

**KNOWLEDGE ORGANIZATION AND
CONTENT GENERATION IN
KNOWLEDGEMEDIARIES**

by

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B.E. (Honors). Electronics and Communication Engineering
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Submitted to the Department of Electrical Engineering and Computer Science
and the Engineering Systems Division
in Partial Fulfillment of the Requirements for the Degrees of
MASTER OF SCIENCE IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
and
MASTER OF SCIENCE IN TECHNOLOGY AND POLICY
at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
September 2000

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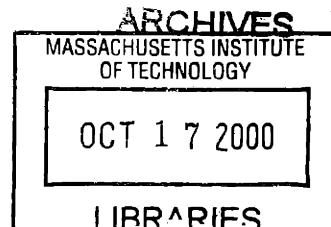
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ABSTRACT

The revolution after the ongoing Network Centric Era is predicted to be the Content Centric Era or the Knowledge Era. Knowledge will play a key role in the success of organizations and people. Knowledge Management Systems (KMS) and Communities of Practice (CoP) have made it possible to share, transfer and store knowledge amongst people who are co-located or within one organization. The web has made it possible to break geographical and organizational barriers for sharing knowledge. Knowledge workers of the Knowledge Era will tend to form Networked Improvement Communities (NIC) which will focus on niche topics or problems, which are similar for all members of the NIC. Knowledgemediaries are web based services which will help form NICs and support inter-organizational knowledge systems.

One such tool is the Lean Enterprise Model (LEM) which has been developed by the Lean Aerospace Initiative (LAI). The LAI was formed by leaders from the U.S. Air Force, Massachusetts Institute of Technology (MIT), labor unions, and defense aerospace companies to improve efficiency by implementing "lean" across the aerospace industry. The LEM is a systematic framework for organizing and disseminating MIT research and external data source results embedded in a hierarchy of Lean Principles, Practices and Metrics.

The research objectives of this thesis are to develop a set of recommendations for the LEM to graduate into a Lean Knowledgemediary. The recommendations were based upon key success factors identified for Knowledgemediaries through case studies and studying LEM shortcomings and new challenges faced by the LEM. The frameworks for the case studies are broadly defined as knowledge organization and content generation methodology. LEM shortcomings have been identified through a LEM survey, feedback from the LAI Team and analysis of the LEM based on the case study framework. The

new challenge faced by the LEM is the integration of two new tools being developed by LAI, i.e., Lean Enterprise Self-Assessment Tool (LESAT) and Transition to Lean (TTL) Roadmaps.

The primary recommendations are to make content generation semi-centralized, improve the feedback process on LEM datasheets and to develop a new graphical interface similar to one of the analyzed case studies, which will integrate the new tools and overcome some shortcomings of the LEM.

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ACKNOWLEDGEMENTS

I would first like to express my gratitude to my research advisor and mentor Professor Deborah Nightingale for having given me the opportunity to do a research assistantship under her guidance. Her suggestions, insights, and encouragement have been a great help to not only complete my thesis but also make my experience at MIT an experience of a lifetime.

I would like to thank Prof. Stuart Madnick, who has kept immense patience and provided the much-needed insights at times when I felt I was on a dead end. He was always very encouraging and helpful. His critical reviews helped a lot in all aspects of the thesis right from the stage of the thesis proposal.

I would like to thank LAI for having given me the opportunity and resources to help me conduct my research and write my thesis. I would like to thank all my friends at TPP, EECS, LAI and the rest of MIT who I am sure have played a role in completing my thesis at some stage or the other.

Last but not the least I would like to thank my parents and my sister who have always kept their faith in me and were always encouraging me to finish my thesis. Finally, I would like to thank Pooja for her patience, support and encouragement at all times, without whom this thesis would not have been completed.

I would like to thank God for having brought together an amazing set of people around me whose synergy and guidance led me through an amazing two years at MIT and ending it with a thesis.

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1. Introduction

1.1 Overview

The Information Technology (IT) industry has grown from a System Centric Era in 1970s into a PC Centric Era, followed by the ongoing Network Centric Era. The next revolution will be the Content Centric Era where knowledge will play a crucial role for individuals as well as organizations. Knowledge workers who are moving into the Content Centric Era are already facing issues of information overload caused by the hyper growth of the web.

Knowledge workers have indulged in knowledge transfer through communities of practice (CoP). This knowledge transfer is more on operational knowledge, which is knowledge about internal systems and operations. The need for knowledge can vary from operational knowledge to tactical knowledge and as one goes higher up it is strategic knowledge.

The web has made it possible for people facing similar problems to share their knowledge and know-how. Knowledge workers who were confined to geographical constraints can now become Networked Knowledge Workers. Such knowledge workers will form the Networked Improvement Communities (NIC) which will be a one-stop shop for all knowledge and information on that specific topic. Web-based knowledge services, which will cater to the needs of the networked knowledge workers or NICs by focusing on one or a set of niche topic/subjects, will be called Knowledgemediaries. Knowledgemediaries will cater to networked improvement communities through a balance of automated and intellectual analysis of information, which is processed into knowledge.

