A SYSTEMATIC FRAMEWORK TO IMPROVE KNOWLEDGE MANAGEMENT THROUGH INFORMATION TECHNOLOGY

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

A SYSTEMATIC FRAMEWORK TO IMPROVE KNOWLEDGE MANAGEMENT THROUGH INFORMATION TECHNOLOGY

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ABSTRACT

Organizations rely on their information technology (IT) infrastructure to perform on a daily basis, and a constant debate on whether the IT tools used are the appropriate ones to achieve their strategic planning objectives is always present. Many IT tools are modified or purchased to encourage knowledge flow within the organization, but there are no established frameworks to help organizations link their business priorities and IT infrastructure.

This research presents a systematic framework for knowledge management through IT structured according to the Baldrige Performance Criteria; which gives the framework the capacity to be implemented in any organization. A survey instrument measuring importance and user satisfaction of IT is used to analyze the impact of IT tools in an organization through the Opportunity Algorithm (OA) and Analytical Hierarchy Process (AHP). Quality Function Deployment (QFD) is lastly used along with a Knowledge Management System (KMS) flowchart based on current literature to provide a guideline for organizations to define their current knowledge domains and identify issues preventing knowledge flow.

The implementation of this framework at the Missouri Small Business Development Center helped management decide what IT tools are more important based on their organizational needs. It also helped in identifying factors of each IT tool that provide the biggest opportunity for improvement; and increased collaboration for knowledge management across the company.

CHAPTER 1

Introduction

1.1 Knowledge World

We live in a society where knowledge is the source of the highest quality power (Toyama & Nonaka, 2000). This 'knowledge-based society' is defined by the knowledge economy, where success depends on the quality of knowledge which organizations apply to their major business processes (Guanasekaran & Khalil, 2003; Fernie & Green, 2003). Also, where sustainable competitive advantage and superior profitability within an industry is marked by how an organization creates and share its knowledge (Nonaka & Hirotaka, 1995; Von Krogh, Nonaka, & Aben, 2001)

These factors have defined knowledge management inside organizations, since companies need to quickly adapt to market and technology changes. Knowledge management can be defined as the process of figuring or finding out what knowledge the organization has that can be beneficial to other employees if transferred or communicated easily and correctly in order to increase efficiency and productivity.

Information Technology (IT) and Information Systems (IS) play an important role in knowledge management. Grover and Davenport (2001) said that recent studies have shown that organizations use some kind of IT infrastructure to deal with knowledge management projects. On the other hand, it is essential to consider IT just a part of the knowledge management process as other factors are equally relevant. In order to

understand the value that IT provides to organizations, we first need to understand the way a particular organization conducts business and how IS affect the performance of various component activities within the organization (Gottschalk, 2007).

Though there is an ongoing debate on whether IT-driven knowledge management strategies may end up objectifying and calcifying knowledge into static, inert information (Borghoff & Pareschi, 1997), the fact is that technology is quickly adapting to allow organizational members to create, adapt and modify their own IT tools (such as web2.0 tools and social software) in order to become more knowledgeable and create collective knowledge. In other words, IT is molding according to the employees needs, not their employers; and employees are becoming more dependent on technology to perform daily duties.

IT use is inevitable as it is more affordable, powerful, and is quickly becoming part of the subconscious routine of the knowledge worker since it allows people to become aware of the opportunity to exchange knowledge.

1.2 Background

1.2.1 What is Knowledge?

While many researchers (Erden, Von Krogh, & Nonaka, 2008; Fernie & Green, 2003; Von Krogh G. , 2002; Matzler & Renzl, 2008) have agreed that the need of organizations to manage knowledge comes from the consequence of the link between competitive advantage and knowledge; they all have different definitions for knowledge.

Some of the most accepted definitions of 'knowledge' are:

1. 'A justified true belief'(Toyama & Nonaka, 2000), meaning that individuals justify the truthfulness of their observations based on their observations of the world (Erden, Von Krogh, & Nonaka, 2008)
2. 'The capacity to define a situation and act accordingly' (Von Krogh G. , 2002)
3. 'An organized body of information' (Fernie & Green, 2003)

This last definition emphasizes the difference between knowledge and information, which is also analyzed by Nonaka & Takeuchi (1995) as:

'Information is a flow of messages, while knowledge is created by that very flow of information, anchored in the beliefs and commitment of its holder' (Nonaka & Hirotaka, 1995).

Nonaka (2000) also mentions that information becomes knowledge when it is interpreted by individuals and given a context and anchored in the beliefs and commitments of individuals.

4. There are two types of knowledge: explicit and tacit knowledge. Explicit can be expressed in formal language and explained with drawings, writings, data or formulas. Tacit knowledge is difficult to communicate since it is related to senses, ideals, values, emotions, or intuition (Toyama & Nonaka, 2000; Nonaka & Hirotaka, 1995)

1.2.2 Knowledge Management (KM) & Knowledge Management Systems (KMS)

Knowledge Management (KM) is defined by Gottschalk (2003) as 'a method to simplify and improve the process of creating, sharing, distributing, capturing, and understanding knowledge in a company'. Hence, KM main target is to create and share knowledge more efficiently within an organization; through systematic and innovative methods, practices, and tools, which include Knowledge Management Systems.

A Knowledge Management System (KMS) is any system that supports KM creation, capturing, storage and transferring inside an organization. This knowledge exchange can occur at different levels such as (Karlsen & Gottschalk, 2003):

a) Between Individuals
b) From Individuals to Explicit sources
c) From Individuals to Groups
d) Between groups
e) Across Groups
f) From the group to the organization

According to literature (Karlsen & Gottschalk, 2003; Nonaka & Hirotaka, 1995; Matzler & Renzl, 2008; Grover & Davenport, 2001) some of the benefits of implementing a reliable KMS are:

a) Reduce management errors and improve service and profitability
b) Improve decision making
c) Create less work and reduce redundant work
d) Increase of organizational knowledge

1.3 Problem Statement

The primary goal of KM is to create and share knowledge more efficiently inside an organization. In order to do this, organizations need to figure out what information is available and how to ensure workers will have access to it. While most companies structure their KMS with various types of IT tools, lack of knowledge make management to acquire IT tools that do not fit their organization profile or do not understand well enough in order to make them perform the way they should according to their organizational needs.

The development of a systematic framework to improve knowledge management through information technology is proposed in this research. This framework should allow an organization's KMS to understand if their IT tools fit their organizational profile and to identify areas for IT, knowledge and organizational improvement.

This research interest comes from the gaps found in literature where current organizations have not linked their KMS with their organizational structure, the role of current IT tools in the transfer of knowledge, 'task and structural factors that enable knowledge transfer'(Grover & Davenport, 2001) and how to achieve organizational motivation to increase knowledge creation and sharing within knowledge workers.

Another problem that needs to be addressed is how to help organizations understand the interaction between IT and workers, along with their insight on current IT infrastructure for knowledge creation. This due to the flexibility and autonomy most IT tools give end users, which may cause knowledge gaps between the organization and halt KM objectives.

1.4 Research Objective

Organizations rely on many IT tools to perform on a daily basis, and a constant debate on whether the IT tools used are the appropriate ones to achieve their strategic planning objectives is always present. Many IT tools are modified or purchased to encourage knowledge flow within the organization, but there are no established frameworks to help organizations measure what IT tools or IT tools attributes should be improved for organizational improvement.

This research aims to establish a systematic framework based on an organizational adaptable survey instrument, the integration of Quality Function Deployment (QFD), the Opportunity Algorithm (OA) and Analytical Hierarchy Process (AHP) to analyze the impact that various IT tools and their attributes have on current organizations. Knowledge Management System (KMS) flowcharts based on current knowledge management literature are also included and can help an organization define their current knowledge domains and suggest tools to find new ones for organizational improvement. The framework will be based on an organizational profile according to the Baldrige Performance Criteria which will help link the survey instrument and KMS model with the organizations' structure, mission, and values.

This framework will be implemented at the Missouri Small Business Development Center as a case study to show results, and should have the potential to be implemented in any organization.

1.5 Thesis Organization

This thesis is organized in five chapters. Chapter 1 includes a brief description of knowledge and knowledge management, problems found, motivation, and research objectives

Chapter 2 provides an extensive literature review on topics concerning knowledge, knowledge management, knowledge management systems, IT, and decision making techniques.

Chapter 3 explains the methodologies used to analyze the problem. The systematic framework is described in detail and decision making techniques are explained thoroughly to simulate functionality.

Chapter 4 presents an implementation example of the systematic framework done at the Missouri Small Business Development Center (MSBDC); with the goal of analyzing the current use of IT in their KMS and to identify the most valuable IT tools available. Areas of opportunity for improvement to improve IT usage and increase knowledge creation and sharing throughout the organization are also analyzed in this chapter.

Chapter 5 shows and analyzes the results from the framework implementation example, major contributions, feedback obtained up to date, and recommendations for further research.

CHAPTER 2

Literature Review

2.1 Introduction

The study of knowledge inside organizations has been a topic of great concern for a long time now and has been growing since the cognitive revolution back in the 1950's. Before the 1950's knowledge was viewed as purely explicit. To the cognitivists, all knowledge could be coded, transferred and stored very easily (Grover & Davenport, 2001; Matzler & Renzl, 2008). Nowadays, knowledge bridges the gap between cognition and action (Von Krogh G. , 2002); and we have learned to distinguish between explicit and tacit knowledge (Nonaka & Hirotaka, 1995) . Also, models of knowledge creation are available to provide an easier way to understand knowledge management (KM).

That's the main reason why knowledge management is an important area of study since most organizational leaders, knowledge workers, and customers have agreed that knowledge is what makes an organization work (Borghoff & Pareschi, 1997). By knowledge, a person can infer numerous things such as information and processes that workers have learned by performing their daily jobs, information in databases, presentations, manuals, reports, and many more sources of information.

2.2 The Study of Knowledge in Knowledge Management

Knowledge Management (Knowledge Management and Organizational Learning, 2008) is defined as:

"the business activity that encompasses identifying and mapping intellectual assets within the organization, generating new knowledge for competitive advantage within the organization, making vast amounts of corporate information accessible, sharing of best practices, and technology that enables all of the above."

In easier terms, this definition of KM involves figuring out what information is available inside an organization, which can be available in many ways. In order to devise strategies for making all these information accessible to workers, who can use it to create new knowledge and help increase the company's knowledge domain; which will lead to improving organizational results.

Matzler (2008) states the importance of knowledge management from past literature as an intangible asset important to an organization due to globalization, changing markets and the increase use of information technology. It has made possible to gather information from different sources and allowed people from different departments and different regions in the world to communicate and exchange valuable information in a cheaper way. KM is also a potential source of competitive advantage since it is hard to imitate or substitute by others.

In fact KM has become an important area of study in different fields such as organizational behavior, organizational theory, strategic management, information systems, marketing, economics, psychology and sociology (Von Krogh G. , 2002). An example is Nonaka's work, which is up to date one of the most important studies that have defined KM in the past decade. His knowledge studies were linked to KM when he

said that ‘an organization is not merely an information processing machine, but an entity that creates knowledge through action and interaction’ (Nonaka & Hirotaka, 1995). His research then placed special importance on the difference between tacit and explicit knowledge.

2.2.1 Explicit Knowledge VS Tacit Knowledge

In his book “The Knowledge Creating Company”(Nonaka & Hirotaka, 1995), he applies his past research on knowledge to explain how Japanese organizations excel in many industries thanks to the way they manage and create knowledge to improve organizational results. He discusses two types of knowledge: tacit (subjective) and explicit (objective). Explicit knowledge is defined as ‘the one expressed in formal and systematic language and shared in the form of data, scientific formula, manuals, etc.’ (Nonaka 1995). Explicit knowledge is easy to process and transfer. On the other hand, tacit knowledge is tied to the senses, movement, skills, physical experiences, rules of thumbs, and intuition (Nonaka & Hirotaka, 1995; Von Krogh G. , 2002), making it difficult and costly to share with others. However, in order to promote knowledge creation a thorough interaction between tacit and explicit knowledge needs to exist, since knowledge cannot be created by only focusing on tacit or explicit knowledge alone.

He then introduces five steps that are crucial for knowledge creation. 1) The first one is the intention, defined by each organization to evaluate and justify knowledge. 2) Autonomy, necessary for individuals to be able to create ideas and spread to the rest of the group. 3) Fluctuation and Creative Chaos, which refers to the interaction that should exist between the organization and its outside environment. 4) Redundancy, defined as

‘the existence of information that goes beyond the immediate operational requirements of organizational members’, and 5) Requisite Variety, where internal diversity has to exceed the one from the outside world, members need access to information, and harmony is needed in the workplace (Nonaka & Hirotaka, 1995). These five conditions encourage knowledge creation inside an organization and promote a knowledge continuous cycle.

This book which presented one of the first knowledge management processes does a great job explaining knowledge transformation, and the importance of allowing every member of an organization to be part of the interaction within these two types of knowledge. The knowledge continuous cycle, called ‘knowledge spiral’ (Nonaka & Hirotaka, 1995; Toyama & Nonaka, 2000), is the result of the interaction of individuals with other team members, since most knowledge creation occurs at a group level. The book addresses the need of future research in areas such as the importance of linking the ‘intention’ of knowledge creation with the organizations’ vision or mission, and in general the need of relating business concepts with KMS creation. Also, the book does not mention the use of IT to improve knowledge transformation (tacit to explicit & vice versa), a hot research area nowadays due to the flexibility and autonomy must IT tools give to their users.

2.2.2 Knowledge Conversion Process: SECI, Ba, and Leadership

From the previous knowledge study, Nonaka et al (2000) defined the knowledge conversion process SECI. This process shows how to use socialization, externalization, internalization and combination to convert knowledge. The process model consists of three main elements: the SECI (knowledge creation process), Ba (shared context for

knowledge creation) and leadership to focus on understanding the dynamic process in which an organization creates, maintains, and exploits knowledge. They start by arguing that most organizations have little understanding on how to create and share knowledge, and mention the importance of knowing how an organization is structured and managed, how it interact with its environment, and how its members interact with each other.

SECI (Figure 2.1) is based on the interaction between explicit and tacit knowledge to create knowledge inside an organization. The first step is socialization, a process of converting new tacit knowledge through shared experiences (Toyama & Nonaka, 2000). Human interaction is recommended due to the difficulty of transferring tacit knowledge and usually occurs in informal social meetings outside the organization. Externalization is the process when tacit knowledge is made explicit knowledge, and knowledge is crystallized (Toyama & Nonaka, 2000). Combination is when all these new explicit knowledge is disseminated among members of an organization. At this point of the process the authors suggest; as well as in the previous study, the importance on linking the KMS to the organizational structure concepts, such as corporate vision, to create more valuable explicit knowledge. Internalization is the final process where explicit knowledge becomes tacit (Toyama & Nonaka, 2000). This is achieved when explicit knowledge is internalized by while learning on the job.

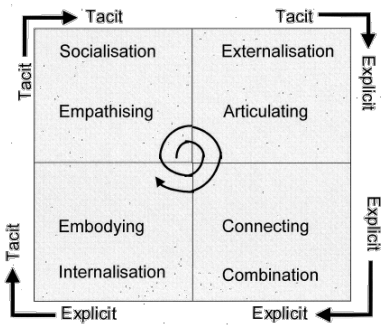


Figure 2. 1 The SECI process (Toyama & Nonaka, 2000)

From Figure 2.1 we notice that inside SECI, the knowledge spiral is present and moves in a continuous loop from tacit to explicit, explicit to combination, combination to tacit, and can also act in an individual context or a group context.

In order for SECI to take place, the existence of 'Ba' (Figure 2.2) or a 'place' is required. Ba was originally introduced by Kitaro Nishida as a 'place where information is interpreted to become knowledge' (Toyama & Nonaka, 2000). Four types of Ba are then discussed by Nonaka as: 1) Originating: Physical, face to face experiences where individuals share their feelings, emotions, experiences and mental models during the Socialization phase. 2) Dialoguing: Collective face to face interactions, where tacit knowledge is made explicit through the externalization of common terms and concepts accepted collectively. 3) Systemizing: Collective explicit knowledge is combined with existing knowledge that can be communicated in easier forms to more people. 4) Exercising: Where people internalize the explicit knowledge that has been made available by learning on the job, and providing them an opportunity to create new tacit knowledge.

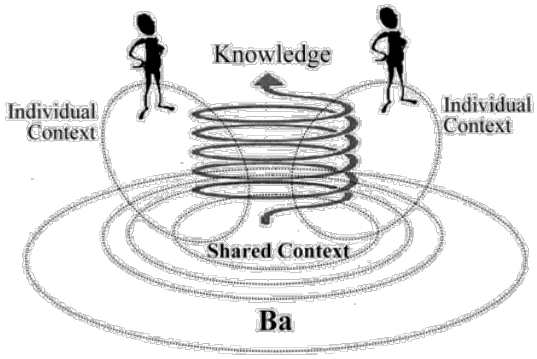


Figure 2. 2 : Shared context for knowledge creation (Toyama & Nonaka, 2000)

The last part of the proposed model explains the importance of identifying and exploiting knowledge assets. Knowledge Assets are defined as a 'firm specific resources that are indispensable to create values for the firm'. These knowledge assets include experiential assets such as care, love, and trust. Conceptual knowledge assets like explicit knowledge in the form of images, symbols and languages; that can be retained easier than experiential assets. Systemic knowledge assets include IT tools and any type of documentation that contains collaborative knowledge.

This knowledge creation model can be resumed as using the existing knowledge available inside organization knowledge assets, to create new knowledge that will become part of the organizations' knowledge assets by following the SECI process that takes place inside a Ba.

The model is a good starting point for understanding how the use of IT tools benefit knowledge creation and sharing, since the systemizing Ba requires of effective tools that can help collect and communicate knowledge and information effectively and efficiently. Even though, the paper does not address how to link the use of IT to the systemizing Ba or to the SECI process, it does provide important ideas such as creating IT tools that can provide immediate feedback (i.e. Assessment tools) to build new hypothesis that can further help in the creation of new knowledge. It also addresses the importance of making the systematic knowledge assets tools visible and available to everyone in the organization to increase the rate of knowledge creation and sharing. The importance of Ba in IT is further discussed in the next section of the chapter.

2.2.3 Strategic Framework for Knowledge Management

A further study done by Nonaka with Von Krogh and Aben (2001) developed a framework for knowledge creation and sharing based on four knowledge strategies. It also provided an insight on how to structure a company prior to implementing the knowledge strategy. The term 'knowledge domain' is introduced and it is defined as any type of explicit and tacit knowledge already available inside an organization. Some examples are: data, handbooks, manuals, presentations, and key people (Von Krogh, Nonaka, & Aben, 2001). These knowledge domains are more easily define through knowledge workshops, where people inside and organization can meet with experts in particular areas from inside and outside the organization. Knowledge workshops result in shared vocabulary and terminology, and the creation of the Community of Practice (CoP), which aims to identify knowledge gaps (knowledge where knowledge is not available) in particular knowledge domains in order to nurture the sharing and creation of new knowledge and practices inside an organization. The CoP impact will depend on the value it can have on business operations and values of a given organization, reason why further research should be done to make sure KM and KMS are tied to the organization structure in order to motivate employees to create and share knowledge, but most importantly to make knowledge visible inside the organization to promote and benefit from this knowledge sharing.

2.2.3.1 Knowledge Creation Strategic Process

The KM model known as “Knowledge Strategy” (Von Krogh, Nonaka, & Aben, 2001) applies knowledge processes to existing or new knowledge domains to achieve strategic goals. This process assumes that knowledge is dynamic and will change gradually as knowledge domains and knowledge inside an organization keep updating.

The four strategies proposed in this KM model (Figures 2.3 & 2.4) begin by leveraging knowledge throughout the organization, and then proceed to the expanding strategy where they increase the scope and depth of knowledge. When knowledge is acquired from partners and other organizations the appropriating strategy occurs, while the probing strategy takes place when new knowledge is developed from scratch.

