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# Knowledge Management at General Electric: A Technology Transfer Case Study

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## ABSTRACT

Knowledge management is the active transfer of knowledge throughout an organization. Such organizations may be corporations, nonprofit organizations, governments, or international agencies. It involves the capture, refinement, storage, and dissemination of knowledge. Essentially, the goal of knowledge management is to enable the successful transfer of the right knowledge to the right people, in the right format, at the right time. Methodologies for knowledge management can and should be utilized by international organizations.

We describe how General Electric Corporation (GE) has implemented knowledge management to enable technology transfer in an international organization. GE has demonstrated that knowledge management systems can have an immediate impact, and financial benefit to international organizations that have a willingness to embrace a knowledge sharing culture. They were able to leverage their knowledge, in a global sense, to create significant returns. We conclude with an evaluation of how other firms can utilize the GE approach.

## Keywords:

Knowledge management, technology transfer

## INTRODUCTION

Knowledge management has existed within organizations throughout our entire recorded history. From the earliest cave paintings, to the passing of oral traditions spanning generations, we have recognized the need to share our knowledge for the improvement and growth of organizational units to which we belong. However, it has only been within the past decade that serious study has been given as to how information technology can support knowledge management. Exponential growth in capacity to handle processing and storage has made it possible to store and retrieve vast amounts of knowledge. Sounds simple! However, there is a complex set of issues to address in order to effectively design and implement a knowledge management system that enables the successful transfer of the right knowledge to the right people, in the right format, at the right time.

The knowledge economy is currently changing workers' experiences. Organizations and countries must rethink economic strategies. "How well an individual, an organization, an industry, a country does in acquiring and applying knowledge will become the key competitive factor. There will be no poor countries. There will only be ignorant countries" (Anonymous, 1995). In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge (Nonaka, 1991). Grant (1996) suggested that *knowledge is mainly the significant competitive asset that an organization possesses*.

An organization or country that manages knowledge well has the potential to create significant value. Knowledge management is an important strategy to increase organizational competitiveness (Bell and Jackson, 2001). Stephen Denning's description of the World Bank's experiences is one of transition. He tells how a large, bureaucratic organization took knowledge seriously and changed its whole strategy. Mitre Corporation had similar results (Turban and Aronson, 2001). These two examples show the effectiveness of this new strategy shift to a knowledge organization.

We begin by providing a definition for knowledge management and defining its strategic implications to an organization's overall information technology plan. We then discuss a successful knowledge management implementation at General Electric Corporation. The GE implementation provides a model that describes how knowledge management systems support technology transfer within an organization, be it a corporation, nation, or multinational agency. The GE implementation model is directly applicable to describe how knowledge transfer can be accomplished at a national or global level.

## BRIEF REVIEW OF THE LITERATURE

One of the essential emerging information system strategies is the transition from competitive advantage-based information into optimization-based knowledge management (Malhotra, 1998). Knowledge is vital in an organization because of the actions and consequences to which it leads (Davenport and Prusak, 1998). Knowledge can be defined to be information combined with experience, context, and interpretation. Knowledge management is the transformation of knowledge into a format that can be utilized effectively and efficiently throughout an organization (Davenport, et al., 1998); knowledge management is a set of processes for transferring the intellectual assets of the organization to value processes such as innovation and knowledge acquisition (Knapp, 1998); knowledge management is a strategic process whose desired goal is to harness the value of information by integrating it with the processes and policies that govern the manipulation of intellectual assets (Loshin, 2001); or stated simply knowledge management is making shared information useful (Bushko and Raynor, 1998). Gray (1999) points out that "a knowledge advantage is a sustainable advantage. For sustainable advantage, knowledge is better than technology because technology can and will be copied." King (1999) defined knowledge management as "the acquisition, explication, and communication of mission specific professional expertise in a manner that is focused and relevant to an organizational participant who receives the communication." While there is no universally accepted definition for knowledge management, there is a common thread running throughout each of these definitions.

Ulrich (1998) defined six reasons why knowledge management (also referred to as *intellectual capital*) is critical to an organization:

1. It is an organization's only appreciable asset.
2. Knowledge work continues to increase.
3. Employees with the most intellectual capital are also usually the most portable, so it is critical to retain their knowledge.
4. Many managers ignore the importance of intellectual capital and fail to capitalize on its benefits.
5. Reward and incentive programs need to be in place to recognize the employees who contribute the most intellectual capital.
6. Knowledge needs to be managed; as such it requires vision and strategy.