Knowledgemediaries will have a set of domain experts who will be involved in knowledge organization, assessing user needs and conducting intellectual analysis.

1.2 Research Objectives

The Lean Aerospace Initiative (LAI) was formally launched in 1993 when leaders from the U.S. Air Force, Massachusetts Institute of Technology (MIT), labor unions, and defense aerospace businesses forged a partnership to improve efficiency across the aerospace industry. The LAI has many implementation tools, of which one is the Lean Enterprise Model (LEM). The LEM is similar in some respects to the concept of Knowledgemediaries.

The Lean Enterprise Model (LEM) is a hierarchy of Lean Principles, Practices and Metrics to help LAI (Lean Aerospace Initiative) members identify and assess the leanness of their own organizations. The LEM was originally developed as a wall chart by a team from LAI. It was later transformed into a web-based tool. The web-based LEM is populated by MIT, external data derived from surveys, case studies and other research activities in specific areas of the LEM. The LEM has undergone some enhancements over the last two years. As a result of new tools being developed by LAI, as well as identified user needs, the LEM faces some new challenges. The question arose as to what would be required to develop the LEM into a "Lean Knowledgemediary".

The research objectives were to evaluate the enhancements in the LEM based on a set of frameworks. These same frameworks would also be used to evaluate other tools like the LEM to get some insights into different Knowledgemediary systems. Based on the comparison and contrast with other tools, the final objective of the research was to develop a set of recommendations for the LEM.

In short, the scope and objectives of this research effort include:

- Evaluating the scope of tools like the LEM.
- Developing a set of frameworks for evaluating previous LEM enhancements
- Comparing, contrasting and analyzing case studies based on the same frameworks
- Evaluating the new challenges for the LEM

- Suggesting next steps for the LEM based on lessons learnt from other tools and knowledgemediary systems.

1.3 Frameworks

These are a set of frameworks chosen for evaluating the LEM and other case studies. The frameworks highlight the differences/similarities between the tools/case studies. The evaluations assist in developing recommendations for the next steps for the LEM. The frameworks examined are listed below and detailed in Chapter 4.

Type of Information Processing: There are three types of information processing as defined by Frank Rose [2]: Synthetic, Synoptic, Analytic Information Processing.

Type of Knowledge Focus [4]: The knowledge focus of a tool can be on strategic knowledge, tactical knowledge and/or operational knowledge. Usually Knowledgemediary systems can be called inter-organizational knowledge management systems and hence would tend to focus on both tactical and strategic knowledge.

Type of Problem faced by the User [4]: People usually face three types of problems, i.e., structured, semi-structured and unstructured. The needs of the user vary based on the problem faced and the type of knowledge required by the user is usually correlated to the type of problem the user faces.

Type of Belkin's Information Seeking Model [16]: This analysis is based on Belkin's Model of types of information seeking process models. Information Seeking (IS) is a process in which the concentration is on the user. IS also focuses on understanding the heuristics and dynamic nature of browsing through information resources. There are four types of Information Seeking.

A) Browsing: Scanning or searching for a resource

- B) Learning: Expanding knowledge of the goal, problem, system or available resources
- C) Recognition: Identifying relevant items (via system or cognitive association)
- D) Metainformation: interacting with the items that map the boundaries of the task

Content Generation Methodology and Quality Control: Content generation methodology can vary from a centralized system to semi-centralized to decentralized system. Quality control on the data and knowledge disseminated can vary depending upon the type of system used for content generation.

1.4 Case Studies

The following case studies were analyzed based on the frameworks developed through research and literature review. The case studies are not exactly like the LEM but each one has specific characteristics, which fit into the concept of Knowledge mediaries, and the evaluations contribute to the final suggestions made for the Lean Knowledge intermediary.

Global System for Sustainable Development (GSSD): A system developed at MIT to gather distributed sources of information on the issues of sustainability through coordination with a globally distributed set of institutions. GSSD uses a multi-dimensional knowledge networking system of public and private networks, based on an integrated framework and an evolving quality controlled, cross-referenced knowledge base.

www.knowledgespace.com: KnowledgeSpace is a knowledge service designed to help improve business performance. It integrates Arthur Andersen's business resources with daily news and insights to help business professionals find answers to their key business issues.

Netscape Open Directory Project (ODP): The Open Directory Project (ODP) is a comprehensive directory of the web, which relies on a vast army of volunteer editors distributed across the globe. As the web continues to grow at staggering rates, automated

search engines are increasingly unable to turn up useful results to search queries and editorial staff at commercial directory sites can't keep up with rate of submissions, quality control and updating old links. The ODP boasts of more than 27,000 editors, with over 240,000 categories.

Process Hand Book (PHB): The Process Hand Book (developed at MIT) is a tool for sharing and managing business knowledge. It organizes this knowledge using two key dimensions: the different *parts* of business processes and the different *types* of business processes. The Process Handbook, in addition to storing process maps (internally or externally to other sites/databases), can be used to organize process documentation, "best practice" libraries, measurement and benchmarking data, links to relevant web sites, and other kinds of knowledge. Although presently still a research tool and in the process of being commercialized, it has approximately 5000 processes templates, organized using several key principles and based on the notion of activity decomposition.