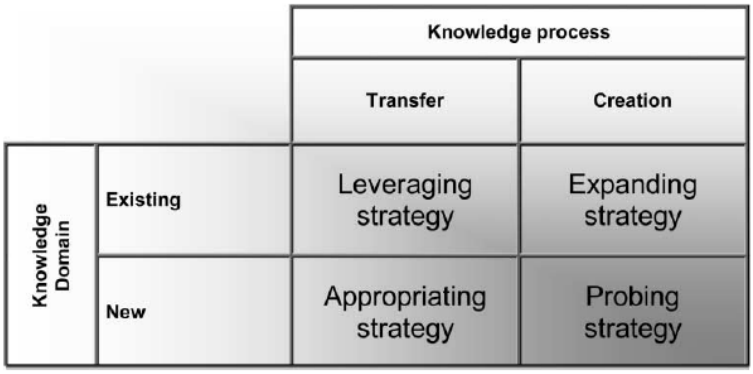


Figure 2.3 Four Knowledge Strategies (Von Krogh G. , 2002)

This model encourages organizations to obtain an overview of their knowledge domains in order to create and share knowledge in a continuous cycle. They again suggest autonomy in order to promote creativity and innovation which can lead to creating new knowledge. The authors suggest future research of KMS application inside an organization to be tightly coupled with other strategizing activities within the organization in order to develop a knowledge based advantage. The use of IT inside KMS

is another topic that should be further researched since both Knowledge Workshops and CoP's could be implemented using available IT software (i.e. Blogs, Community Platforms, Web Meeting Systems, SharePoint, and Instant Messengers). Using IT might provide a cheaper way for organizations to manage knowledge and for people to exchange, share, create, and become aware of knowledge.

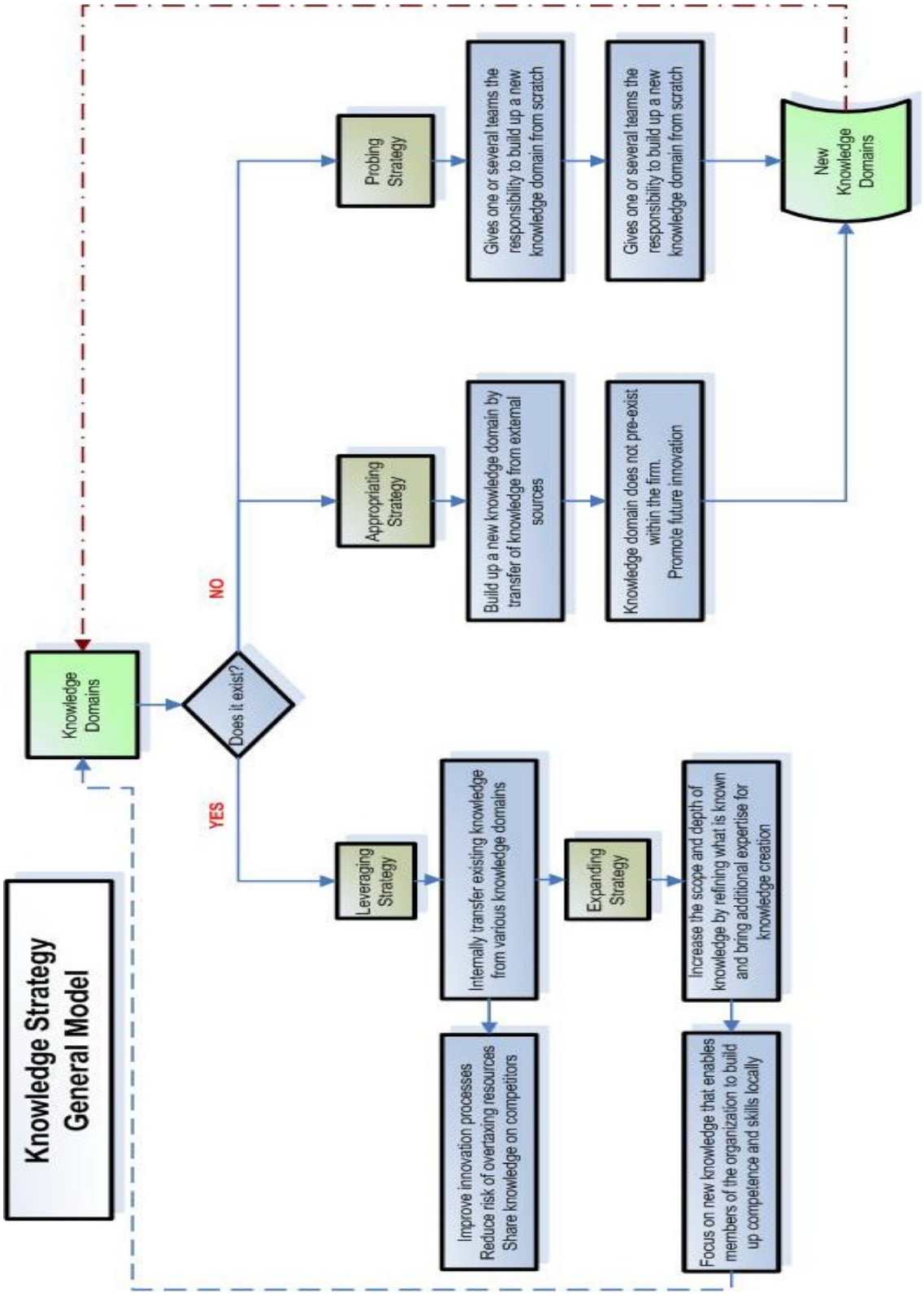


Figure 2.4 Four Knowledge Strategies Detailed

2.3 Information Technology in Knowledge Management

Considering the way IT has been designed recently, IT is considered to be a driving-force for knowledge creation (Akiyoshi, 2008), contrary to the idea of many researchers mainly in the last decade, who said IT could end up turning knowledge into static and inert information (Borghoff & Pareschi, 1997). Today, the use of IT inside KM and KMS to promote knowledge sharing and creation is an important area of research in the IT domain. However, the first step for developing and deploying IT strategies and tools inside KMS need the organization leaders to be aware of the limits of IT. First, because deploying IT tools do not guarantee solving every knowledge problem present at time. Second, IT tools are designed with a general view, which gives management the task to make sure the IT tools being used match the organizational and cultural profile.

2.3.1 Survey of Information Technology in Knowledge Management

Grover and Davenport (2001) provide a very good survey of the impact of IT in KM at an organizational level; a summary table is shown below:

Decade	**Role of IT**
1960's	• Inflexible • Centralized mainframe that only allowed electronic data processing. • Organizations became data heavy. • Data management systems kept data in check.
1970's	• MIS were added data into useful information reports. • Very few people had access to info. • Management struggled to manage information correctly.

Early 1980's	• Informational control to managers • PC's were used by management to cater to their own unstructured data and information needs.

Late 1980's	• Strategic Information Systems
	  o Focused on organizational effectiveness.
	  o Inter organizational deployment
	  o Competitive Advantage
	• Focus remained on Information

2000's	• Data is classified, summarized, transferred or corrected to add value.
	• This information becomes knowledge within a certain context.
	• Knowledge is used to reduce uncertainty and gives competitive advantage.
	  o Understand processes better.
	  o Take us to a higher plane in the organization.

Table 2.1 Information Technology in Knowledge Management

2.3.2 Current and Future Impact of IT in KM

IT has been proposed as a way to help overcome time and space constraints (Erden, Von Krogh, & Nonaka, 2008) due to its capability to facilitate data and information exchange; or in other words, distribute explicit knowledge. IT development focuses on creating tools to create direct connections among people and promote socialization. Applications such as e-mail, virtual meeting systems, instant messaging (IM) and blogs are some examples of this IT tools.

IT has the potential of saving time and extra work. With current IT tools management can find the right person for a particular task with some kind of internal yellow pages. CoP's can be formed the same way and if time and space are a constraint,

location can be virtual through tools such as virtual meeting systems, instant messaging, bulletin boards, discussion groups (i.e. Google Lists), or personal blogs.

Von Krogh (2002) states that through these types of virtual interactions people can form reciprocal relationships and make a more coherent group or community. Some benefits include (Gottschalk, 2007; Guanasekaran & Khalil, 2003; Von Krogh G. , 2002):

a) People doing favors for others
b) Promoting intellectual exchange
c) Finding people with the same professional interests or areas of expertise in order to form social and professional groups
d) Increase productivity by working with people in different areas to achieve a goal involving more than one area of expertise
e) Developing common technical vocabulary for effective communication.

It is important to mention that physical interaction might still be needed as explained by Nonaka (2000) when defining Originating and Dialoguing Ba.

In regards to emotions and feelings, IT promotes exchange, help and trust. This develops unity and promotes personal rewards. Sometimes these personal rewards are not given by management but come from personal satisfaction of helping peers and being acknowledged by the rest of the community group. Though, both Nonaka and Van Krogh agree that ‘a mind-set shift is needed to change the idea of knowledge being a private good to being a public good owned by the community’.

One concern many researchers have had since past decades is the influence IT have on authenticity and veracity of information (Akiyoshi, 2008; Von Krogh G. , 2002). The problem in the past when relying on IT tools, especially with web 2.0 tools such as

portals and assessment tools was that if the information available was not reviewed, irrelevance and inconsistencies were found, which resulted in time consuming tasks that were not optimal for organizational results.

In recent years, IT tools have been developed to allow immediate feedback from peers who are able to validate the content of any information uploaded into any available portal or assessment tool. Still there is some debate regarding if these immediate feedback is enough to validate the reliability of organizational knowledge created by employees (Von Krogh G. , 2002).

Also, more attention has been given to developing web 2.0 tools to enhance knowledge creation (Gottschalk, 2007; Akiyoshi, 2008; Guanasekaran & Khalil, 2003). Some available tools are the use of internal organization portals and assessment tools which allow users to retrieve knowledge among the different knowledge domains inside the organization. These kinds of tools have shown that IT tools are being designed to adapt to employees needs in order to become more knowledgeable and create collective knowledge.

The use of IT is inevitable as it is more affordable, powerful, and is quickly becoming part of the subconscious routine of the knowledge worker, since it allows people to become aware of the opportunity to exchange knowledge. People will continue to create knowledge and decide how they communicate and collaborate with their peers through social network tools.

2.4 Successful Knowledge Management

One of the main problems organizations face is not being able to achieve their KM objectives. Reasons include lack of information organizations have regarding their own knowledge and how their KMS are doing in managing, locating, retrieving and spreading organizational knowledge.

Successful KM requires systems, methods and procedures (Gottschalk & Karlsen, 2004) to create a framework to guide organizations in understanding their current KMS and IT infrastructure. In order to understand 'what a user wants or needs' (Gottschalk, 2007), what IT tools work according to organizational profile and culture (Akiyoshi, 2008), and include a clear organizational plan on knowledge creation and sharing.

2.5 Opportunity Algorithm

As mentioned before, most organizations rely on building an IT infrastructure with diverse IT tools that management considers will facilitate them achieve their KM goals (Borghoff & Pareschi, 1997). Often, management invests in IT without knowing if they are acquiring the right IT tools for their company which later on lead to questions and uncertainty arise when having to identify why these IT tools are not performing the way they should.

Management usually thinks that giving their employee's and customers' what they want will guarantee success. The problem is that 'customers should not be trusted to come up with solutions' (Ulwick, 2002) since their perception of a particular IT tool may be subjective and change throughout time.

Ulwick (2002) proposed an outcome-based research to turn customer inputs into innovation by understanding the desired outcomes that are important to customers but are not currently satisfied by existing products and services. The opportunity algorithm (Ulwick, 2002) given by:

Importance + Max [Importance – Satisfaction, 0] = Opportunity

It can be input into a survey asking participants to rate each desired outcome in terms of its importance and degree of satisfaction. This calculation will reveal opportunity areas for product or system development and improvement.

2. 6 Analytical Hierarchy Process (AHP)

It has been shown that relying on survey data obtained from surveys might not be the best approach when dealing with complex decision making. Analytical Hierarchy Process (AHP) is a multi criteria decision making technique that helps dealing with subjectivity. It focuses on helping decision makers to find a solution that best suits a particular need allowing some small inconsistency due to human judgment, which is not always dependable.

AHP was developed by Thomas L. Saaty and is based on three principles (Kott, 1996):

a) Decomposition: Breaks problem down into individually manageable elements, which result in a hierarchical structure that groups issues of homogenous importance together with respect to the elements in the adjacent level above.

b) Measurement of Preferences: Calculate a relative ratio scale of measurement derived from pair-wise comparisons of the elements in a level of the hierarchy with respect to the influence of an element in the level above.

c) Synthesis: Priority vectors are derived for all comparisons in the hierarchy and global measure of priority is calculated by successively weighting and adding from the top level of the bottom level of the hierarchy.

2. 7 Quality Function Deployment (QFD)

The original intent of Quality Function Deployment (QFD) was to provide product developers with a systematic method for "deploying" the voice of the customer into product design (Cohen, 1995). In other words, it is an effective tool for planning attributes of new products that enables a development team to specify clearly customer demands and involves all members of the producer or supplier organization.

A key practice of Design for Six Sigma and included in the ISO 9000:2000 standards for customer satisfaction, QFD provides a way to translate conceptual requirements into items that area workable, measurable, and capable of design enhancement.

QFD is built according to a matrix called "House of Quality" (HOQ) (see Fig 2.5) and contains two main parts:

a) Horizontal Rows: "What?"

- Representing Employees requirements and point of views (From Surveys/Interviews)

b) Vertical Rows: “How?”

- Representing the steps proposed in the KMS model to achieve areas of concern in the KM area.

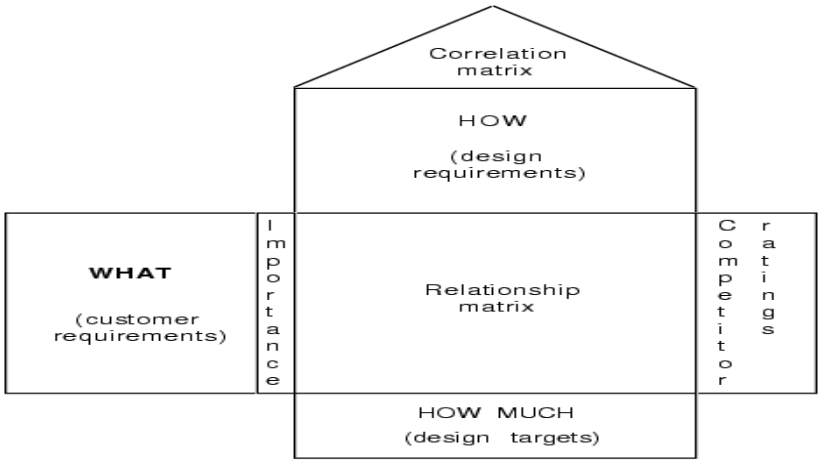


Fig 2.5 QFD House of Quality Matrix

2.8 Significance of Study

As shown in this chapter, literature shows that KM is a subject that has been linked profusely to organizational KMS but has not provided guidelines or taken into account many business and management areas such as organizational profile and context, that are directly associated with organizational performance.

There is also a strong belief from literature suggestion that linking the KMS to the organizational profile and then linking it to Information Technology will provide a cheaper and faster way to create and share knowledge inside the organization, hence provide competitive advantage to the organization.

CHAPTER 3

Methodology /Approach

3.1 Introduction

This chapter contains the methodology and approach followed in this research for the creation of a systematic framework to improve KM through IT. In order to create a framework that links organizational business processes, KM, and IT; two objectives need to be achieved:

1) Create an organizational profile to identify customer needs and requirements regarding the use of IT
2) Adaptation and deployment of survey instrument

With the purpose of structuring a decision making tool to help organizations understand the importance and satisfaction of their current IT infrastructure to improve KM, three objectives need to be achieved:

3) Provide management with a decision making tool to identify best IT tools in current KMS
4) Identify areas of opportunity for improvement of IT tools
5) Knowledge creation and sharing improvement according to organizational needs

The framework uses an organizational adaptable survey instrument, the integration of Quality Function Deployment (QFD), the Opportunity Algorithm (OA) and Analytical Hierarchy Process (AHP) to analyze the impact that various IT tools and their attributes have on current organizations. The framework also includes Knowledge Management System (KMS) flowcharts based on current knowledge management literature that can help organizations define their current knowledge domains and suggest tools to find new ones for organizational improvement. The framework follows the Baldrige Performance Criteria to help link the survey instrument and KMS model with the organizations' structure, mission, and values.

The correct implementation of this framework should assist management in:

1) Understanding the organization's KMS and overall IT infrastructure.
2) Identifying workforce needs and perceptions through the survey.
3) Best IT tools for employees and the organization.
4) Opportunity for improvement of current KMS and IT infrastructure.
5) Improve knowledge creation and sharing through IT usage.

The framework was built thinking of continuous improvement since IT tools have been and will be developed and modified to promote user friendliness and hence increase knowledge creation and sharing. As mentioned in the literature review, if these IT tools are implemented and used correctly, they can effectively support knowledge management and improve organizational results (Karlsen & Gottschalk, 2003; Grover & Davenport, 2001).

3.2 Organizational Profile to Identify Customer Needs and Requirements regarding the use of Information Technology

In order to link organizational business processes, KM and IT; the framework uses the Baldrige Criteria for Performance Excellence to create an organizational profile. An organizational profile based on the Baldrige Criteria serves as an initial assessment to help an organization identify their organizational priorities based on organizational needs and requirements. From the organizational profile findings, the survey instrument proposed in this research can be adapted to provide management with the right questions to understand their KMS and IT infrastructure.

3.2.1 The Baldrige Criteria for Performance Excellence

The Baldrige criteria for performance excellence help organizations assess their improvement efforts, to diagnose their overall performance management system, and to identify their strengths and opportunities for improvement. The first step of the Baldrige criteria is defining an organizational profile; and to understand its importance, we first take a glance at the Baldrige criteria for performance excellence system which is made up of seven main categories (see Fig 3.1)

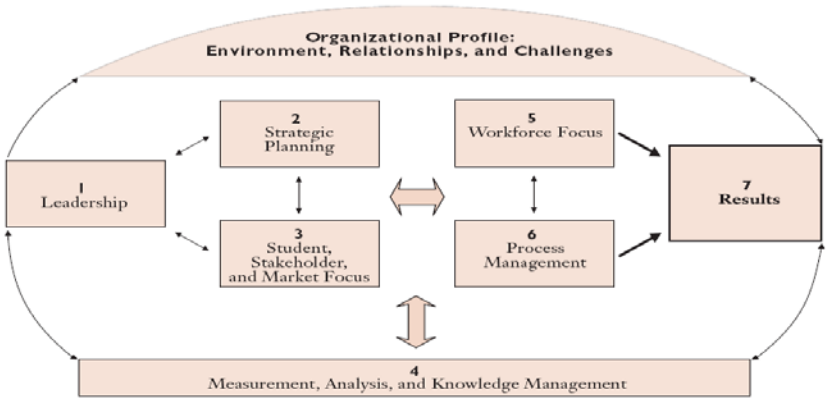


Fig 3.1 Baldrige Criteria for Performance Structure

Graham (2008) presents the Baldrige Criteria for Performance Structure as a System (Appendix A: Fig A1), making it easier to follow.

3.2.2 Defining an Organizational Profile

The Organizational Profile (Fig 3.2) encompasses the whole system and provides an overall picture of an organization, its operations, and strategic challenges. By defining an organizational profile, organizations (Education Criteria for Performance Excellence, 2008):

1) Outline an initial self-assessment to understand the organization.
2) Identify potential gaps in key information and focus on key performance requirements and results.
3) If there is no previous information available on a conflicting topic, the organizational profile can serve as a complete assessment, and these topics can be used for action planning.

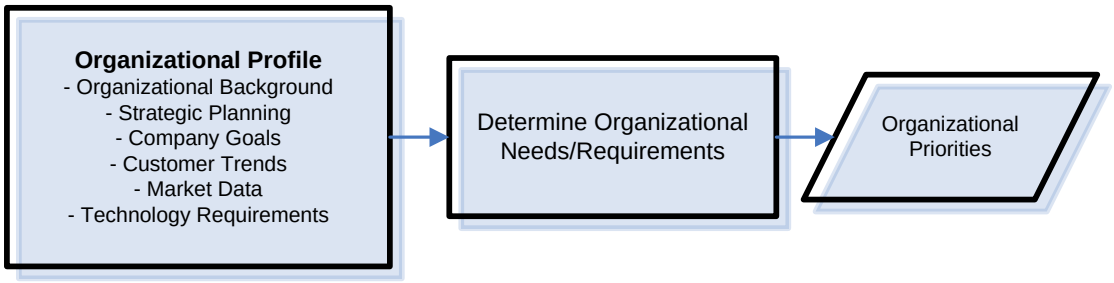


Fig 3.2 Organizational Profile

The Organizational Profile can be examined in two main areas:

1) Organizational Description: Focuses on describing an organization's operating environment and key relationships with customers, partners, and stakeholders.
2) Organizational Challenges: Focuses on describing an organization's competitive environment, key strategic challenges, and system for performance improvement.