Additionally, knowledge as an asset is not consumed.

Knowledge management is not a singular technology, it is a collection of technologies such as Intranets, data warehousing, decision support systems, groupware, customer relationship management systems, and document management systems that are strategically linked throughout an organization. There are three basic technologies required for knowledge management. They are: communication, collaboration and storage. These exist in every knowledge management system (Aronson, Turban and Liang 2005).

Gray (1999) identifies five ways in which knowledge can be generated: acquisition, dedicated resources, fusion, adaptation, and networking. Acquisition is through internal and external sources. It can be bought from consultants and universities, or by acquiring a company. Dedicated resources usually come in the form of an R&D department or training department. Fusion involves bringing people together with different perspectives in multidisciplinary teams. The individuals in the teams come together and share their knowledge to arrive at solutions. Adaptation involves creating solutions to meet changing conditions. Networking involves sharing then creating new knowledge by informal self-organizing networks. Effective knowledge transfer requires trust. It also requires that *people absorb and apply the knowledge*.

Knowledge management strategy focuses on the acquisition, communication and exploitation of knowledge through transformation and learning. Knowledge management systems therefore, should focus on improving the processes to transform tacit knowledge into explicit knowledge (King, 2001).

To assess the usefulness of a knowledge management system, there must be a means to measure the effectiveness of the knowledge transfer process within an organization. Verkasalo, and Lappalainen (1998) defined knowledge utilization within an organization in terms of six distinct phases. Phase 1 is knowledge acquisition, which refers to the separation of a piece of knowledge from the provider's knowledge domain. Phase 2, knowledge documentation shifts information and their linkages onto the knowledge transfer medium. Phase 3 is the information and knowledge transmission. In this phase, receiver has the documented information and knowledge available. Phase 4 is information retrieval, which is the first step in understanding the information by the receiver. Phase 5 is knowledge perception, which is the indication that the receiver has understood the knowledge and its links. Phase 6 is decision-making: the use of the knowledge in conjunction with the receivers existing knowledge. Decision-making is the measure of benefit of the knowledge management process of the organization. If the knowledge does not add either short-term or long-term benefit to the organization, then it is of no use. A measure of knowledge transfer efficiency was developed based upon process delay (D); process width (W); and effort (E). The scaled use of these variables is used to create an efficiency index. The efficiency index can be used to compare the transfer rate of knowledge by different systems. Within the six-phase utilization process, several limitations were noted. Knowledge documentation is one the most significant problem areas. Knowledge experts, who frequently do not have the time, nor see the benefit to completing it, should complete the documentation. In addition, keeping the documentation up to date, as new knowledge is acquired can be a difficult task. They provide an empirical method for evaluating the efficiency of knowledge management systems across dissimilar industry groups. Communities of practice are the typical medium for performing this function.

Graham and Pizzo (1996) developed a framework to help organizations manage and position knowledge for competitive advantage. The framework contains four elements that are dynamically linked in a closed loop. The first component is to identify the strategic business drivers. Graham & Pizzo (1996) found that senior management should set the stage for the overall context in which knowledge management is to be used in an organization. By establishing it as a strategic business objective it will have greater emphasis and usage throughout the organization. The second component is to establish the knowledge core and their interrelationships. This involves analyzing what and where critical business knowledge exists and tracing the use of knowledge patterns throughout an organization. The third component is to apply just enough discipline. This establishes the constraints of use for knowledge within an organization and serves to help focus an organization. The final component is to monitor and rebalance the knowledge management system.

GE illustrates the manner in which a global knowledge management system can be implemented, how effective it can be and how it was a major success due to organizational commitment. We describe the GE knowledge management system efforts next.

## **GE FINANCIAL: KNOWLEDGE IN ACTION**

Support Central, GE's knowledge management system, is the implementation of retired CEO Jack Welch's vision to transform the organization into a superior knowledge network. It illustrates how a directed management strategy and willingness to transform an organizational culture can successfully enable knowledge sharing at all levels of an organization (Talmadge, 2002).

