names with the corresponding addresses and personal data, it becomes information – data with context. This information could now be used to address letters. However, it is still not what Ackoff (1989) would consider knowledge. If, on learning that all of these names represent members of a specific interest group who would be likely to attend a particular conference, this now becomes knowledge because it has meaning for a particular reason. If, upon soliciting these people to attend the conference, it is found that most of them will only attend if the cost is less than a certain amount, one has gained insight into this particular group of people, and therefore the knowledge has, to some extent, produced wisdom. Therefore, knowledge is information with meaning, and is important because it can be used to gain insight.

## 2. Knowledge Workers

The concept of knowledge workers was introduced long before knowledge-intensive organizations were mentioned in the literature. Drucker (1959) introduced the idea of knowledge workers as a manifestation of the rise of what he labeled The Educated Society. Grahn (1981) defined a knowledge worker as one who creates, designs, and develops both physical products and ideas. The knowledge worker was defined by Belcher (1987) as one who uses information, theory, and concept, as opposed to physical force or labor, to produce products in jobs that are usually non-repetitive, non-routine, and discretionary. Drucker (1993) described knowledge workers as individuals who add to a company's products and services by applying their knowledge. All of these definitions illustrate the key premise that knowledge workers are those who work with ideas, concepts, and theories to produce a company's output using creativity and innovation.

The knowledge worker has become an important factor of production. This development is what allows the highly developed societies and economies of today to become and remain competitive (Drucker 1966). Knowledge workers have structured knowledge, technical abilities, and professional experience (Davenport and Prusak 1998). They require considerable formal education and must develop a habit of continuous learning (Amar 2002). According to Quinn, Finkelstein, and Anderson (1999) knowledge workers maintain a body of knowledge, or professional intellect. This knowledge becomes an intellectual asset for an organization only when it is continuously improved, updated, and shared. Within their knowledge-intensive organizations knowledge workers gather, process, develop, and apply knowledge in innovative ways to produce a sustained competitive advantage for the organization (Starbuck 1992; Amar 2002). These definitions can be summarized as follows: knowledge workers are people who work with knowledge for the purpose of innovation.

### 3. Innovation

Webster (1988, 630) defines *Innovation* as "something that is newly introduced or created." Because innovation is a key part of being a knowledge worker, it is important to understand how that term is used in a corporate context. In the corporate context, innovation is the process of bringing a new idea or application into general use. Damanpour's (1991) rather broad definition of innovation is the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization. Jonash and Sommerlatte (1999) define innovation as encompassing an entire process that starts with an idea and continues from the initial development of that idea to the marketable product or service. This research combines these definitions into one which includes both the concepts of generating ideas and applying these ideas for practical applications. Therefore, innovation is the development of new ideas that result in the practical application of those ideas.

### 4. Knowledge Management

Knowledge management is the term used to describe the many different organizational knowledge initiatives or applications that are discussed, utilized, or researched. Wigg (1997) defined knowledge management as the systematic application of knowledge to maximize an organization's effectiveness in the use of its knowledge assets. Frappaolo and Capshaw (1999) provided a working definition of knowledge management as the practices and technologies that facilitate the efficient creation and exchange of knowledge on an organizational level. Duffy (2000) defined knowledge management as a set of business practices and technologies used to assist an organization in obtaining the maximum advantage from knowledge. Collins (2003) defined knowledge management as the ability to locate and bring together relevant information and the people who need it so that they can take more effective action when doing their job. Finally, Keyser (2004) defined the term knowledge management as the strategies employed by an organization to support the systematic use of organizational knowledge for the purpose of