Each area contains a number of questions that must be answered to define the organizational profile and can be found in Appendix A: Fig A2, A3, & A4.

In order to simplify the understanding and creation of an organizational profile, a summary of key elements and questions included in the Baldrige Criteria are shown below.

Organizational Profile Questionnaire Summary

Organizational Description

- Organizational Environment (Purpose, Services offered)
- Organizational Culture (Vision and values)
    - Main Goal and Expectations
- How do you do it? (How do you implement your strategy)
- Product/Service Description/type (Who is your customer and relationship w/ customer)
    - Customer target (purpose of service/product)
- Structure of organization (role, responsibility, number of people)
- Competitive Environment
    - Who are your competitors? (size and growth compared to your organization)

Problem Approach & Strategy Planning

- Describe problem
- When is it happening? Where is it happening?

- Problem background (from past experience)
    - Has any solution strategy being developed to fix the problem?
    - Has any of this solutions being deployed (Results & Observations)

Measurements and Main Goals

- How has this problem affected your desired performance?
- Has this problem affected your customer relationship and satisfaction?

3.2.3 Organizational Profile on Management of Information, IT, and knowledge

To understand the use and impact of IT inside an organization the Baldrige Criteria includes a section about management of information, IT, and knowledge (See Fig 3.3) This section includes a questionnaire (Appendix A: Fig A5) that will help an organization understand where they stand in regards to their IT usage and overall understanding of their IT infrastructure.

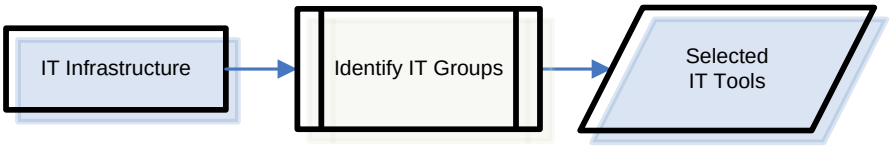


Fig 3.3 Management of Information Technology

From this questionnaire, management will be able to get a glimpse of how well they understand their current IT infrastructure and KMS. Some of the key aspects they will find are:

1) Data communication and reporting ease:
    - Including data interpretation.
    - Use of graphics or any visual aid.
    - Data analysis.

2) IT purchase and implementation:
    - Methods to evaluate potential hardware and software.
    - Appropriate user training for new IT tools.
    - Stages of IT implementation.
3) Reliability and Functionality:
    - Frequency of IT tools monitoring for reliability.
    - IT tools testing for crashing or interruption.
    - Software updating
4) IT maintenance and safety:
    - Frequency of IT infrastructure evaluation
    - Information protection
    - Data integrity
5) Information and Knowledge Management:
    - Approach for documenting employee knowledge, best practices and lessons learned
    - Ease for documenting knowledge
    - IT tools user friendliness
    - IT tools access and navigation ease

3.2.4 Organizational Priorities

Once management has defined organizational needs in regard to the organizational profile and management of IT and knowledge, the organization can set the organizational priorities.

Organizational priorities will be chosen according to the level of importance of an organizational need according to an organization's strategic plan. At this stage management will decide what IT tools and IT tools attributes are fundamental for their current KMS. These IT tools and attributes will be analyzed through the survey to understand the impact of IT in KM and the organization in general.

3.3 Adaptation and deployment of survey instrument

To analyze the impact of IT in KM and the organization, a survey instrument is used. The survey instrument is designed to adapt with the framework and consists of a set of qualitative and quantitative questions in regards to organizational priorities, strategic planning, and IT infrastructure (See Appendix B: Doc B1). The survey population will be composed of organization employees and the survey should be approved and go through the Institutional Review Board (IRB) to protect respondents privacy.

The survey instrument should cover open questions regarding current, past, and future use, importance, satisfaction, and development of IT inside the organization to understand workforce perception regarding the use and impact of IT for enabling them to do their jobs. These open ended questions will provide qualitative data for an initial data analysis assessment and will be decision factors for the development of the QFD tables in stage 5 to help improve knowledge creation and sharing.

The quantitative part of the survey should ask respondents to rate each IT tool attribute being studied in terms of its importance and degree of satisfaction (see Fig 3.4). The proposed measurement scale is a seven-point linear numerical scale ranging from a high 7 to a low 1. This scale was chosen since items are to be judged on a single

dimension and arrayed on a scale with equal intervals. Advantages of using this linear numerical scale include simplicity and clarity which make the format to be clean and straightforward (Alreck, 2004). These quantitative data can be used as an initial assessment to understand the degree of importance and satisfaction of the overall IT infrastructure, each IT tool, and each IT tool attributes. The data can also be used to do a statistical analysis based on workforce profile (i.e. management vs. staff), an identify differences between management and staff perceptions regarding KM practices and IT.

Real Time Communications such as Instant messengers (i.e. AIM) are commonly used inside the organization as a work tool. Overall how satisfied are you with these communication tools?							
Importance	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Satisfaction	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Fig 3.4 Importance vs. Satisfaction Question Example

Once the survey has been deployed and data from respondents has been obtained, an initial descriptive statistical analysis consisting of means and histograms can be done. Descriptive statistics provide a general idea of where an organization stands for decision making. The problem is that management cannot only rely on these results since surveys tend to be subjective due to respondents lack of knowledge.

"Customers should not be trusted to come up with solutions; they are not experts or informed enough. They should be asked only for outcomes; that is, what they want a product or service to do for them." (Ulwick, 2002)

T-tests are also done to assess the statistical significance of two dependent variables sample means (i.e. IT tools), and hence identify what IT tools are the most used.

$$H_0 \quad \mu_1 = \mu_2$$

$$H_1 \quad \mu_1 \neq \mu_2$$

$$\propto = 0.05$$

3.4 Provide Management with a decision making tool to identify best IT tools in current KMS

In order to deal with survey subjectivity and provide management with a decision making tool to identify the best IT tools according to the attributes by which the IT infrastructure is being measure the model uses an adaptable analytical hierarchy process (AHP) model.

AHP has been widely used in multiple criteria decision making and is used in this framework due to its compatibility to be integrated with QFD (Vaidya, 2006). The AHP process consists of three main operations and is shown systematically by Ho (2008) in Fig 3.5:

1. Hierarchy Construction
2. Priority Analysis
3. Consistency Verification

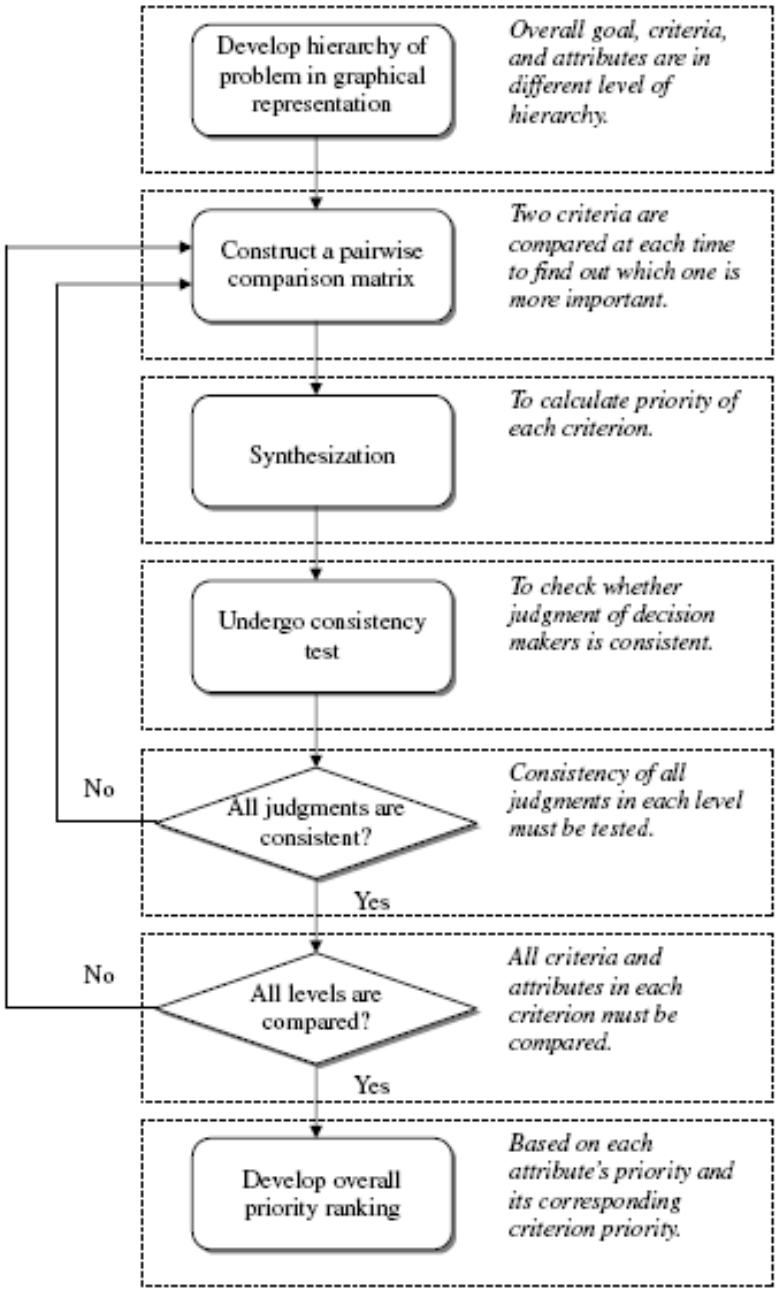


Fig 3.5 AHP Systematic Model (Ho, 2008)

The AHP model used for this framework is a three level model and is presented in the framework as shown in Fig 3.6

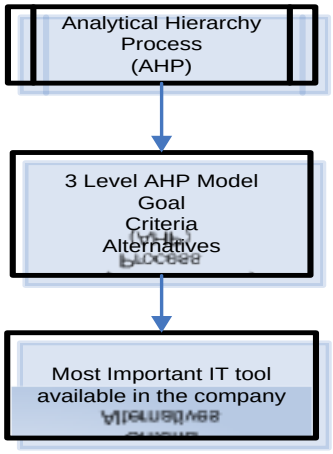


Fig 3.6 Analytical Hierarchy Process

3.4.1 Hierarchy Construction

The AHP model was broken down hierarchically (see Fig 3.7) into:

1. Level 0: Goal of the Analysis
2. Level 1: Multi criteria containing the attributes being analyzed
3. Level 2: Alternative choices

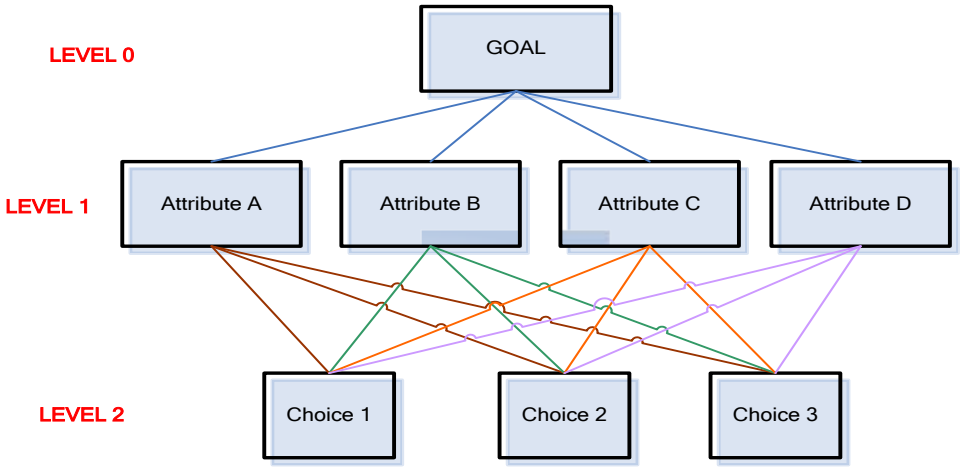


Fig 3.7 Hierarchy Structure of AHP Model

3.4.2 Priority Analysis

In this stage of the AHP process, each attribute in Level 1 has to be compared with each other. The number of comparisons can be defined by:

$$\frac{n(n-1)}{2}$$

n is the number of attributes being analyzed

A comparison matrix is created by comparing two attributes at a time and assigning an importance judgment score. Importance judgment scores (Table 3.2) range from a low 1/9 for extremely less important, 1 for equal importance, to a 9 for extremely more important. Since all the attributes have to be compared with each other, actual judgments will be shown as reciprocals in the comparison matrix (i.e. if A compared to B is 9, then B compared to A is 1/9).

9	A is extremely more important than B
7	A is very strongly more important than B
5	A is strongly more important than B
3	A is moderately more important than B
1	A is of equal importance with B
1/3	A is moderately less important than B
1/5	A is less important than B
1/7	A is strongly less important than B
1/9	A is extremely less important than B

Table 3.1 Importance Judgments Scale Range

To prioritize the comparison matrices, the priority vector is computed by calculating the normalized Eigen vector of the matrix. An approximation to the matrix Eigen value can be easily calculated by adding each column of the comparison matrix and dividing each

element of the comparison matrix with the value obtained previously. The normalized Eigen value or priority vector is then obtained by averaging the rows.

3.4.3 Consistency Verification

In order to verify the consistency of the AHP analysis three calculations need to be made:

1. The largest Eigen value has to equal to the size of the comparison matrix.

$$\lambda_{max} = n$$

2. Consistency Index (CI) needs to be calculated

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

3. Random Consistency Index (RI) according to number of attributes needs to be divided by the Consistency Index to obtain the Consistency Ratio (CR). The RI table was provided by Saaty (1980) as:

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Table 3.2 Random Consistency Index Values

In order to show consistency the value of the CR need to be smaller than10% to accept consistency. Any value higher than 10% will result in subjective judgments.

3.4.4 Level 2 analysis and Result

The same procedure has to be done for Level 2. Comparison matrices, priority analysis and consistency verification need to be done for each choice, with respect to each factor.

The last step in order to identify best choices according to our goal is calculating the overall composite weight. The overall composite weight is simply the weight of each alternative based on the weight of Level 1 and Level 2. In other words, the linear combination obtained by multiplying the weights and priority vectors (Saaty, 1980).

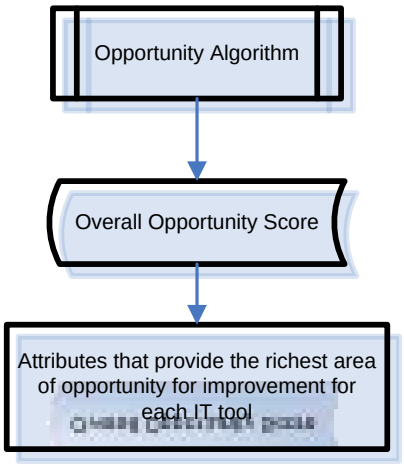
The overall composite weight will allow management to identify what choices (IT tools) are the most important for the organization based on the attributes selected for the study.

3.5 Identify areas of opportunity for improvement of IT tools

As mentioned in the literature review, many organizations acquire IT tools that might not be the best fit for their organization and further on do not understand why those tools are not working the way they should. Even though workers are the ones who use these IT tools on a daily basis and are supposed to be knowledgeable about them, truth is that people's perception is usually subjective and changes from time to time depending on their performance and ability to use technology.

In order to deal with these inconsistencies, the opportunity algorithm (OA) is used in this framework to identify areas of opportunity for improvement of the current KMS and IT infrastructure. OA turns customer inputs into innovation by understanding the desired outcomes of customers but are not satisfied by existing products or services.

The quantitative part of the survey instrument is formatted to ask respondents to rate each IT tool attribute being analyzed in terms of its importance and degree of satisfaction. With these data the opportunity score can be calculated by running the OA mathematical formula (see Fig. 3.8)



Importance + Max [Importance – Satisfaction, 0] = Opportunity Score

Fig 3.8 Opportunity Algorithm Process

The OA will give in return an opportunity score, which will score higher whenever an attribute is rated as important but not well satisfied, meaning there is a high opportunity for improvement. It is important to note that in the OA formula the number inside the brackets in [Importance-Satisfaction] cannot be less than zero. This is because 'high levels of satisfaction do not detract from importance' (Ulwick, 2002).

For this framework, since many attributes opportunity scores are being calculated, a ranking of opportunity is done. This is done to identify the areas particular to each IT tool that offer the most promising opportunity for improvement and hence improve the usability of that IT tool in the organization.

3.6 Improve Knowledge Management with current Information Technology Infrastructure

To improve KM with the current IT infrastructure, the last stage of the framework integrates previous results from the qualitative survey results, OA and AHP to adapt Quality Function Deployment (QFD).

3.6.1 Qualitative Analysis

The survey instrument (See Appendix B) includes open ended questions regarding the development of IT in the organization. The purpose of these open ended questions is to provide an internal benchmarking of the organizations KMS and IT infrastructure to identify what IT tools have improved throughout time and which ones need to be further analyzed to provide better results. The qualitative analysis of the survey results will also help management to find key customer needs and requirement that can be input into QFD to improve each IT tool being studied.

3.6.2 Quality Function Deployment (QFD)

As explained in the literature review, QFD is an effective tool for planning attributes of new products according to customer demands priorities which are then transformed into functional and technical features for product design. The framework integrates QFD with the OA and AHP. The integration of QFD and AHP has proven to help deal with the subjectivity that these two decision making tools have shown in the past.

The QFD for this framework is structured as shown in Figure 3.9 consists of horizontal rows of '*What*', representing customer demands and vertical columns of '*How*', representing ways to achieve them. The '*What*' is defined by the qualitative analysis and AHP results, where management can identify issues dealing with the use of IT that are preventing them from creating or transferring knowledge inside the organization. The '*How*' is defined with the help of current KM models that are currently available and are analyzed in the literature review. In order to understand current KM models, two of Nonaka's KM models were systematized and included in Appendix C: Fig C1 & C2.

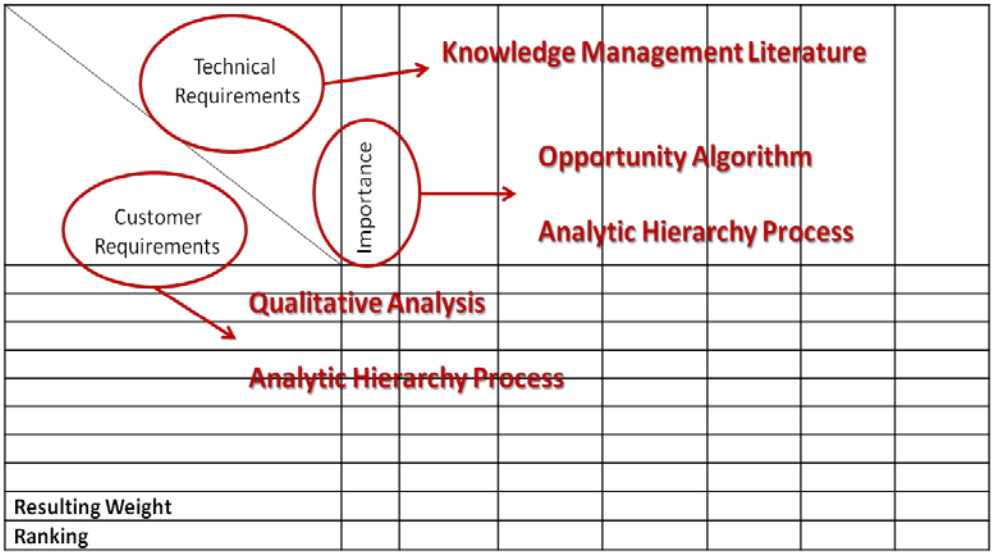


Fig 3.9 QFD Framework Structure

The importance of each customer requirement included in the 'How' part of the QFD is determined according to the OA and AHP results. This will help management to assign importance rates based on the results of two decision-making tools and prevent management from assigning importance rates that might be questionable due to management uncertainty and subjectivity.

3.7 Systematic Framework and Implementation Scenario

The finalized systematic framework (Fig 3.10) contains the elements explained in previous sections starting with the creation of an organizational profile and the adaptation of the survey instrument according to organizational priorities in regards to KM and IT.

With the results obtained from the survey instrument a set of decision making tools help management decide what IT tools are more important based on their organizational profile. It also helps in identifying areas of opportunity for improvement of each IT tool analyzed. Finally, integrating QFD with OA and AHP helps considering problems that affect the effective creation and sharing of knowledge in the company.