*Organizational culture* has a direct and immediate effect upon the participant's willingness to share and use organizational knowledge. Cultures that promote openness and teamwork will accept knowledge management systems readily. Organizations that reward a "knowledge is power" culture need to radically transform to embrace a knowledge sharing culture. At GE, Jack Welch had built a knowledge sharing culture, so the leap to utilizing KM technologies was viewed as a step forward in the organization's evolution.

In the financial services industry, knowledge can be an organization's most valuable asset. It is essential that financial analysts accurately assess market trends, economic conditions, political and legal implications. When knowledge is a vital asset it becomes critical that the organization can effectively create, retain, maintain, access,

and disseminate it throughout the entire organization. In 1999, Jack Welch announced that GE's corporate strategy would embrace e-business as one of its official corporate initiatives. As tactical plans began to emerge, it became apparent that merely using the Internet as a means to enable supply chain management was not enough. They need to go further, linking all employees together to *maximize the intellectual capital of the organization*.

Welch purported that excellent organizations exhibited two characteristics: boundarylessness and a learning culture. Knowledge sharing was considered to be essential because of the vast network of distributed organizations that comprise the GE Corporation. This was not a new concept for GE. In the early 1980's, Welch promoted *integrated diversity*; sharing of knowledge across business units. His vision was for business units to share their core competencies to increase profitability.

At GE, the result was *Support Central*, a portal application designed to enable knowledge sharing across the organization. Prior to the construction of Support Central, eight critical success factors were identified to enable the successful development of a knowledge sharing application for the organization. These included to:

1. Identify the types of knowledge required to support the corporate strategy.
2. Identify individual employee's skills and expertise.
3. Store existing knowledge in a structured manner.
4. Collect and retain external knowledge and information.
5. Store all knowledge in indexed and inter-linked knowledge repositories.
6. Implement a knowledge sharing network.
7. Integrate the knowledge network into the decision-making process.
8. Create new knowledge promoting research and development.

In the design of Support Central, they evaluated two strategies to knowledge management systems implementation: codification and personalization. In a *codification strategy*, knowledge is encoded and indexed for ease of access. In a *personalization strategy* knowledge and expertise are identified throughout the organization and a network is established to enable one-on-one contact. Many organizations utilize an 80/20 or 20/80 split in these strategies based upon their orientation (Aronson, Turban, and Liang, 2005). On the other hand, certain, highly skilled, research-oriented industries may exhibit traits that require approximately equal efforts with both approaches. For example, Koenig (2001) argues that the pharmaceutical firms in which he has worked indeed requires about a 50/50 split. Turban, Aronson, & Liang (2004) suspect that industries that require both major engineering effort and major research effort fits the 50/50 hybrid category. GE is such a firm.

GE decided that they must answer three questions prior to determining the proportion of each strategy to pursue:

1. Does GE offer customized or standardized products and services?
2. Are the products and services at GE mature or innovative?
3. Do they rely on tacit or explicit knowledge to resolve issues and support their products and services?

In each case there is no clear cut answer. GE is one of the largest corporations in the world, with products ranging from high tech medical equipment to light bulbs. Their corporate culture encourages research and development leading to mature products. They are constantly in search of new and innovative products and services. As a result, they determined that they needed a hybrid corporate strategy that would support both codification and personalization. They recognized that there are advantages and disadvantages to both approaches. Codification into explicit knowledge makes it readily available to all employees at any time. However, codification requires interpretation and presents the challenge of keeping knowledge current. The personalization model is premised on the assumption that an expert can be easily identified and is readily available.

Support Central was designed to support both strategies. It is a single entry portal designed to give all employees 24x7 access to a large array of knowledge repositories and a directory of topic experts. This includes access to reports, white papers, cases, forums and chats. Users can personalize their homepage to fit their individual needs. It is available via the corporate intranet and is accessible by employees, contractors, vendors, and suppliers. The objectives of Support Central are to:

- Gather frequently used information and make it available to every employee.
- Offer interactive multi-media training.
- Provide each business with the ability to manage and maintain unique knowledge repositories.

- Save employee time and money when searching for information.
- Gain competitive advantage by capitalizing on existing knowledge within the corporation.
- Achieve cost savings for all GE businesses.