The framework is structured to promote continuous improvement inside the organization implementing this framework. The framework was implemented and tested at the Missouri Small Business Development Center (MSBDC) and results are shown in the next chapter.

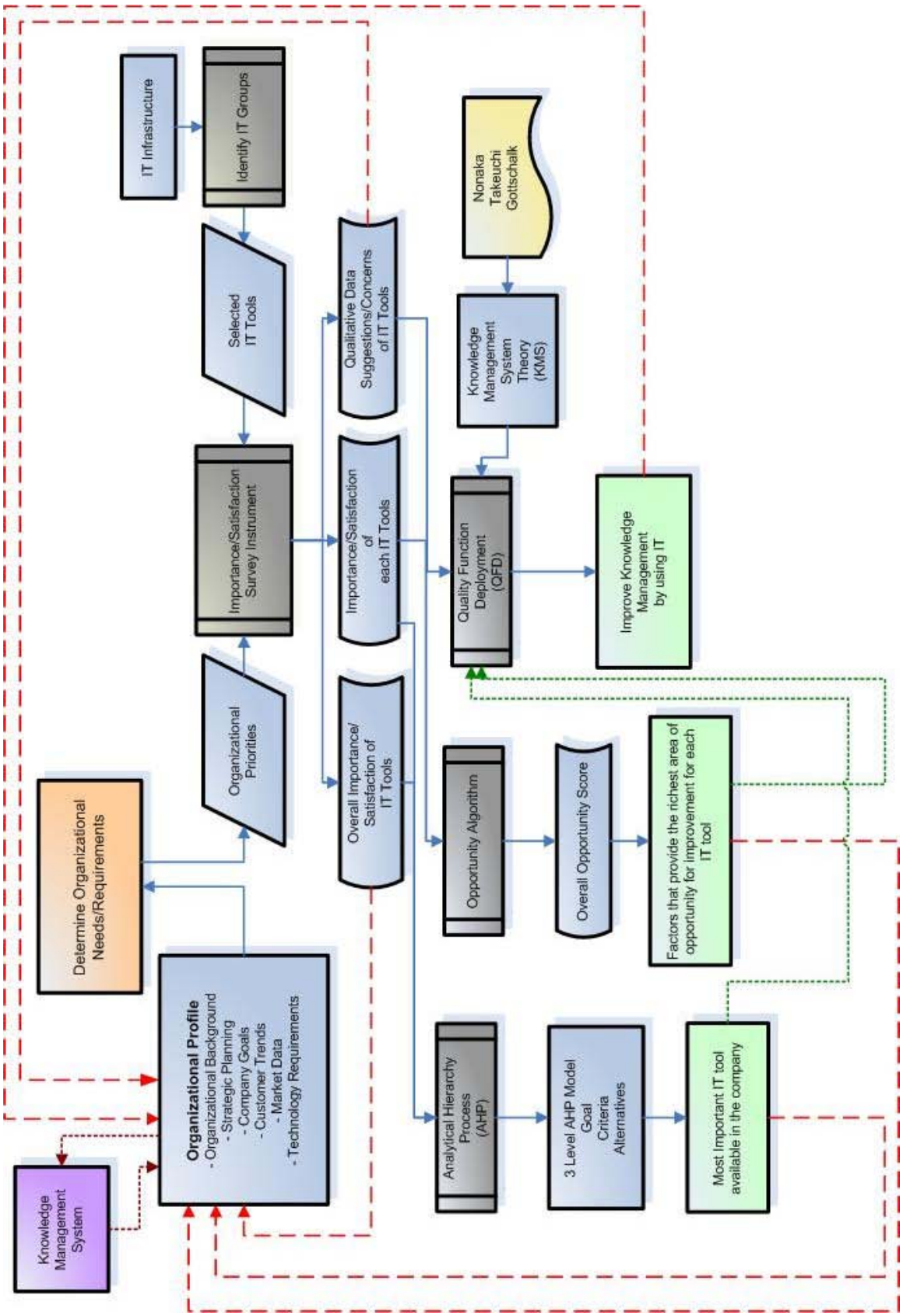


Fig 3.10 Systematic Framework to improve KM through IT

CHAPTER 4

Implementation Case

4.1 Stage 1: Organizational Profile to Identify Customer Needs and Requirements regarding use of IT

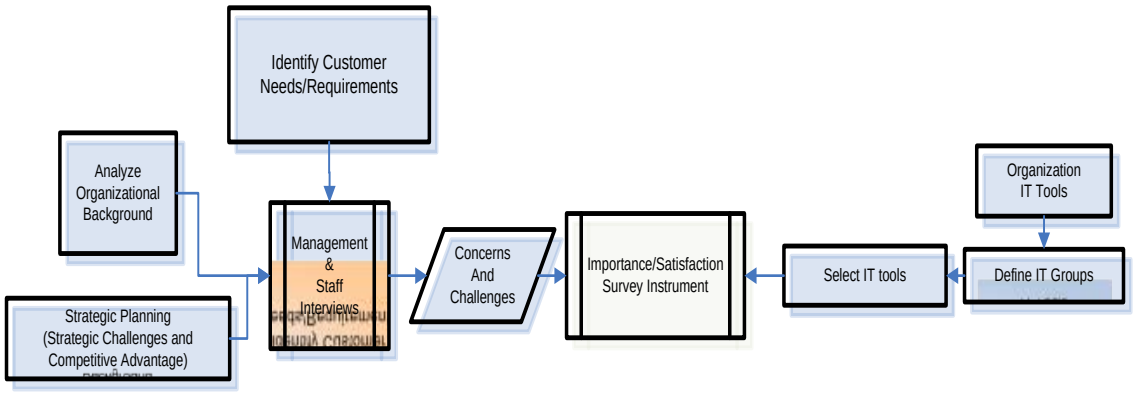


Fig 4.1 MSBDC Implementation Stage 1

An organizational profile of the MSBDC was first done in order to understand how the organization operates. It also served as a self-assessment for the MSBDC to identify conflicting topics and areas that need improvement in regard to the way they use and understand their IT infrastructure and KMS.

According to the MSBDC's organizational profile, strategic planning and their current Information Technology (IT) tools used, a survey instrument (see Appendix B: Doc B1) was adapted to measure the organizational impact of IT. The survey instrument consisted of analyzing six main areas regarding current, past, and future use of IT inside

the organization. It included three open-ended questions regarding the importance, satisfaction, and development of IT technology inside the company. The other three questions analyzed four different IT tools currently used inside the MSBDC based on a seven-point linear numerical scale ranging from a high 7 to a low of 1, measuring six main attributes:

- Reliability
- Ease of Use
- Software functionality
- Information quality
- Response time
- Navigation and communication ease

Survey participants were asked to rate each IT tool in terms of its importance and degree of satisfaction.

The four IT tools analyzed in this survey included:

1. **WebCATS**: A reporting system required to record and report deliverables to the company. The whole organization uses this online database to enter all client and training information. The data is then analyzed and pulled for various reports to funders. Counselors at the MSBDC are asked to keep their data up to date at least monthly and the input data such as counseling sessions training, impact (jobs created, loans received, etc). WebCATS is the foundation for all reports they run and all data that they use.
2. **WebAPPS**: System created and supported by the University of Missouri Extension and serves the same purpose as webCATS. The MSBDC crosswalks

key information such as trainings and counseling from CATS into APPS on a monthly basis. The Business Development program is required to use webAPPS for all calendaring and scheduling of training events. Counselors in the field are required to use the webAPPS calendaring system to post all the training events they offer. They are supposed to do this at least one month in advance of the program. The system tries to serve all the various parts of Extension, which includes the MSBDC and five other programs, so it cannot be customized to the MSBDC's needs at all.

3. **The Portal**: The portal is an internal internet site that is used to communicate/share information with the whole program. The portal has various links which counselors/leadership can access for important information about the MSBDC program. The Portal menu is showed below in Fig 4.2.

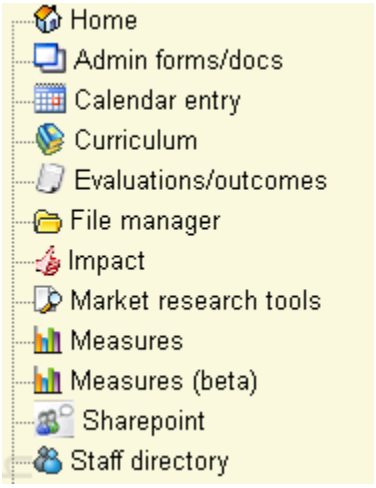


Fig 4.2 The Portal Menu

The main aspect of the portal is the Measures function. This is the interface from webCATS and other databases that MSBDC uses to a user-friendly dashboard/scorecard system. Counselors and leadership can log on to the portal/measures and see all the impact/data in real-time from webCATS and the MSBDC's evaluation system. The portal shows the results of the MSBDC program, and it can be viewed for year to date, past years, etc. It can also be viewed from the statewide level, to the regional level, and down to the center and individual level.

4. **Client Assessment**: The client assessment tool is to be used whenever a counselor sees a client for the first time. The tool is an online survey that the counselor sends to the client before the first counseling session. The clients fills out a survey online (link: http://www.missouribusiness.net/assessment/) and the results are sent to the counselor and used in the first session. This system is used to make that first hour of counseling in a much more effective way. What used to take a counselor and hour to ask the client, now the client can fill out ahead of time, the counselor can review it, and then the counselor and client can use that first hour to discuss the issues and take action steps.

4.2 Stage 2: Conduct Quantitative/Qualitative Survey

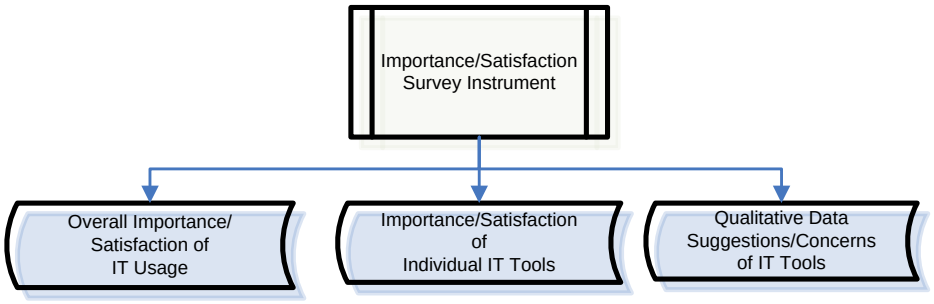


Fig 4.3 MSBDC Implementation Stage 2

The survey was sent out to a total of 78 people in the MSBDC including management and staff. A total sample of 52 responses was gained, for an effective response rate of 67%. The survey questionnaire was self administered by respondents through a web-based questionnaire and the survey responses were kept confidential according to IRB.

The survey outputs included three main areas of results:

1 Overall importance and satisfaction of current IT tools.
   a. Results from Management.
   b. Results from Staff.
2 Current importance and satisfaction of each IT tool included in the survey.
   a. Results from Management.
   b. Results from Staff.
3 Qualitative data with suggestions and concerns regarding the use of IT tools and KM.
   a. Results from Management.
   Results from Staff

4.3 Survey Data Analysis

4.3.1 Overall IT Infrastructure

The first thing that was analyzed was the overall importance and satisfaction of the current IT infrastructure available at the MSBDC. The results as shown in Fig 4.4 show a higher importance and satisfaction average score for the IT infrastructure according to management.

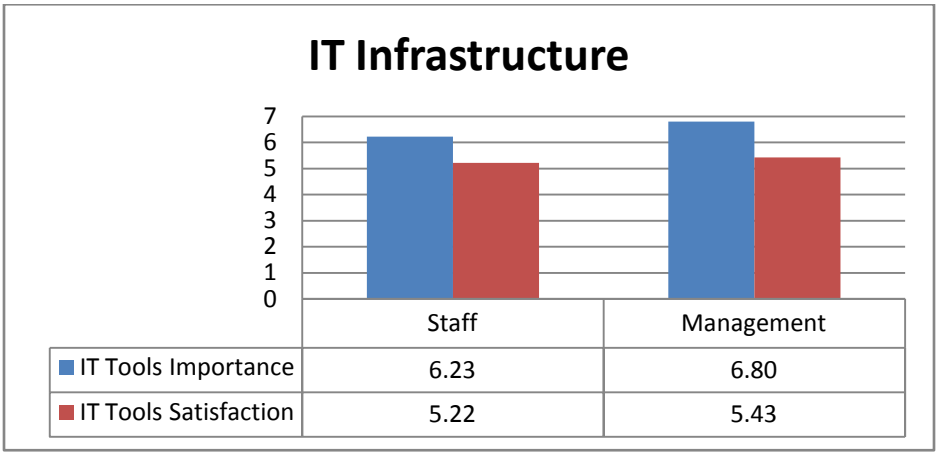


Fig 4.4 Overall Importance vs. Satisfaction of IT infrastructure

The six attributes measured in the survey were also analyzed (Fig 4.5) to identify what attributes average scores are considered as the most important according to organizational needs to perform their jobs. Reliability and Ease of Use ranked highest, and Response Time and Functionality ranked lower in terms of importance. While Response Time and Reliability ranked highest, and Navigation/Communication Ease and Functionality ranked lowest in terms of satisfaction.

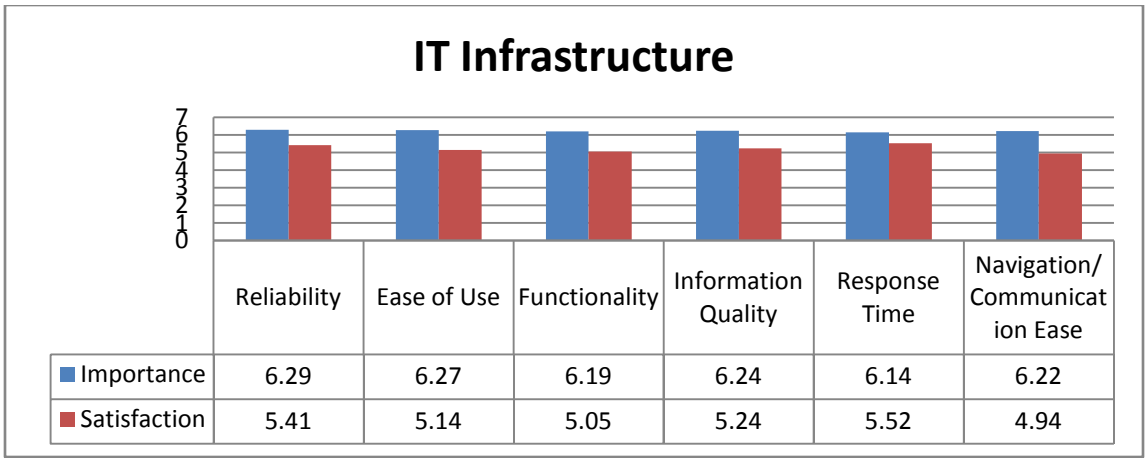


Fig 4.5 Overall Importance and Satisfaction of IT Infrastructure Attributes

4.3.2 IT Tools Analysis

Each IT tool included in the survey was analyzed according to management and staff in terms of importance and satisfaction average scores. Staff average results can be seen in Table 4.1, where WebCATS ranked highest and WebAPPS lowest in terms of importance. In terms of satisfaction, the Portal ranked highest and WebAPPS ranked lowest.

Tool	Importance	Satisfaction
WebCATS	6.51	5.47
Portal	6.42	5.66
Assessment	6.05	5.32
WebAPPS	5.92	4.42

Table 4.1 IT tools results according to Staff Results

Management average results are shown in Table 4.2 and show WebCATS and the Assessment ranking highest and WebAPPS lowest in terms of Importance. While the Portal ranked highest, and WebAPPS ranked lowest in terms of Satisfaction.

Tool	Importance	Satisfaction
WebCATS	6.83	5.75
Portal	6.79	6.54
Assessment	6.83	5.92
WebAPPS	6.75	3.50

Table 4.2 IT tools results according to Management Results

Each IT tool was also analyzed independently to identify the effect of the six attributes under study. From staff results (Appendix D: Table D1) it is important to notice that for the IT tools that serve as databases and knowledge repositories (WebCATS and WebAPPS) Reliability and Ease of Use ranked highest, and Response Time ranked lowest in terms of Importance. While Reliability and Response Time ranked highest, and Navigation/Communication Ease ranked lowest in terms of satisfaction. The Portal followed the same trend as WebCATS and WebAPPS in terms of importance and satisfaction. The Assessment tool which serves as a customer relationship management (CRM) tool ranked Navigation/Communication Ease and Information Quality highest, and Reliability lowest in terms of Importance. While Response Time and Ease of Use ranked highest, and Reliability ranked lowest in terms of Satisfaction.

Another point to notice from the survey results is the different perceptions management and staff (Appendix D: Tables D1 and D2) has in regards to what attributes are important for each IT tool.

4.3.3 Assessing Statistical Significance

T-tests (Table 4.3) are also done to assess the statistical significance of two dependent variables sample means, and hence identify what IT tools are the most used.

$$H_0 \quad \mu_1 = \mu_2$$

$$H_1 \quad \mu_1 \neq \mu_2$$

$$\propto = 0.05$$

From Table 4.3 we can see that the Portal has the highest satisfaction score. We can conclude that this tool is significantly more developed than the Client Assessment

tool and the WebAPPS software. However it is not possible to conclude that it is more developed than WebCATS.

Dependent Variables		t-val, p-val		
	Mean	**WepAPPS**	**The Portal**	**Client Assessment**
WebCATS	5.47	9.42, 0.00	-1.95, 0.052	1.30, 0.193
WebAPPS	4.42		-11.47, 0.00	-7.51, 0.00
Portal	5.66			3.10, 0.002
Client Assessment	5.32			

Table 4.3 Hypothesis Testing

4.4 Stage 3: Provide Management with a decision making tool to identify best IT tools.

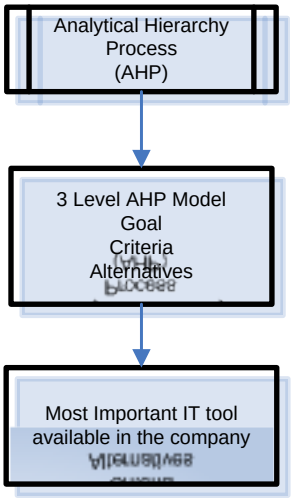


Fig 4.6 MSBDC Implementation Stage 3

A three level AHP model was adapted (Fig 4.7) to identify the most important IT tools according to survey results. Level 0 shows the AHP model goal, Level 1 shows the attributes being studied, and Level 2 shows the four IT tools being analyzed.

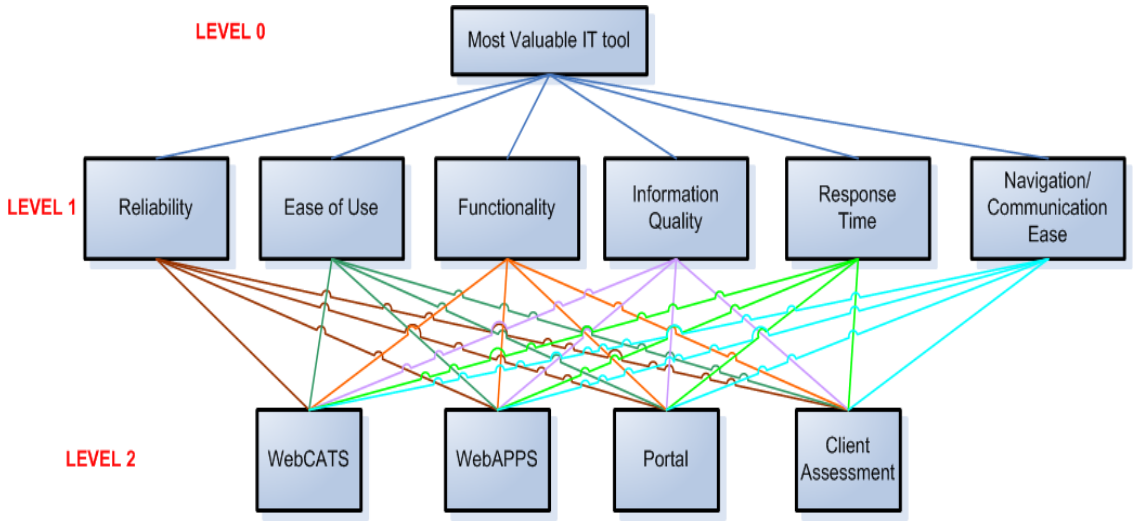


Fig 4.7 MSBDC AHP Model

First, the overall importance of each attribute (Table 4.4) was calculated (calculations can be found in Appendix E). According to AHP calculations the three more important attributes are Reliability, Ease of Use and Information Quality. This is consistent with the statistical results obtained from simply analyzing the data, though it shows the big importance gap that exists between the three highest ranked attributes and the lowest three (i.e. Information Quality 21.62 against Navigation/Communication Ease with only 11.86)

	Raw Weights	**Normalized**
Reliability	0.28	27.69
Ease of Use	0.25	25.19
InfoQuality	0.22	21.62
Nav/Com	0.12	11.86
Functionality	0.09	9.41
ResponseTime	0.04	4.23

Table 4.4 IT Tools Attributes Importance

Once the overall importance of each attribute was calculated, each IT tool was compared against each other in terms of every attribute (see Table 4.5). Results show that webCATS and the Portal are more developed than the other IT tools. WebAPPS scored the lowest for every attribute except for Reliability where the Assessment ranked lowest.

	Reliability	Ease of Use	Functionality	Info Quality	Response Time	Nav/Com
Weight	0.277	0.252	0.094	0.216	0.042	0.119
WebCATS	53.06	63.44	44.46	57.39	40.14	40.14
WebAPPS	9.53	5.12	5.10	4.45	5.41	5.41
Portal	32.83	20.71	40.71	29.13	40.14	40.14
Assessment	4.58	10.72	9.74	9.03	14.31	14.31

Table 4.5 Individual IT Tools Attributes Importance

The overall importance of IT tools was calculated using results from Table 4.5 and ranked WebCATS as the most important IT tool available at the MSBDC followed by the Portal. The final IT tools importance ranking is shown in Table 4.6 and shows a big importance gap between WebCATS and the Portal, and the Assessment and WebAPPS.

	Weight	Rank
WebCATS	53.72	1
Portal	30.90	2
Assessment	9.14	3
WebAPPS	6.24	4

Table 4.6 IT Tools Importance

4.5 Stage 4: Identify Areas of Opportunity for Improvement

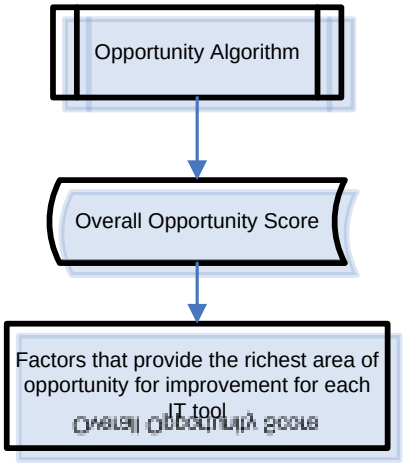


Fig 4.8 MSBDC Implementation Stage 4

Average Opportunity= Importance + MAX (Importance – Satisfaction, 0)

After running the opportunity algorithm, areas of opportunity for improvement were found for each IT tool. Table 4.7 shows the opportunity score for WebCATS, where Ease of Use ranked first and Response Time ranked lowest according to both Staff and Management results. This should not be interpreted as WebCATS doing poorly in terms of Ease of Use, but as the attribute with the most potential for improving WebCATS performance by meeting customer needs.

	WebCATS			
	Staff		**Management**	
Attribute	**Average Opportunity**	**Rank**	**Average Opportunity**	**Rank**
Ease of Use	7.96	1	8.75	1
Info Quality	7.66	2	8	3
Nav/Com Ease	7.66	2	8	3
Functionality	7.57	3	8.25	2
Reliability	7.51	4	7.25	4
Response Time	7.19	5	7.25	4

Table 4.7 Opportunity Algorithm Results for webCATS

In the case of WebAPPS, Table 4.8 shows the opportunity score ranking Ease of Use as the attribute with the highest opportunity for improvement according to both Management and Staff. It is also interesting to notice that Navigation/Communication Ease ranks second in importance for improvement since as explained back in section 4.1, the company crosswalks their information from WebCATS to WebAPPS facing communication and information transfer problems.

	WebAPPS			
	Staff		Management	
Attribute	**Average Opportunity**	**Rank**	**Average Opportunity**	**Rank**
Ease of Use	7.83	1	10.75	1
Nav/Com Ease	7.66	2	10.5	2
Functionality	7.62	3	10.5	2
Info Quality	7.36	4	10.25	3
Reliability	7.15	5	8.5	5
Response Time	6.98	6	9.5	4

Table 4.8 Opportunity Algorithm Results for webAPPS

The Portal was the only IT tool where Staff and Management scores differ in attribute with highest opportunity for improvement. As seen in Table 4.9, Staff ranked Navigation/Communication Ease as the highest attribute, while Management said Functionality should be improved first to increase the performance of the Portal.

	Portal			
	Staff		Management	
Attribute	**Average Opportunity**	**Rank**	**Average Opportunity**	**Rank**
Nav/Com Ease	7.55	1	6	4
Reliability	7.28	2	7.25	2
Ease of Use	7.28	2	7	3
Functionality	7.28	2	7.75	1
Info Quality	7.04	5	7.25	2
Response Time	6.72	4	7.25	2

Table 4.9 Opportunity Algorithm Results for Portal

The Assessment tool opportunity scores as seen in Table 4.10 showed that Navigation/Communication Ease is the attribute with the highest opportunity for improvement according to both Staff and Management results.

	Assessment			
	Staff		Management	
Attribute	**Average Opportunity**	**Rank**	**Average Opportunity**	**Rank**
Nav/Com Ease	7.21	1	8.5	1
Info Quality	7	2	8.25	2
Functionality	6.89	3	7.5	4
Reliability	6.74	4	7.25	5
Ease of Use	6.57	5	7.5	4
Response Time	6.43	6	8	3

Table 4.10 Opportunity Algorithm Results for Assessment

These results show the areas where there is a greater opportunity for improvement of each IT tool. As stated by Ulwick (2002), the future improvement of the attributes with highest opportunity score will help improve the satisfaction level. Therefore, once improvements in these areas have been done a re-evaluation should be done to see the results and find new areas for improvement.

4.6 Stage 5: Knowledge creation and sharing improvement according to organizational needs

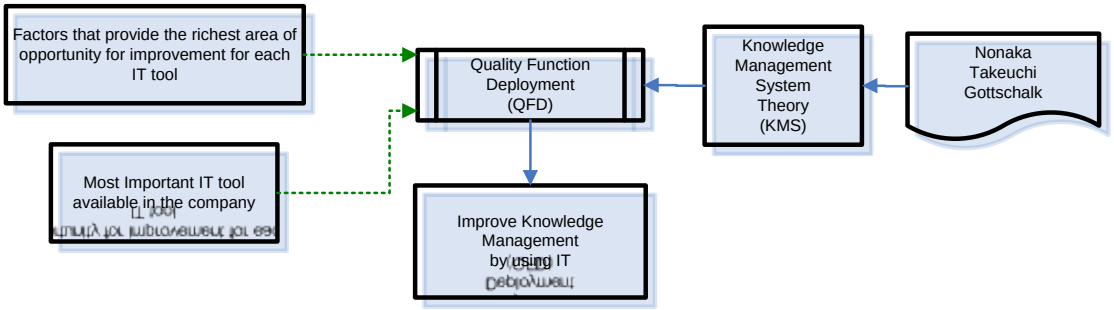


Fig. 4.9 MSBDC Implementation Stage 5

4.6.1 Qualitative Analysis

The survey included three questions regarding overall satisfaction of the IT Infrastructure.

1) The first question asked respondents for their opinion on the current IT tools available to do their work. As shown in Fig 4.10, 38% said they are very satisfied, while only 2% said they are unsatisfied. 11% did not answer the question and 50% expressed some degree of satisfaction (i.e. Satisfied, Somewhat and Moderately Satisfied)

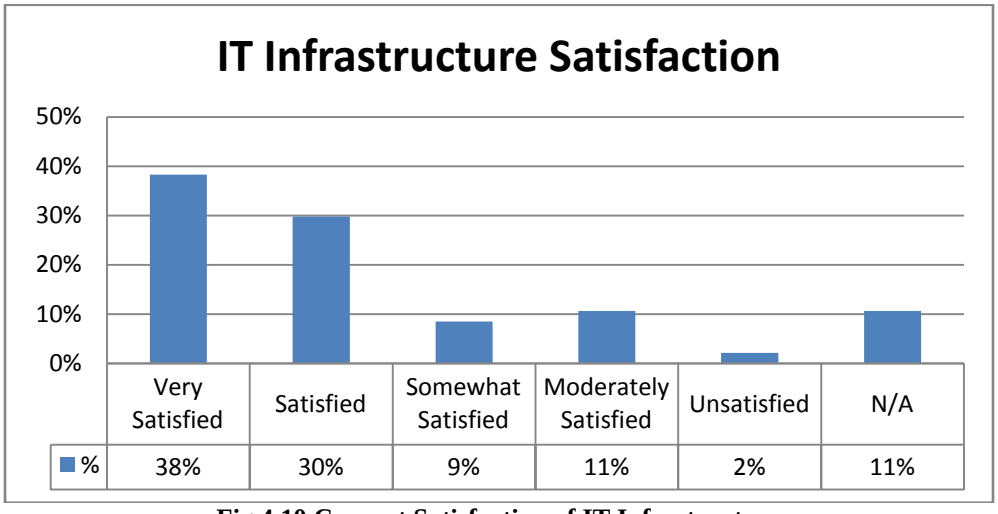


Fig 4.10 Current Satisfaction of IT Infrastructure

2) The second question asked respondents to compare the current IT Infrastructure with respect to the past IT tools or services they had available. As seen in Fig 4.11, 28% of the survey respondents rated the current IT infrastructure as better, 19% as much better, and 9% as excellent. On the other side, 11% rated the current IT tools as cumbersome and less user friendly, 9% said it is worse and 9% said it is the same.

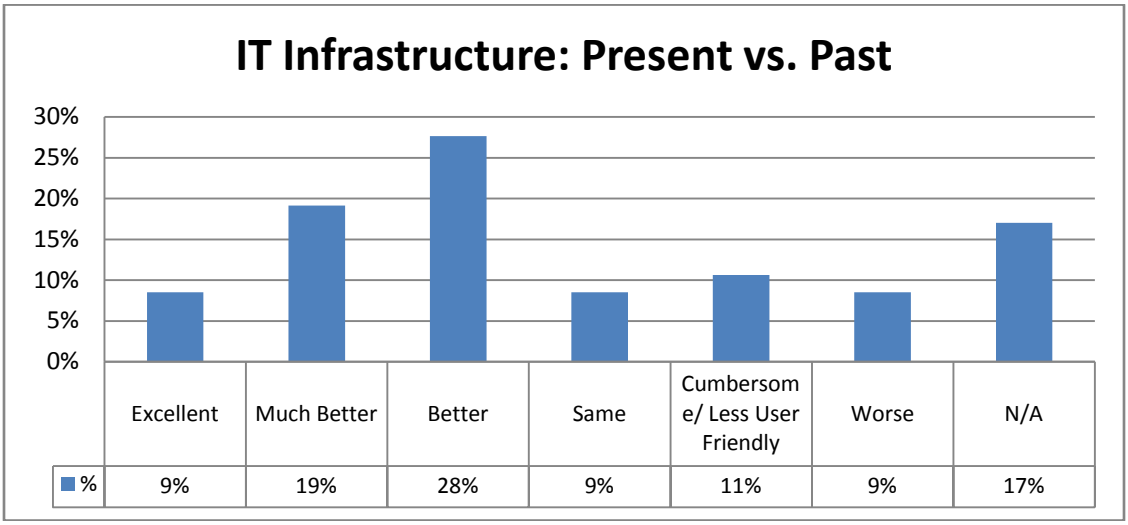


Fig 4.11 Current Satisfaction of IT Infrastructure

3) The third question asked respondents if there were any IT tools not currently available that would help them improve their job efficiency. The results showed that respondents are content with the IT tools available for them to perform their job. No one responded there is a need to invest in more technology, though there were three major respond trends:

   a. IT tools should be able to integrate better. Cross walking information makes information and IT tools cumbersome.

   b. There should be more collaboration between peers to improve IT usage and information quality.

c. More training and assistance is required for everyone to be aware of the opportunities and capabilities each IT tool has to offer.

4.6.2 Quality Function Deployment

In order to provide management at the MSBDC with a guide on how to improve their KM through their available IT, QFD's for each IT tool were created. Since QFD deals with subjectivity when deciding on importance scores and rankings; AHP, OA, and the qualitative analysis were used to help management take better scoring decision.

The WebCATS QFD is presented in Fig 4.12 (See Appendix F for other QFD's). Customer Requirements were defined first according to respondents' comments regarding WebCATS and looking at AHP attribute rankings where Ease of Use, Information Quality, and Reliability ranked highest. Technical requirements were decided by management according to KM suggestions found in Appendix C KM models and KM literature. The importance scores were assigned taking in consideration both the OA and AHP attributes rankings, where Ease of Use ranked highest (hence, Importance=9), and Response Time ranked the lowest (hence, Importance=1).

Each customer requirement was evaluated against each technical requirement and management decided on the relation score between each of them. Again 9 was given if customer requirement and technical requirement were highly related, to a blank score if they were not related at all. These scores were then adjusted based on the importance of each customer requirement by multiplying the scores and adding each comparison. The results showed that:

1) Offering more training classes would improve the performance of WebCATS by making it more user friendly, improving navigation and

identifying software areas that cause trouble to end-users. Knowledge sharing will also be improved by offering more training classes.

2) Allowing users to personalize their WebCATS menu would allow the software to be more user friendly, improve navigation, and hence, increase knowledge creation and sharing.

3) Creating Knowledge Workshops or Communities of Practice (CoP's) would help employees to improve their software usability, identify areas where people might need help in using the software; hence, increasing their knowledge sharing capabilities and improving information veracity available to others.

Technical Requirements / Customer Requirements	Importance	Create Knowledge Workshops or CoP's	Offer more training classes	Improve IT tools integration	Revise new knowledge	Improve IT tools personalization	Increase Navigation and Communication Ease
More User-Friendly	9		7			9	7
IT Tool Integration	3			9			5
More Training	5	7	9				
Help and Update Tool	5	7	7				5
Easier Navigation	5		5			9	7
Faster Navigation	1			7			7
Increase Knowledge Sharing	7	9	5	5	9	9	
Information Veracity	7	9			9		
Resulting Weight		**196**	**203**	**69**	**126**	**189**	**145**
Ranking		**3**	**1**	**6**	**5**	**2**	**4**

Fig 4.12 MSBDC's WebCATS QFD

QFD's for the other three IT tools can be found in Appendix F.

CHAPTER 5

Conclusion

5.1 Framework Goals

The goal of this research was to create a systematic framework to improve Knowledge Management through Information Technology. The systematic framework was developed with two main goals in mind:

1. Helping management follow a consistent approach to understand organizational needs/priorities regarding KM and IT.
2. Structuring a decision making tool that systematically integrates organizational needs with KM and IT.
    a. Allowing Management to identify the most important IT tools available in current KMS.
    b. Identifying areas of opportunity for improvement of each IT tool being studied.
    c. Understand organizational needs that can lead to an increase of KM creation and sharing.

5.2 Benefits gained from Systematic Framework Implementation

5.2.1 Helping management follow a consistent approach to understand organizational needs/priorities regarding KM and IT.

Since the framework follows the Baldrige Performance Criteria for preparing the survey instrument, the survey adapted for the MSBDC (Appendix B) was able to identify the four most important IT tools currently available at the organization's KMS. The four IT tools selected were the ones considered to be the most important according to the organizational profile created by answering the Baldrige Questionnaires (Appendix A). These questionnaires also helped linking the survey instrument and KMS model with the organizational priorities, finding the attributes that were considered to be affecting knowledge transfer and IT performance.

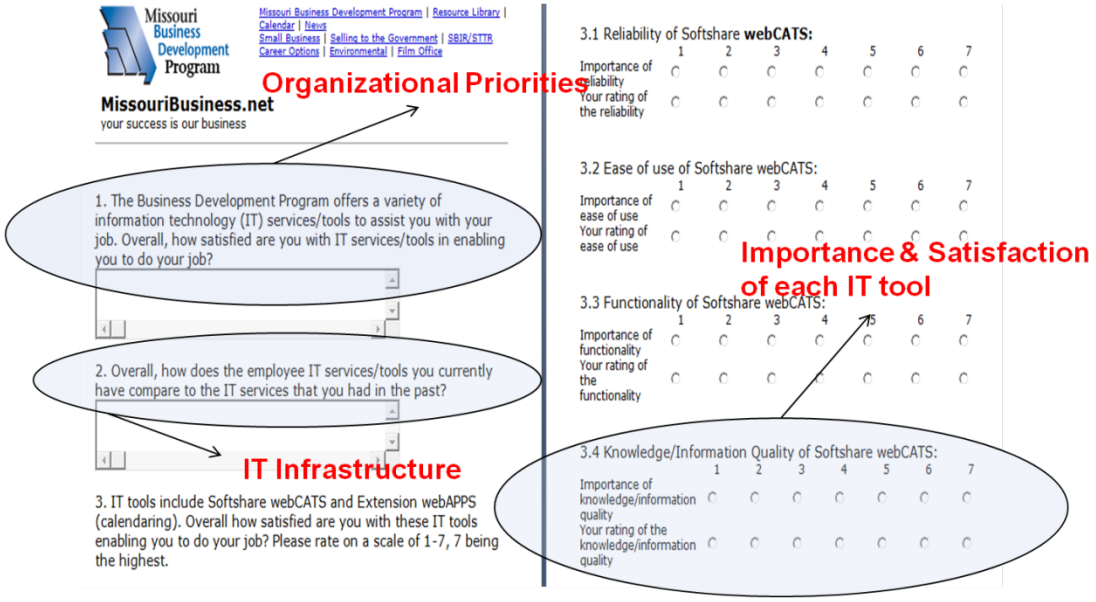


Fig 5.1 MSBDC Survey Instrument

The survey deployed at the MSBDC proved to be of the interest of workers. The effective response rate of 67% (52 out 78 responses gained) allowed management to see how even though over 70% of their workforce expressed some degree of satisfaction in

regards to the current KMS and IT infrastructure, there are many details that can be fixed to improve the use of IT to increase knowledge creation and sharing.

5.2.2 Structuring a decision making tool that systematically integrates organizational needs with KM and IT

With survey respondents' data, a better understanding of the interaction between IT and workers, along with their insight on current IT infrastructure for knowledge creation and sharing was achieved. The framework does not rely on survey statistics to base its decisions, however descriptive survey statistics were used as an initial assessment to understand the degree of importance and satisfaction of the overall IT infrastructure, each IT tool, and each IT tool attributes. The data was also used to do a statistical analysis based on workforce profile (i.e. management vs. staff), an identified the differences between management and staff perceptions regarding KM practices and IT.

The framework does not rely on survey statistics because survey results tend to be subjective due to different causes such as respondent's lack of knowledge or understanding. Instead the framework bases its results on the integration of Quality Function Deployment (QFD), the Opportunity Algorithm (OA) and Analytical Hierarchy Process (AHP) to analyze the impact that IT tools and their attributes have at an organization.

5.2.2.1 Allowing Management to identify the most important IT tools available in current KMS

The framework three level AHP model helps to confirm original survey results and allows management to identify the most important attributes and most important IT tools being studied. As seen in Figure 5.2, in the MSBDC implementation, according to AHP calculations the three most important attributes were consistent with the statistical survey results obtained from simply analyzing the data, though AHP showed the big importance gap that exists between the three highest ranked attributes and the lowest three.

AHP Results

	Raw Weights	Normalized
Reliability	0.28	27.69
Ease of Use	0.25	25.19
InfoQuality	0.22	21.62
Nav/Com	0.12	11.86
Functionality	0.09	9.41
ResponseTime	0.04	4.23

Survey Results

	Importance
Reliability	6.29
Ease of Use	6.27
Information Quality	6.24
Navigation/ Communication Ease	6.22
Functionality	6.19
Response Time	6.14

Fig 5.2 AHP vs. Survey IT Attributes Results

The overall importance of IT tools was also found and the difference with survey results is shown in Figure 5.3. It is important to notice the final ranking was similar to survey results, but again a big gap between WebCATS and the Portal compared to the Assessment and WebAPPS is present. While the results show mathematical consistency and survey subjectivity was reduced; future research and improvement of an AHP model based on fuzzy logic will allow results to be even less subjective and increase result consistency.