This was further refined by establishing a short-term and long-term strategy. In the short term, GE sought to:

1. Implement Support Central across all GE businesses worldwide.
2. Create useful *communities* (often called communities of practice) to handle specific business processes.
3. Develop customized Support Centrals to meet local needs, particularly in regards to language and culture.
4. Accommodate third party experts into *island communities*.

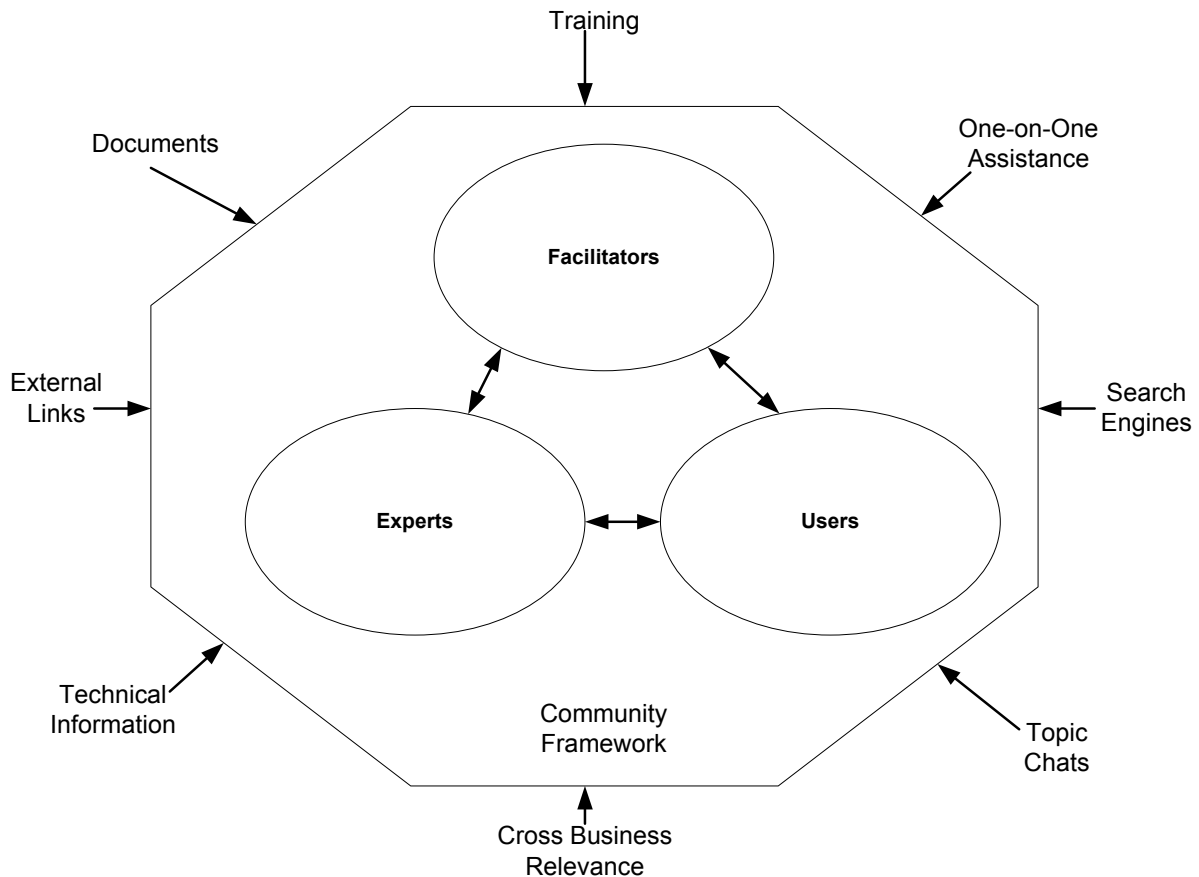
The long term strategy included to:

1. Create a user-friendly central library that will improve the way GE does business.
2. Integrate all documents and applications to streamline information access.
3. Increase service to vendors, suppliers and customers and ultimately achieve cost savings.