AHP Results

Tool	Weight	Rank
WebCATS	53.72	1
Portal	30.90	2
Assessment	9.14	3
WebAPPS	6.24	4

Staff Survey Results

Tool	Importance	Rank
WebCATS	6.51	1
Portal	6.42	2
Assessment	6.05	3
WebAPPS	5.92	4

Management Survey Results

Tool	Importance	Rank
WebCATS	6.83	1
Assessment	6.83	2
Portal	6.79	3
WebAPPS	6.75	4

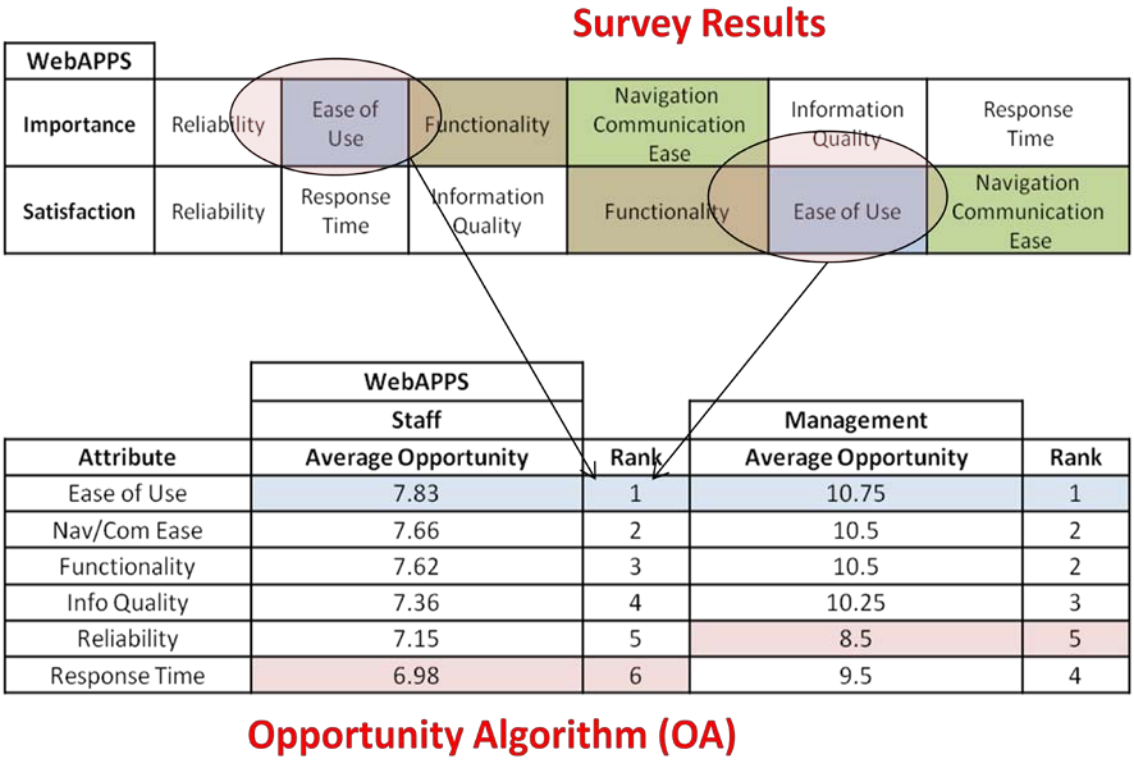
Fig 5.3 Most Important IT Tools available AHP vs. Survey Results

5.2.2.2 Identifying areas of opportunity for improvement of each IT tool being studied

The framework also used the Opportunity Algorithm, a decision making tool that helped dealing with respondents subjectivity in regards to what they want from the IT tools they have, to improve their usage performance and be able to exploit the technology they have available.

The results in Figure 5.4 show the difference between relying on simple statistics and using the OA when analyzing WebAPPS. The OA given by: *Importance + Max [Importance – Satisfaction, 0] = Opportunity*, showed the attributes where there is a greater opportunity for improvement of each IT tool. The final opportunity for improvement ranking placed Ease of Use as the attribute with the highest opportunity for improvement according to both Management and Staff. This could have been impossible to identify by just relying on statistics which ranked Ease of Use second highest in order of importance and second to last in terms of user satisfaction in survey results.

This should not be interpreted as WebAPPS doing poorly in terms of Ease of Use, but as the attribute with the most potential for improving WebAPPS performance by meeting customer needs. Another comparison is Reliability which ranked highest in terms of both Importance and Satisfaction, hence scoring low in terms of opportunity for improvement due to other attributes that can be improved first.



	WebAPPS			
	Staff		Management	
Attribute	Average Opportunity	Rank	Average Opportunity	Rank
Ease of Use	7.83	1	10.75	1
Nav/Com Ease	7.66	2	10.5	2
Functionality	7.62	3	10.5	2
Info Quality	7.36	4	10.25	3
Reliability	7.15	5	8.5	5
Response Time	6.98	6	9.5	4

Fig 5.4 Areas of Opportunity for Improvement for WebAPPS

As stated by Ulwick (2002), the future improvement of the attributes with highest opportunity score will help improve the satisfaction level. Therefore, once improvements in these areas have been done a re-evaluation should be done to see the results and find new areas for improvement. Further research should be done on the integration of OA with other decision making tools such as AHP and QFD.

5.2.2.3 Understand organizational needs that can lead to an increase of KM creation and sharing

The last stage of the framework provides management with a guide on how to improve their KM through IT in their current KMS. By integrating QFD with OA, AHP and the qualitative data obtained from survey results helped dealing with the subjectivity that QFD and AHP used alone have shown in the past.

From integrating QFD with other decision making tools the follow conclusions were found:

1. **Importance Scores are more objective:** Management was able to base importance scores based on OA results which helped dealing with one of the main problems QFD has shown in the past, 'score uncertainty'. With the OA scores, management has a list of attributes that show the amount of opportunity for improvement they present for a particular IT tool. While if relying on simple survey results management still have to decide between different rankings depending on degree of importance or satisfaction.
2. **Understanding Organizational Needs and Prioritize Customer Requirements:** With the qualitative data containing customer requirements and needs, and the AHP showing how each attribute affects an IT tool; management can prioritize customer requirements and needs. This allows management to only focus on the customer requirements that affect an IT tool the most.

3. **KMS flowcharts helped finding technical and organizational requirements that can improve IT usage and hence improve KM creation and sharing:** By making flowcharts of current KM models the technical requirements needed to improve knowledge creation and sharing were decided easier. The flowcharts provide a guide for management to identify different areas of KM that need to be address according to customer requirements or needs, which are usually decided solely on management knowledge or intuition.

5.3 Conclusion and Future Research

This systematic framework has shown that if implemented correctly following each step and the correct use of the decision making tools selected it will assist management:

1) Understanding the organization's KMS and overall IT infrastructure.
2) Identifying workforce needs and perceptions through the survey.
3) Best IT tools for employees and the organization.
4) Opportunity for improvement of current KMS and IT infrastructure.
5) Improve knowledge creation and sharing through IT usage.

The framework has the potential to become a decision support system and will be tested again at the MSBDC to measure the impact of the first results, as it was built thinking of continuous improvement. As of today, the framework has given results that management were not able to find by simply relying on survey analysis or intuitive decisions based on what management consider would be the best improvements according to organizational needs. The framework results can be refined and become

more objective if research is done in the area of QFD integration with AHP and OA by using fuzzy set theory or artificial neural networks.

In the area of knowledge management, the framework can go more in depth in the area of knowledge workshops and Communities of Practice which are an important area of both the information systems and organizational psychology fields. This due to the importance of achieving organizational advantage by creating and sharing knowledge through diverse IT tools that provide the capability of knowledge flow within organizations.

Although this framework was created to improve the current KMS and IT infrastructure, with some modification and further research on purchasing methods, the framework can be used for purchasing decisions.

Appendix A

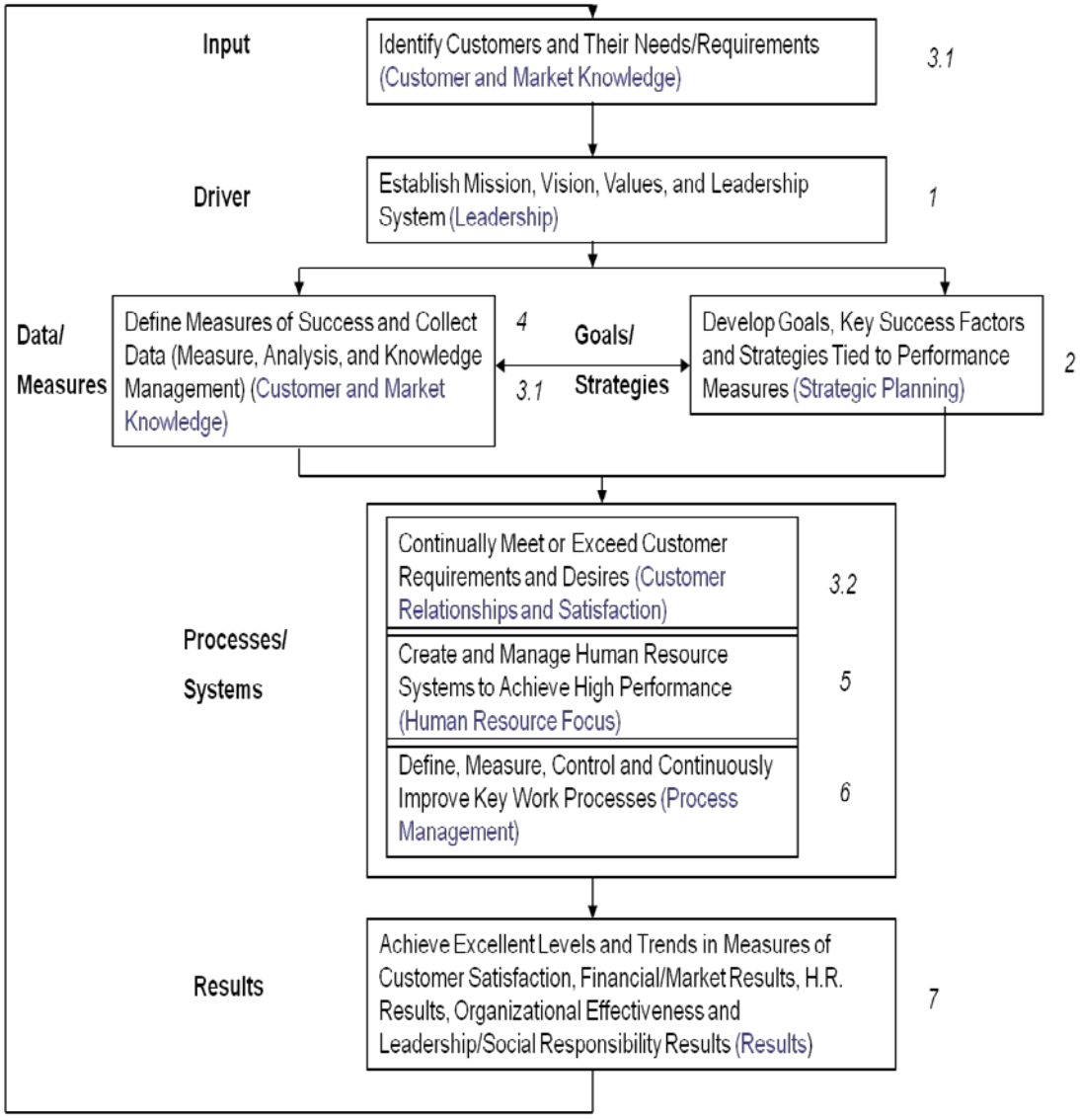


Fig A1. Systematic Representation of the Baldrige Criteria (Graham, 2008)

P.1 Organizational Description: What are your key organizational characteristics?

Describe your organization's operating environment and your KEY relationships with students, STAKEHOLDERS, suppliers, and PARTNERS.

Within your response, include answers to the following questions:

a. Organizational Environment

(1) What are your organization's main EDUCATIONAL PROGRAMS, OFFERINGS, AND SERVICES? What are the delivery mechanisms used to provide your EDUCATIONAL PROGRAMS, OFFERINGS, AND SERVICES?

(2) What is your organizational culture? What are your stated PURPOSE, VISION, MISSION, and VALUES?

(3) What is your WORKFORCE profile? What are your WORKFORCE groups and SEGMENTS? What are their KEY requirements and expectations? What are their education levels? What are your organization's WORKFORCE and job DIVERSITY, organized bargaining units, KEY benefits, and special health and safety requirements?

(4) What are your major facilities, technologies, and equipment?

(5) What is the regulatory environment under which your organization operates? What are the mandated federal, state, and local standards, curricula, programs, and assessments; applicable occupational health and safety regulations; accreditation requirements; administrator and teacher certification requirements; and environmental and financial regulations? What are your district boundaries and service offering restrictions, as appropriate?

b. Organizational Relationships

(1) What are your organizational structure and GOVERNANCE system? What are the reporting relationships between your GOVERNANCE board/policymaking body and your SENIOR LEADERS, as appropriate?

(2) What are your KEY student SEGMENTS, STAKEHOLDER groups, and market SEGMENTS, as appropriate? What are their KEY requirements and expectations for your programs, offerings, services, and operations? What are the differences in these requirements and expectations among student SEGMENTS, STAKEHOLDER groups, and market SEGMENTS?

(3) What are your most important types of suppliers, PARTNERS, and COLLABORATORS? What role do these suppliers, PARTNERS, and COLLABORATORS play in your WORK SYSTEMS and in the delivery of your EDUCATIONAL PROGRAMS, OFFERINGS, AND SERVICES? What role, if any, do they play in your organizational INNOVATION PROCESSES? What are your most important requirements for your suppliers?

(4) What are your KEY partnering relationship and communication mechanisms with suppliers, students, and STAKEHOLDERS?

Fig A2. Organizational Description Questionnaire from Baldrige Criteria

P.2 Organizational Challenges: What are your key organizational challenges?

Describe your organization's competitive environment, your KEY STRATEGIC CHALLENGES and ADVANTAGES, and your system for PERFORMANCE improvement.

Within your response, include answers to the following questions:

a. Competitive Environment

(1) What is your competitive position? What is your relative size and growth in your education sector or markets served? What are the numbers and types of competitors for your organization?

(2) What are the principal factors that determine your success relative to your competitors and comparable organizations delivering similar services? What are any KEY changes taking place that affect your competitive situation, including opportunities for INNOVATION and collaboration, as appropriate?

(3) What are your KEY available sources of comparative and competitive data from within the academic community? What are your KEY available sources of comparative data from outside the academic community? What limitations, if any, are there in your ability to obtain these data?

b. Strategic Context

What are your KEY education and LEARNING, operational, human resource, and community-related STRATEGIC CHALLENGES and ADVANTAGES? What are your KEY STRATEGIC CHALLENGES and ADVANTAGES associated with organizational SUSTAINABILITY?

c. PERFORMANCE Improvement System

What are the KEY elements of your PERFORMANCE improvement system, including your organizational evaluation and LEARNING PROCESSES?

Fig A3 Organizational Challenges Questionnaire from Baldrige Criteria

4.1 Measurement, Analysis, and Improvement of Organizational Performance: How do you measure, analyze, and then improve organizational performance? (45 pts.)

Process

Describe HOW your organization measures, analyzes, aligns, reviews, and improves student and operational PERFORMANCE through the use of data and information at all levels and in all parts of your organization. Describe HOW you SYSTEMATICALLY use the results of reviews to evaluate and improve PROCESSES.

Within your response, include answers to the following questions:

a. PERFORMANCE Measurement

(1) HOW do you select, collect, align, and integrate data and information for tracking daily operations and for tracking overall organizational PERFORMANCE, including progress relative to STRATEGIC OBJECTIVES and ACTION PLANS? What are your KEY organizational PERFORMANCE MEASURES, including KEY short-term and longer-term budgetary and financial MEASURES? HOW do you use these data and information to support organizational decision making and INNOVATION?

(2) HOW do you select and ensure the EFFECTIVE use of KEY comparative data and information from within and outside the academic community to support operational and strategic decision making and INNOVATION?

(3) HOW do you keep your PERFORMANCE measurement system current with educational service needs and directions? HOW do you ensure that your PERFORMANCE measurement system is sensitive to rapid or unexpected organizational or external changes?

b. PERFORMANCE ANALYSIS, Review, and Improvement

(1) HOW do you review organizational PERFORMANCE and capabilities? What ANALYSES do you perform to support these reviews and to ensure that conclusions are valid? HOW do you use these reviews to assess organizational success, PERFORMANCE relative to competitors and comparable organizations, and progress relative to STRATEGIC OBJECTIVES and ACTION PLANS? HOW do you use these reviews to assess your organization's ability to respond rapidly to changing organizational needs and challenges in your operating environment?

(2) HOW do you translate organizational PERFORMANCE review findings into priorities for continuous and breakthrough improvement and into opportunities for INNOVATION? HOW are these priorities and opportunities DEPLOYED to FACULTY, STAFF, and other work groups throughout your organization to enable EFFECTIVE support for their decision making? When appropriate, HOW are the priorities and opportunities DEPLOYED to your feeder and/or receiving schools and to your suppliers, PARTNERS, and COLLABORATORS to ensure organizational ALIGNMENT?

(3) HOW do you incorporate the results of organizational PERFORMANCE reviews into the SYSTEMATIC evaluation and improvement of KEY PROCESSES?

Fig A4 Organizational Challenges #2 Questionnaire from Baldrige Criteria

4.2 Management of Information, Information Technology, and Knowledge: How do you manage your information, information technology, and organizational knowledge? (45 pts.)

Process

Describe HOW your organization ensures the quality and availability of needed data, information, software, and hardware for your WORKFORCE, students and STAKEHOLDERS, suppliers, PARTNERS, and COLLABORATORS. Describe HOW your organization builds and manages its KNOWLEDGE ASSETS.

Within your response, include answers to the following questions:

a. Management of Information Resources

(1) How do you make needed data and information available? How do you make them accessible to your WORKFORCE, students, STAKEHOLDERS, suppliers, PARTNERS, and COLLABORATORS, as appropriate?

(2) How do you ensure that hardware and software are reliable, secure, and user-friendly?

(3) In the event of an emergency, how do you ensure the continued availability of hardware and software systems and the continued availability of data and information?

(4) How do you keep your data and information availability mechanisms, including your software and hardware systems, current with educational service needs and directions and with technological changes in your operating environment?

b. Data, Information, and Knowledge Management

(1) How do you ensure the following properties of your organizational data, information, and knowledge:

- accuracy
- integrity and reliability
- timeliness
- security and confidentiality

(2) How do you manage organizational knowledge to accomplish the following:

- the collection and transfer of WORKFORCE knowledge
- the transfer of relevant knowledge from and to students, STAKEHOLDERS, suppliers, PARTNERS, and COLLABORATORS
- the rapid identification, sharing, and implementation of best practices
- the assembly and transfer of relevant knowledge for use in your strategic planning PROCESS

Fig A5 Information Technology and Knowledge Management Questionnaire from Baldrige Criteria #2

Appendix B

Doc B1 Survey Template for MSBDC

Missouri Business Development Program | Resource Library | Calendar | News
Small Business | Selling to the Government | SBIR/STTR
Career Options | Environmental | Film Office

MissouriBusiness.net
your success is our business

---

1. The Business Development Program offers a variety of information technology (IT) services/tools to assist you with your job. Overall, how satisfied are you with IT services/tools in enabling you to do your job?

2. Overall, how does the employee IT services/tools you currently have compare to the IT services that you had in the past?

3. IT tools include Softshare webCATS and Extension webAPPS (calendaring). Overall how satisfied are you with these IT tools enabling you to do your job? Please rate on a scale of 1-7, 7 being the highest.

	1	2	3	4	5	6	7
3.1 Reliability of Softshare **webCATS:**							
Importance of reliability	☐	☐	☐	☐	☐	☐	☐
Your rating of the reliability	☐	☐	☐	☐	☐	☐	☐
3.2 Ease of use of Softshare webCATS:							
Importance of ease of use	☐	☐	☐	☐	☐	☐	☐
Your rating of ease of use	☐	☐	☐	☐	☐	☐	☐
3.3 Functionality of Softshare webCATS:							
Importance of functionality	☐	☐	☐	☐	☐	☐	☐
Your rating of the functionality	☐	☐	☐	☐	☐	☐	☐
3.4 Knowledge/Information Quality of Softshare webCATS:							
Importance of knowledge/information quality	☐	☐	☐	☐	☐	☐	☐
Your rating of the knowledge/information quality	☐	☐	☐	☐	☐	☐	☐
3.5 Response time of Softshare webCATS:							
Importance of response time	☐	☐	☐	☐	☐	☐	☐
Your rating of response time	☐	☐	☐	☐	☐	☐	☐
3.6 Ease of locating information in Softshare webCATS:							
Importance of ease of information	☐	☐	☐	☐	☐	☐	☐
Your rating of the ease of information	☐	☐	☐	☐	☐	☐	☐

3.7 Reliability of Extension **webAPPS**:

	1	2	3	4	5	6	7
Importance of reliability	☐	☐	☐	☐	☐	☐	☐
Your rating of the reliability	☐	☐	☐	☐	☐	☐	☐

3.8 Ease of use of Extension webAPPS:

	1	2	3	4	5	6	7
Importance of ease of use	☐	☐	☐	☐	☐	☐	☐
Your rating of ease of use	☐	☐	☐	☐	☐	☐	☐

3.9 Functionality of Extension webAPPS:

	1	2	3	4	5	6	7
Importance of functionality	☐	☐	☐	☐	☐	☐	☐
Your rating of functionality	☐	☐	☐	☐	☐	☐	☐

3.10 Knowledge/information quality of Extension webAPPS:

	1	2	3	4	5	6	7
Importance of knowledge/information quality	☐	☐	☐	☐	☐	☐	☐
Your rating of knowledge/information quality	☐	☐	☐	☐	☐	☐	☐

3.11 Response time of Extension webAPPS:

	1	2	3	4	5	6	7
Importance of response time	☐	☐	☐	☐	☐	☐	☐
Your rating of response time	☐	☐	☐	☐	☐	☐	☐

3.12 Ease of locating information in Extension webAPPS:

	1	2	3	4	5	6	7
Importance of ease of locating information	☐	☐	☐	☐	☐	☐	☐
Your rating on ease of locating information	☐	☐	☐	☐	☐	☐	☐

3.13 If you have any other comments or concerns in regards to webCATS or webAPPS, please provide them in the space below.

4. Team and community tools include the Portal. Overall how satisfied are you with the Portal?

4.1 Reliability of the Portal:

	1	2	3	4	5	6	7
Importance of reliability	☐	☐	☐	☐	☐	☐	☐
Your rating of reliability	☐	☐	☐	☐	☐	☐	☐

4.2 Ease of use of the Portal:

	1	2	3	4	5	6	7
Importance of ease of use	☐	☐	☐	☐	☐	☐	☐
Your rating on ease of use	☐	☐	☐	☐	☐	☐	☐

4.3 Functionality of the Portal:

	1	2	3	4	5	6	7
Importance of functionality	☐	☐	☐	☐	☐	☐	☐
Your rating of functionality	☐	☐	☐	☐	☐	☐	☐

4.4 Response time of the Portal:

	1	2	3	4	5	6	7
Importance of response time	☐	☐	☐	☐	☐	☐	☐
Your rating of response time	☐	☐	☐	☐	☐	☐	☐

4.5 Knowledge/information quality of the Portal:

	1	2	3	4	5	6	7
Importance of knowledge/information quality	☐	☐	☐	☐	☐	☐	☐
Your rating of the knowledge/information quality	☐	☐	☐	☐	☐	☐	☐

4.6 Performance speed of the portal (e.g. opening documents, posting, replication, etc.):

	1	2	3	4	5	6	7
Importance of performance speed	☐	☐	☐	☐	☐	☐	☐
Your rating of performance speed	☐	☐	☐	☐	☐	☐	☐

4.7 Ease of locating information on the Portal:

	1	2	3	4	5	6	7
Importance of ease of locating information	☐	☐	☐	☐	☐	☐	☐
Your rating of the ease of locating information	☐	☐	☐	☐	☐	☐	☐

4.8 Ease of locating personalized learning and career guidance using the Portal:

	1	2	3	4	5	6	7
Importance of ease of locating personalized learning and guidance	☐	☐	☐	☐	☐	☐	☐
Your rating of the ease of locating personalized learning and guidance	☐	☐	☐	☐	☐	☐	☐

4.9 If you have any other comments or concerns regarding the Portal, please provide them in the space below.

5. Customer relationship management or resource tools include the Core Assessment. Overall, how satisfied are you with the Assessment in enabling you to get your job done in the most efficient and effective manner?

5.1 Reliability of the Assessment:

	1	2	3	4	5	6	7
Importance of reliability	☐	☐	☐	☐	☐	☐	☐
Your rating of the reliability	☐	☐	☐	☐	☐	☐	☐

5.2 Ease of use of the Assessment:

	1	2	3	4	5	6	7
Importance of the ease of use	☐	☐	☐	☐	☐	☐	☐
Your rating of the ease of use	☐	☐	☐	☐	☐	☐	☐

5.3 Functionality of the Assessment:

	1	2	3	4	5	6	7
Importance of functionality	☐	☐	☐	☐	☐	☐	☐
Your rating of the functionality	☐	☐	☐	☐	☐	☐	☐

5.4 Knowledge/information quality of the Assessment:

	1	2	3	4	5	6	7
Importance of knowledge/information quality	☐	☐	☐	☐	☐	☐	☐
Your rating of knowledge/information quality	☐	☐	☐	☐	☐	☐	☐

5.5 Response time of the Assessment:

	1	2	3	4	5	6	7
Importance of response time	☐	☐	☐	☐	☐	☐	☐
Your rating of response time	☐	☐	☐	☐	☐	☐	☐

5.6 Ease of communication with the customer in regards to using the Assessment:

	1	2	3	4	5	6	7
Importance of ease of communication with the customer	☐	☐	☐	☐	☐	☐	☐
Your rating of the ease of communication with the customer	☐	☐	☐	☐	☐	☐	☐

5.7 If you have any other comments or concerns regarding the Assessment, please provide them in the space below.

6. According to your own needs, are there any other IT tools not currently available or in use that you believe would help to get your job done more efficiently and/or effectively?

Appendix C

KMS Models

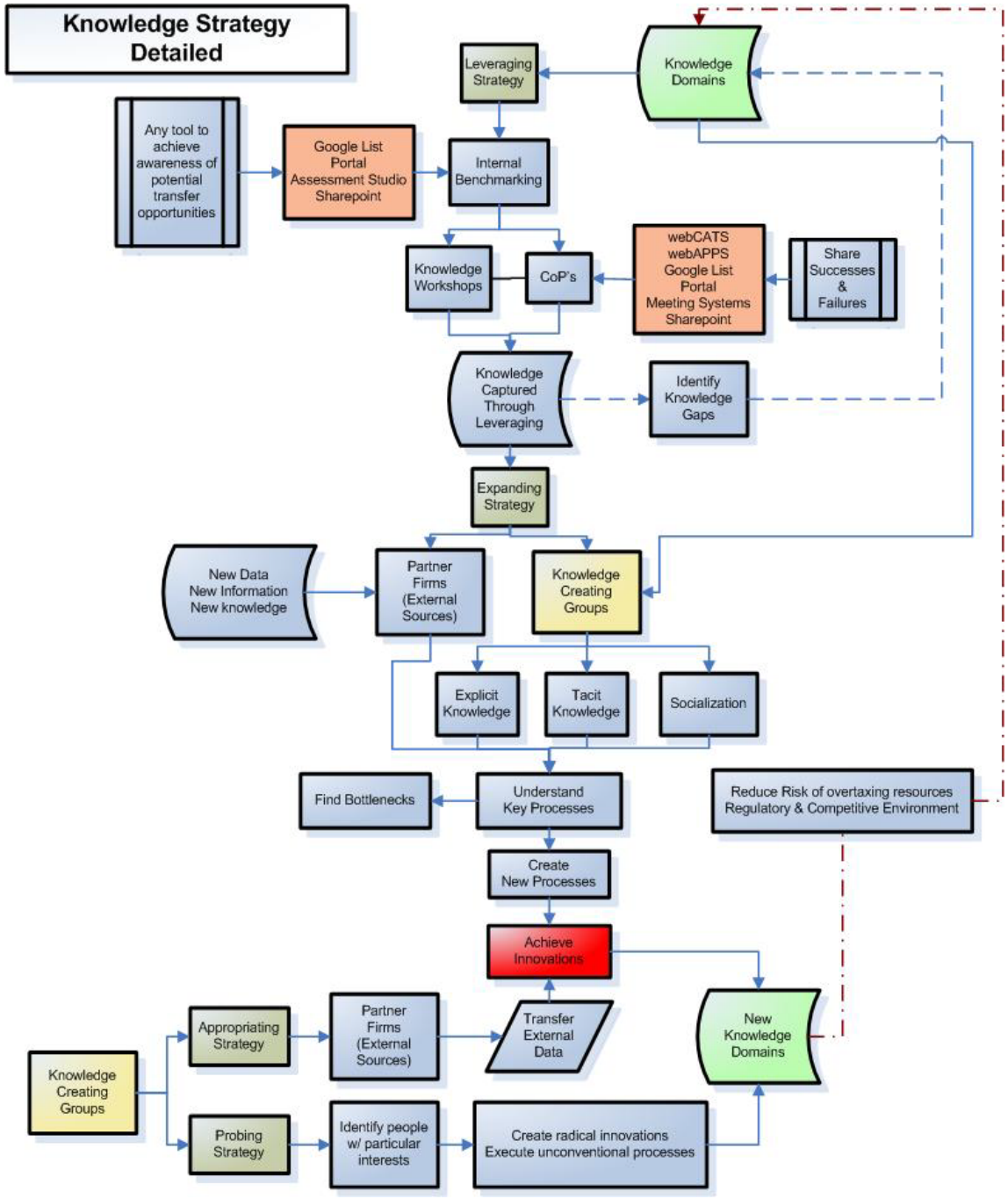


Fig C.1. KM Flowchart according to Nonaka

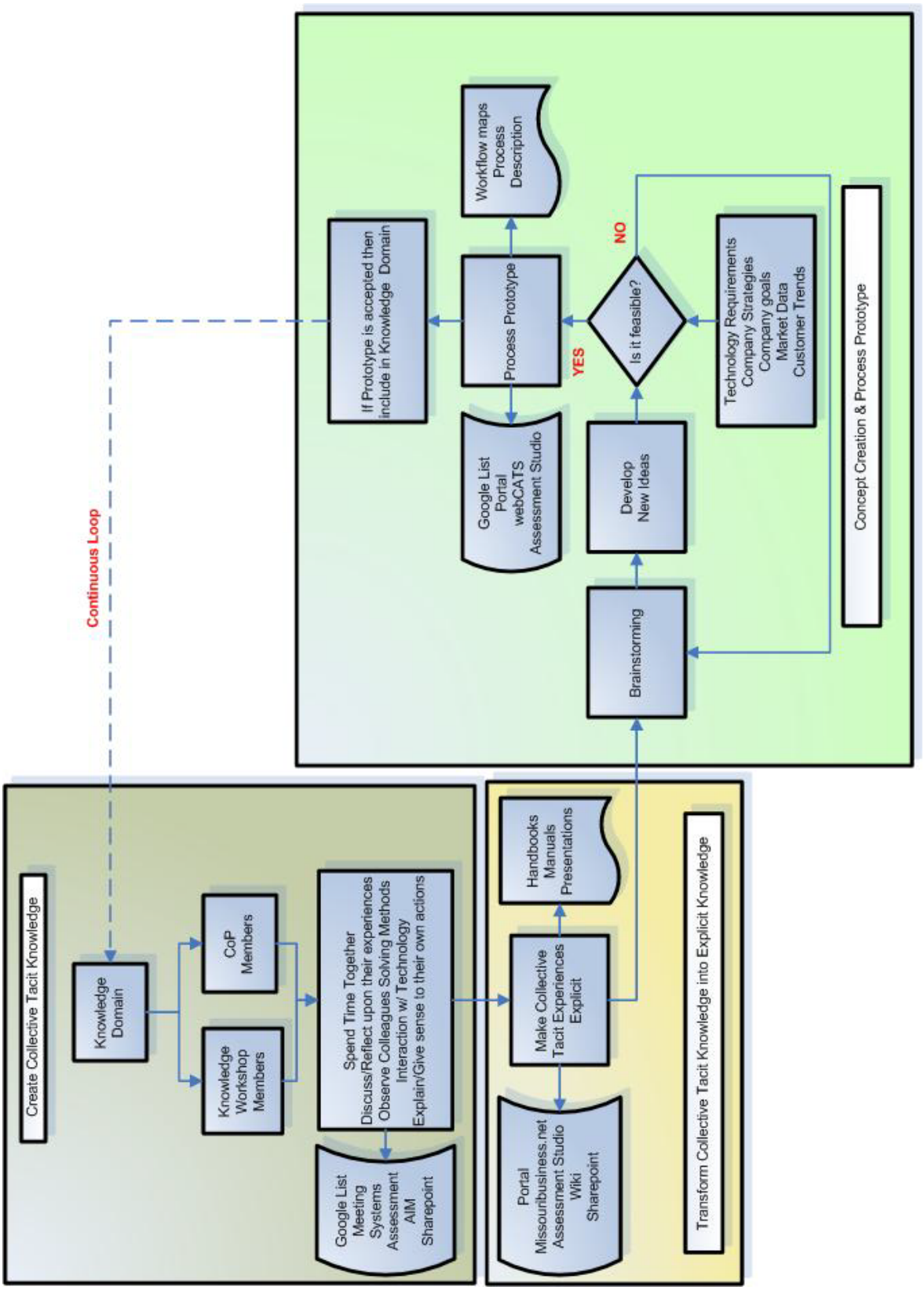


Fig C.2 KM Flowchart #2

Appendix D

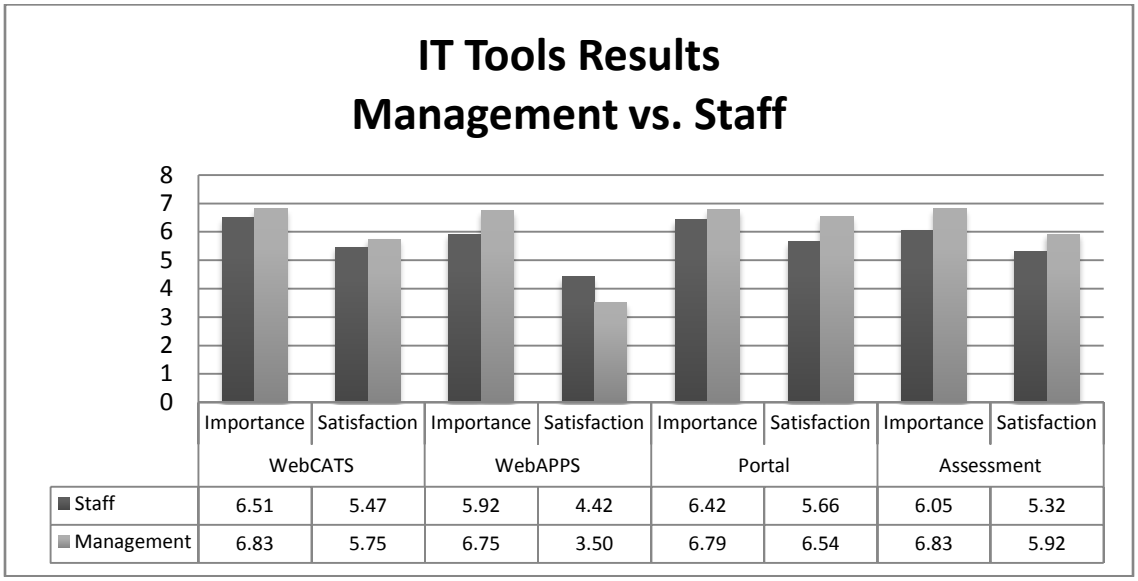


Fig D.1 IT Tools Survey Results Management vs. Staff

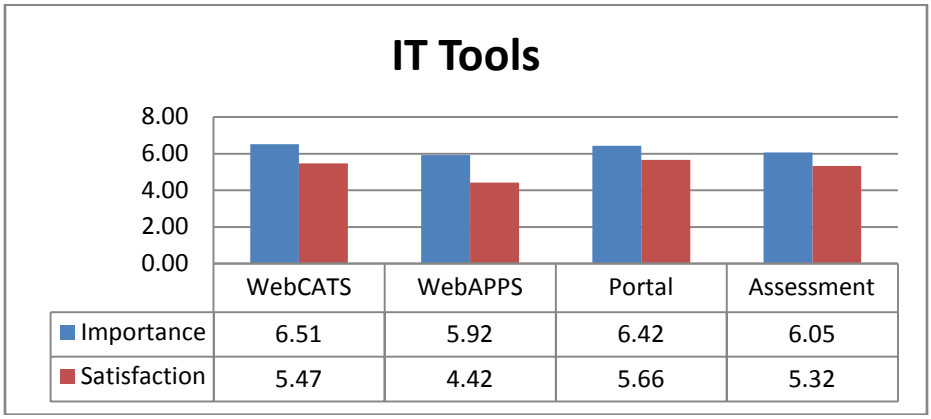


Fig D.2 Staff Survey Results

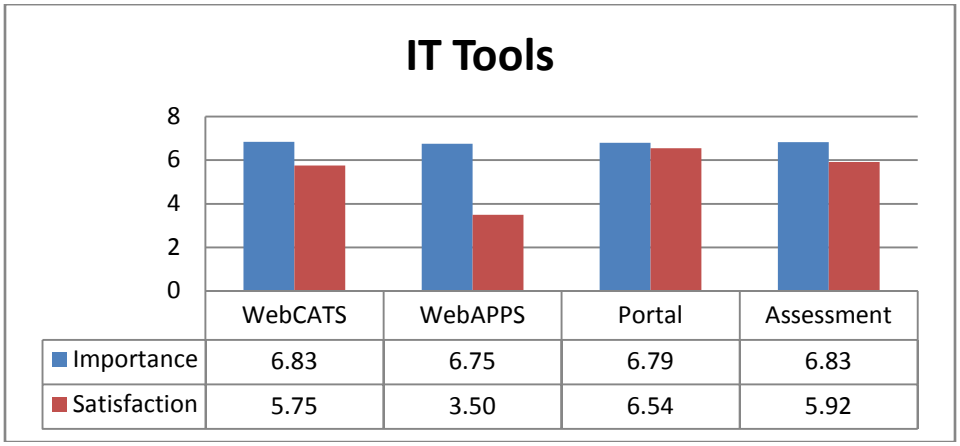
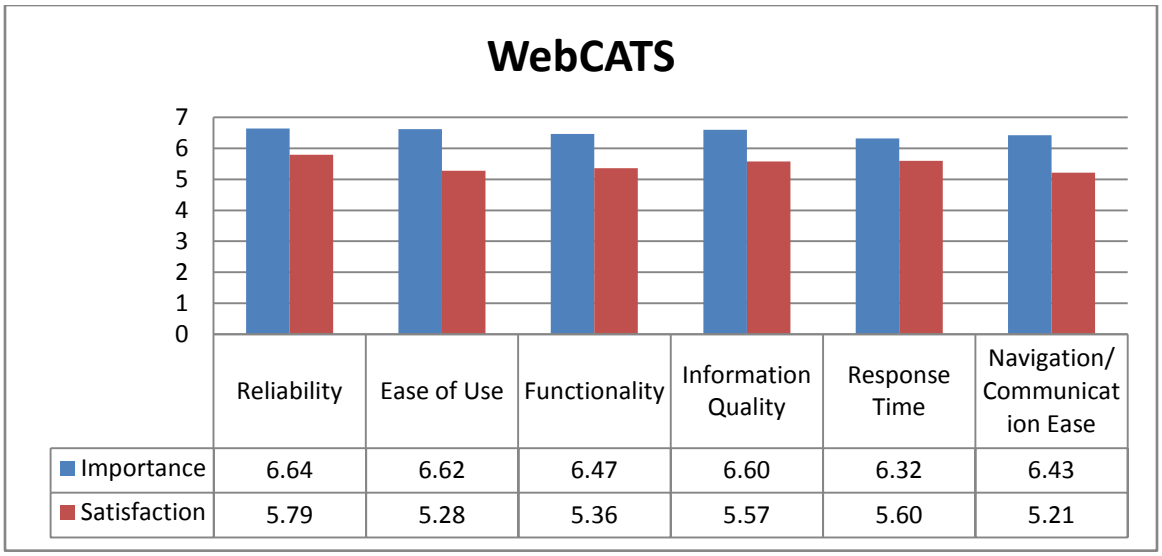
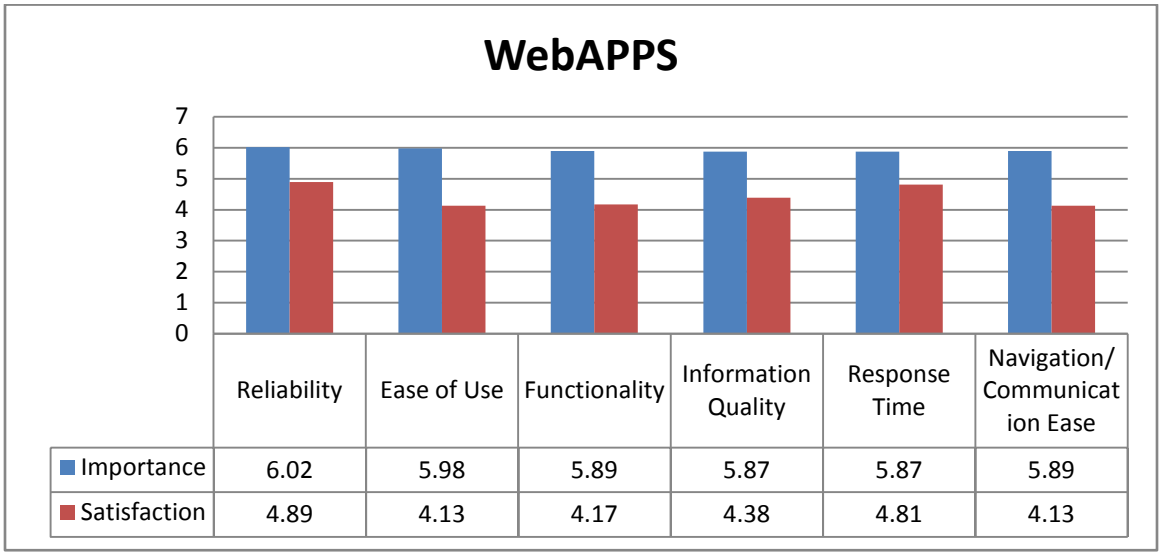