**Knowledge Sharing Model**

The results of the GE Support Central implementation illustrate a model for knowledge sharing throughout a multi-business multi-national corporation (Figure 1). The portal’s login screen indicates the culture it is reinforcing, *Share Knowledge, Find Answers*. It incorporates *internal communities* with *island communities* to enable an unencumbered exchange of information and ideas.

**Figure 1. The General Electric Support Central Community Framework**



Support Central is a self-managed set of communities; therefore facilitators, users and experts are responsible for content management. Content management is recognized as a critical activity to keep knowledge up to date. To create a community within Support Central, six steps are required:

1. Pre-registration – users are defined to the system.
2. Plug-ins – three plug-ins are required to index Word documents.
3. Brainstorm community ideas/assign contacts.
4. Assign roles – each business unit is required to assign a facilitator, co-facilitator and experts (a minimum of three experts are required to form and maintain a community).
5. Create an on-line community – the facilitator is responsible for posting relevant documents and links for the community.
6. Launch the community.

Security is managed at the community level, with users defined as direct users or island communities (remote access users). Three levels of security exist: community level, document level and case level. At the document level, facilitators control who has access to what document through the user's profile. Cases can be secured by facilitators, experts or users. Cases are issues, questions, or areas of analysis initiated by users. Support Central consists of a series of Oracle databases and an application server running Websphere Enterprise Edition. Thunderstone was selected as the search engine due to ability to manage over 100 different document types. Support Central is accessed via Internet browsers and does not require special software (other than common plug-ins).

Support Central supports a multi-language training environment to facilitate the delivery of on-line training worldwide. It supports training for business units and information technology support teams. Some of the training supported includes:

- Employee Reinsurance Corporation Digitization Certification
- GE e-Business training
- Virtual Master Black Belt for GE appliance repair
- Unigraphics for Manufacturing

There are over 165,000 registered users, defined within more than 1,300 communities. Thus far it has met with wide-spread acceptance.

## **DISCUSSION**

GE is a multi-billion dollar corporation that has embraced knowledge management implementation through the use of portals as a means to support a continuous process improvement culture. Support Central utilizes a hybrid strategy of personalization and codification to effectively support the needs of over 160,000 users. It has proven to be an effective implementation of Jack Welch's vision to embrace Internet technologies as the means to transact business. In addition to cost savings, it has supported the transformation of a corporate culture into a knowledge sharing organization.

Knowledge management as a concept has been defined in several ways using numerous technologies. Dynamic organizations find methods to effectively support their tasks in a manner that is embraced by the vast majority of the employee population. Support Central has had dynamic growth since its initial implementation, demonstrating its widespread acceptance within GE. Additionally, one of the significant challenges of managing a knowledge management system is to ensure that there are processes and procedures in place to keep knowledge current.

The implementation of Support Central has resulted in the definition of a model for supporting a knowledge management community framework. It defines the tacit and explicit components needed to effectively implement a knowledge management strategy that consists of personalization and codification components. The community framework is significant because it represents a large-scale knowledge management implementation that provides up to date answers to a vast array of questions and links knowledge experts to specific user cases directly and immediately.

## **SUMMARY AND CONCLUSIONS**

Knowledge management promises to have major impacts on how organizations function. This is evident from the GE case described here. GE leverages its knowledge, in a global sense, to create major returns. Depending upon the field, such returns on investment ranges from 5 to 25, approximately annually. Mitre Corporation conducted an audit of the effectiveness of their KMS. Mitre invested about (U.S.) \$8 million for a two year return of over \$60 million (Turban, et al., 2001). These impacts are available to astute firms, governments and international agencies. The technology for transferring knowledge is readily available, and affordable. If an organization's or a country's culture is ready to share, such systems and methodologies can have deep impacts. Care must be taken. Sometimes limits are imposed by law, based upon culture. For example, the People's Republic of China has an "Information Law" that, roughly stated, indicates that each agency must *buy* information from each other agency, regardless of the consequences for not having shared information. Such information recovery laws will inhibit the development and use of knowledge management systems, and restrain nations economically for years to come. It is critical for countries, as for organizations, to reach a state of readiness before a successful KM effort can be begun.

GE has demonstrated that knowledge management systems can have an immediate impact, and financial benefit to international organizations that have a willingness to embrace a knowledge sharing culture. It is our hope that countries do the same to promote strong economic development.

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