Fig D.3 Management Survey Results



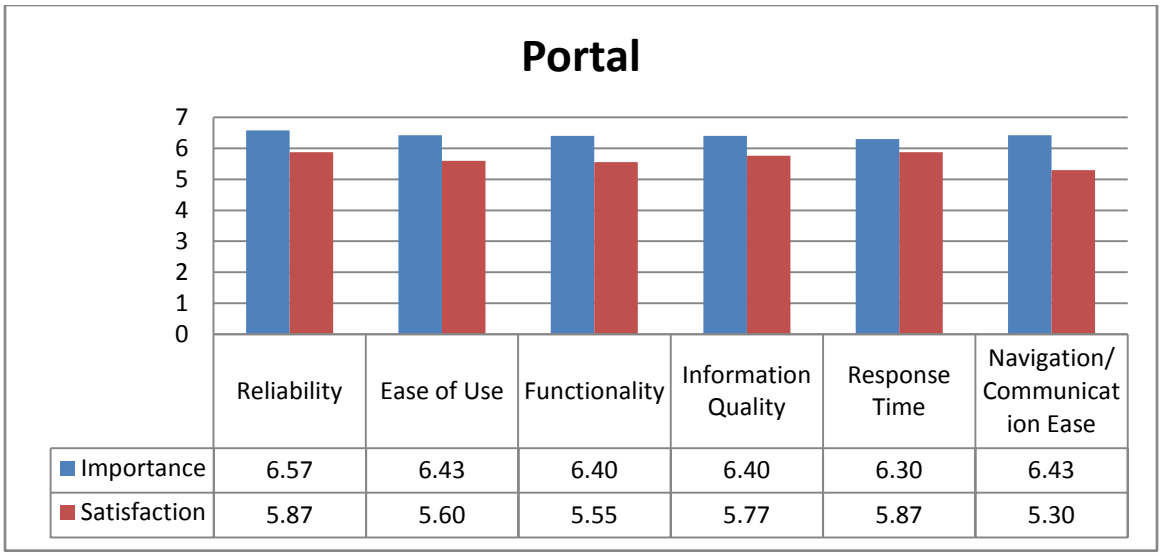
	Reliability	Ease of Use	Functionality	Information Quality	Response Time	Navigation/ Communication Ease
Importance	6.64	6.62	6.47	6.60	6.32	6.43
Satisfaction	5.79	5.28	5.36	5.57	5.60	5.21

Fig D.4 WebCATS Attributes



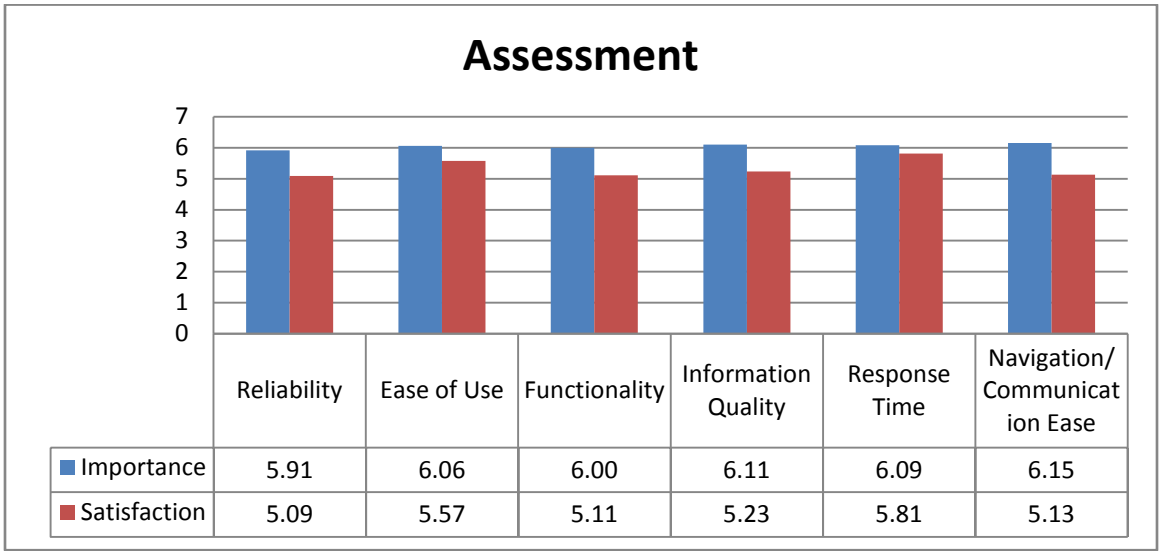
	Reliability	Ease of Use	Functionality	Information Quality	Response Time	Navigation/ Communication Ease
Importance	6.02	5.98	5.89	5.87	5.87	5.89
Satisfaction	4.89	4.13	4.17	4.38	4.81	4.13

Fig D.5 WebAPPS Attributes



	Reliability	Ease of Use	Functionality	Information Quality	Response Time	Navigation/ Communication Ease
Importance	6.57	6.43	6.40	6.40	6.30	6.43
Satisfaction	5.87	5.60	5.55	5.77	5.87	5.30

Fig D.6 Portal Attributes



	Reliability	Ease of Use	Functionality	Information Quality	Response Time	Navigation/ Communication Ease
Importance	5.91	6.06	6.00	6.11	6.09	6.15
Satisfaction	5.09	5.57	5.11	5.23	5.81	5.13

Fig D.7 Assessment Attributes

WebCATS						
Importance	Reliability	Ease of Use	Information Quality	Functionality	Navigation Communication Ease	Response Time
Satisfaction	Reliability	Response Time	Information Quality	Functionality	Ease of Use	Navigation Communication Ease
WebAPPS						
Importance	Reliability	Ease of Use	Functionality	Navigation Communication Ease	Information Quality	Response Time
Satisfaction	Reliability	Response Time	Information Quality	Functionality	Ease of Use	Navigation Communication Ease
Portal						
Importance	Reliability	Ease of Use	Navigation Communication Ease	Functionality	Information Quality	Response Time
Satisfaction	Reliability	Response Time	Information Quality	Ease of Use	Functionality	Navigation Communication Ease
Assessment						
Importance	Navigation Communication Ease	Information Quality	Response Time	Ease of Use	Functionality	Reliability
Satisfaction	Response Time	Ease of Use	Information Quality	Navigation Communication Ease	Functionality	Reliability

Table D1. IT Tools Attributes Results Staff

WebCATS						
Importance	Reliability	Ease of Use	Information Quality	Functionality	Response Time	Navigation Communication Ease
Satisfaction	Reliability	Response Time	Information Quality	Ease of Use	Functionality	Navigation Communication Ease

WebAPPS						
Importance	Ease of Use	Functionality	Information Quality	Response Time	Navigation/ Communication Ease	Reliability
Satisfaction	Reliability	Response Time	Ease of Use	Information Quality	Functionality	Navigation/ Communication Ease

Portal						
Importance	Reliability	Functionality	Response Time	Ease of Use	Information Quality	Navigation/ Communication Ease
Satisfaction	Reliability	Response Time	Navigation Communication Ease	Ease of Use	Functionality	Information Quality

Assessment						
Importance	Information Quality	Response Time	Navigation Communication Ease	Reliability	Ease of Use	Functionality
Satisfaction	Reliability	Ease of Use	Response Time	Information Quality	Functionality	Navigation Communication Ease

Table D2. IT tools Attributes Results Management

Appendix E
AHP Calculations

		Reliability	Ease of Use	Functionality	InfoQuality	ResponseTime	Nav/Com
6.29	**Reliability**	1.00	1.00	5.00	1.00	5.00	3.00
6.27	**Ease of Use**	1.00	1.00	3.00	1.00	5.00	3.00
6.19	**Functionality**	0.33	0.33	1.00	0.33	3.00	1.00
6.24	**InfoQuality**	1.00	1.00	3.00	1.00	5.00	1.00
6.14	**ResponseTime**	0.20	0.20	0.33	0.20	1.00	0.33
6.22	**Nav/Com**	0.33	0.33	1.00	1.00	3.00	1.00
	Totals	**3.87**	**3.87**	**13.33**	**4.53**	**22.00**	**9.33**

	Reliability	Ease of Use	Functionality	Info Quality	Response Time	Nav/Com	Raw Weights	Normalized
Reliability	0.26	0.26	0.38	0.22	0.23	0.32	0.2769	**27.69**
Ease of Use	0.26	0.26	0.23	0.22	0.23	0.32	0.2519	**25.19**
Functionality	0.09	0.09	0.08	0.07	0.14	0.11	0.0941	**9.41**
InfoQuality	0.26	0.26	0.23	0.22	0.23	0.11	0.2162	**21.62**
Response Time	0.05	0.05	0.03	0.04	0.05	0.04	0.0423	**4.23**
Nav/Com	0.09	0.09	0.08	0.22	0.14	0.11	0.1186	**11.86**
	1.00						1.00	100

Importance Judgments

	Reliablility	WebCATS	WebAPPS	Portal	Assessment
6.64	**WebCATS**	1.00	7.00	1.00	9.00
6.02	**WebAPPS**	0.14	1.00	0.14	3.00
6.57	**Portal**	1.00	0.14	1.00	9.00
5.91	**Assessment**	0.11	0.33	0.11	1.00
	Totals	**2.25**	**8.48**	**2.25**	**22.00**

Normalized Importance Judgments

	WebCATS	WebAPPS	Portal	Assessment	Raw Weights	Normalized
WebCATS	0.44	0.83	0.44	0.41	0.5306	53.06
WebAPPS	0.06	0.12	0.06	0.14	0.0953	9.53
Portal	0.44	0.02	0.44	0.41	0.3283	32.83
Assessment	0.05	0.04	0.05	0.05	0.0458	4.58

Importance Judgments

	Ease of Use	WebCATS	WebAPPS	Portal	Assessment
6.62	**WebCATS**	1.00	9.00	3.00	7.00
5.98	**WebAPPS**	0.11	1.00	0.14	0.33
6.43	**Portal**	0.33	0.14	1.00	5.00
6.06	**Assessment**	0.13	3.00	0.20	1.00
	Totals	**1.57**	**13.14**	**4.34**	**13.33**

Normalized Importance Judgments

	WebCATS	WebAPPS	Portal	Assessment	Raw Weights	Normalized
WebCATS	0.64	0.68	0.69	0.53	0.6344	63.44
WebAPPS	0.07	0.08	0.03	0.03	0.0512	5.12
Portal	0.21	0.01	0.23	0.38	0.2071	20.71
Assessment	0.08	0.23	0.05	0.08	0.1072	10.72

Importance Judgments

	Functionality	WebCATS	WebAPPS	Portal	Assessment
6.47	**WebCATS**	1.00	7.00	1.00	7.00
5.89	**WebAPPS**	0.14	1.00	0.14	0.33
6.40	**Portal**	1.00	7.00	1.00	5.00
6.00	**Assessment**	0.14	3.00	0.20	1.00
	Totals	**2.29**	**18.00**	**2.34**	**13.33**

Normalized Importance Judgments

	WebCATS	WebAPPS	Portal	Assessment	Raw Weights	Normalized
WebCATS	0.44	0.39	0.43	0.53	0.4446	44.46
WebAPPS	0.06	0.06	0.06	0.03	0.0510	5.10
Portal	0.44	0.39	0.43	0.38	0.4071	40.71
Assessment	0.06	0.17	0.09	0.08	0.0974	9.74

Importance Judgments

	Info Quality	WebCATS	WebAPPS	Portal	Assessment
6.60	**WebCATS**	1.00	9.00	3.00	7.00
5.87	**WebAPPS**	0.11	1.00	0.14	0.33
6.40	**Portal**	0.33	7.00	1.00	5.00
6.11	**Assessment**	0.14	3.00	0.20	1.00
	Totals	**1.59**	**20.00**	**4.34**	**13.33**

Normalized Importance Judgments

	WebCATS	WebAPPS	Portal	Assessment	Raw Weights	Normalized
WebCATS	0.63	0.45	0.69	0.53	0.5739	57.39
WebAPPS	0.07	0.05	0.03	0.03	0.0445	4.45
Portal	0.21	0.35	0.23	0.38	0.2913	29.13
Assessment	0.09	0.15	0.05	0.08	0.0903	9.03

Importance Judgments

	Response Time	WebCATS	WebAPPS	Portal	Assessment
6.32	**WebCATS**	1.00	7.00	1.00	3.00
5.87	**WebAPPS**	0.14	1.00	0.14	0.33
6.30	**Portal**	1.00	7.00	1.00	3.00
6.09	**Assessment**	0.33	3.00	0.33	1.00
	Totals	**2.48**	**18.00**	**2.48**	**7.33**

Normalized Importance Judgments

	WebCATS	WebAPPS	Portal	Assessment	Raw Weights	Normalized
WebCATS	0.40	0.39	0.40	0.41	0.4014	40.14
WebAPPS	0.06	0.06	0.06	0.05	0.0541	5.41
Portal	0.40	0.39	0.40	0.41	0.4014	40.14
Assessment	0.13	0.17	0.13	0.14	0.1431	14.31

Importance Judgments

	Nav/Com Ease	WebCATS	WebAPPS	Portal	Assessment
6.43	**WebCATS**	1.00	7.00	1.00	3.00
5.89	**WebAPPS**	0.14	1.00	0.14	0.33
6.43	**Portal**	1.00	7.00	1.00	3.00
6.15	**Assessment**	0.33	3.00	0.33	1.00
	Totals	**2.48**	**18.00**	**2.48**	**7.33**

Normalized Importance Judgments

	WebCATS	WebAPPS	Portal	Assessment	Raw Weights	Normalized
WebCATS	0.40	0.39	0.40	0.41	0.4014	40.14
WebAPPS	0.06	0.06	0.06	0.05	0.0541	5.41
Portal	0.40	0.39	0.40	0.41	0.4014	40.14
Assessment	0.13	0.17	0.13	0.14	0.1431	14.31

	Reliability	Ease of Use	Functionality	InfoQuality	ResponseTime	Nav/Com
Weight	0.277	0.252	0.094	0.216	0.042	0.119
WebCATS	53.06	63.44	44.46	57.39	40.14	40.14
WebAPPS	9.53	5.12	5.10	4.45	5.41	5.41
Portal	32.83	20.71	40.71	29.13	40.14	40.14
Assessment	4.58	10.72	9.74	9.03	14.31	14.31

	Weight	Rank
WebCATS	53.72	1
Portal	30.90	2
Assessment	9.14	3
WebAPPS	6.24	4

Appendix F
Qualitative Analysis Results and QFD

Satisfied with IT services/tools	**Unsatisfied with IT services/tools**
Majority	Minority
Very Satisfied	Unsatisfied
Satisfied	So So
"Technology changes to fit the field."	"Difficult to post training events."
"Great resources."	"Systems are getting more complex."
"Helpful and available."	"Not easy enough to use."
IT services/tools are better	**IT services/tools are worse**
Majority	Minority
Much improved	Poor
Better	Less advanced
"Service is consistently good."	"Clunky and less user friendly."
"Easier and more reliable."	"WebCATS is good but WebAPPS is not."
"Practical and highly useful."	"Overwhelming support requirements."
WebCATS	**WebAPPS**
Wonderful	Complicated
Not intuitive	Not user friendly
"Lots of sections not used"	Not intuitive
"Disappointed with lack of information"	"Additional training"
Positive Portal comments	**Negative Portal comments**
"HQ for program"	Organization is difficult to understand.
	Can't tell when new information is added.
	Certain sections are difficult to find—not intuitive.
Positive Assessment comments	**Negative Assessment comments**
Has the potential to be a great tool.	Too hard for clients to use.
The assessment is wonderful.	Too long.
Helps client as the right questions.	Should not be counted if not used.

Table F.1 Qualitative Survey Data

WebCATS

Technical Requirements / Customer Requirements	Importance	Create Knowledge Workshops or CoP's	Offer more training classes	Improve IT tools integration	Revise new knowledge	Improve IT tools personalization	Increase Navigation and Communication Ease
More User-Friendly	9		7			9	7
IT Tool Integration	3			9			5
More Training	5	7	9				
Help and Update Tool	5	7	7				5
Easier Navigation	5		5			9	7
Faster Navigation	1			7			7
Increase Knowledge Sharing	7	9	5	5	9	9	
Information Veracity	7	9			9		
Resulting Weight		**196**	**203**	**69**	**126**	**189**	**145**
Ranking		**2**	**1**	**6**	**5**	**3**	**4**

WebAPPS

Technical Requirements / Customer Requirements	Importance	Create Help tool to Improve software usage	Offer more training classes	Improve IT tools integration	Knowledge Domains should be revised	Improve IT tools personalization	Increase Navigation and Communication Ease
More User-Friendly	9	5	7	9		5	9
IT Tool Integration	9	5		9	5		7
More Training	7	3	9		5		
Easier Data Entry Process	7		7	7	7		7
Easier Navigation	5	5	5		7	9	9
Faster Navigation	3			7	5		7
Increase Knowledge Sharing	1	5	7	9	9	7	
Information Organization	5			9	9	5	
Resulting Weight		**141**	**207**	**286**	**233**	**122**	**259**
Ranking		**5**	**4**	**1**	**3**	**6**	**2**

Portal

Technical Requirements / Customer Requirements	Importance	News Feed for Information updates	Offer more training classes	Improve IT tools integration	Create Knowledge Workshops or CoP's	Improve IT tools menu layout	Increase Navigation and Communication Ease
more training	3		9		7		
Easier navigation	7		5			9	9
Faster navigation	1	9		7		9	7
News feeds tool	7	9			5	5	5
Improve menu layout	9	5				9	7
Increase knowledge sharing	5	5	7	7	7	7	
Integration with other tools	5			9			5
Information update	7	9		7	5		
Resulting Weight		**205**	**97**	**136**	**126**	**223**	**193**
Ranking		**2**	**6**	**4**	**5**	**1**	**3**

Assessment

Technical Requirements / Customer Requirements	Importance	Provide Links to help clients fill Assessment	Offer more training classes	Improve Assessment Signup and Access	Client/Customer Communication	Reduce Assessment Length	Increase Navigation and Communication Ease
More training	1		9				
Easier navigation	5		5				9
Easier access	9			9	5		7
Reduce length	7					9	
Client/counselor communication	7	3		5	9		
Help tool for clients	5	9		7	5		5
Faster navigation	3	3		7			9
Resulting Weight		**75**	**34**	**172**	**133**	**63**	**160**
Ranking		**4**	**6**	**1**	**3**	**5**	**2**

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