1.5 The Lean Knowledgemediary

Based on the observations and analysis made about the LEM and other case studies, the concept of Knowledgemediaries is developed and discussed. The thesis describes the concept of Knowledgemediaries and their scope in the landscape of knowledge management systems and the content centric era. Based on the analysis from the case studies and new challenges faced by the LEM, recommendations are suggested for next steps for the LEM so as to bring it closer to the concept of a Lean Knowledgemediary

1.6 Thesis Outline

Chapter 2: Concept of Knowledgemediaries

This chapter touches upon the changing roles and needs of knowledge workers in the Content Centric Era, which becomes the basis for the need of Knowledgemediaries. The need, concept and structure of a Knowledgemediary are described in this chapter.

Chapter 3: Mapping Knowledgemediary Systems in the context of Knowledge Management Systems

Knowledgemediary Systems focus on inter-organizational knowledge management while knowledge management systems focus on intra-organizational knowledge management. Both have some differences and commonalties, which are discussed in this chapter.

Chapter 4: Knowledge Organization in Knowledgemediaries: Case Studies

This chapter describes the set of frameworks, gives brief descriptions of each of the four case studies and presents the analysis of the case studies based on the frameworks. The analysis for the LEM is made in chapter 6.

Chapter 5: Content Generation and Knowledge Sharing Policy in Knowledgemediaries.

Content Generation and Quality Control are the other two parameters on which the case studies are analyzed. This chapter includes the analysis for the LEM.

Chapter 6: LEM as a Knowledgemediary

This chapter introduces the LEM and presents an analysis of the present LEM as well as the analysis of the enhancements made in LEM 2000. It then compares the results of the LEM survey to the LEM analysis. Lastly, the next steps for the LEM to graduate into a Lean Knowledgemediary are described based on the analysis from four case studies, inputs from the survey and the analysis of the needs of a user of the LEM Tool.

Chapter 7: Some key challenges and features for future Knowledgemediaries

Knowledgemediaries as a concept face numerous challenges. Some of the relevant issues are highlighted and with broad suggestions to face the challenges.

2. Concept of Knowledge mediaries

2.1 Data -Information-Knowledge: The Conundrum

Numerous researchers, academicians and professionals have struggled to define the words in their own context over centuries. Even today, in the Information Age there remain conflicting and varied ideas on the definitions of data, information and knowledge. There have been extensions made to this by further trying to define Wisdom and beyond that, "Truth". There are five words that can be put into a hierarchical format to show the relationship between Data and Higher levels of summarization [1](see Table 2-1).

Level of Summarization	Definition
Truth	Conformation to fact or reality
Wisdom	Ability to Judge soundly
Knowledge	Obtained from experts based on actual experience
Information	Structured data useful for analysis
Data	Unstructured Facts

Table 2-1 Relationship of Data to Higher Levels of Summarization [1999]

2.1.1 Data

Data are symbols, images, sounds, and ideas that can be encoded, stored, and transmitted. A data source offers data with the intention or anticipation that data may be processed into information [2]. For example, in a factory producing widgets, the number of widgets produced everyday is data. This data does not carry any relevance until it is either compared to previous production schedules or compared with the capacity of the machine/factory. A comparative analysis gives information about the performance of the plant.

2.1.2 Information

The word information comes from the Latin word *informatio*, which means illumination, exposition, outline, and unfolding [2]. Information has various forms and definitions. The *syntactic* definition of information conceives and measures a gain in information as loss of entropy. In this context, the value of a message cannot be discussed without taking into consideration the recipient's environment. In the *semantic* context it means that information can only be understood. In the *pragmatic* context information always results in an effect on the recipient. This is different from semantic interpretation because it implicitly requires active utilization of information by the recipient [2]. Hence the gain in information about comparison of number of widgets with another day's production creates a gain in the recipient's environment of understanding, and it may result in specific action when the information might not conform to what the individual had perceived would be the desired outcome. The expectation of the desired outcome was a form of knowledge of the individual.

2.1.3 Knowledge

Knowledge can be defined as insight gained by conducting information analysis based on previous experience and education. Information in this context can then be defined as a stimulus that changes the recipient's knowledge. Boulding [3] provides an analogy based on the economic theory of capital. In capital theory, investment is a flow, as it alters the stock of capital. Information in the same sense is in a flow, as it reveals itself it alters the stock of what is known and hence alters the knowledge space as seen by the decision maker. Analogous to the depreciation of capital is the forgetting of knowledge. Data and information require context while knowledge requires an interconnection of information. At a certain point of time, knowledge can also be the sum of hitherto substantiated individual or collective experiences, understanding, and realization.

Knowledge can be only exchanged or communicated if it can be transformed into information; this kind of knowledge can be processed by means of information technology, and is labeled as *disembodied knowledge (explicit knowledge)*. The other form that exists in people's heads is labeled as *embodied knowledge (tacit knowledge)*.

Hence transformation of Knowledge into information is not the same as converting information into knowledge [3].

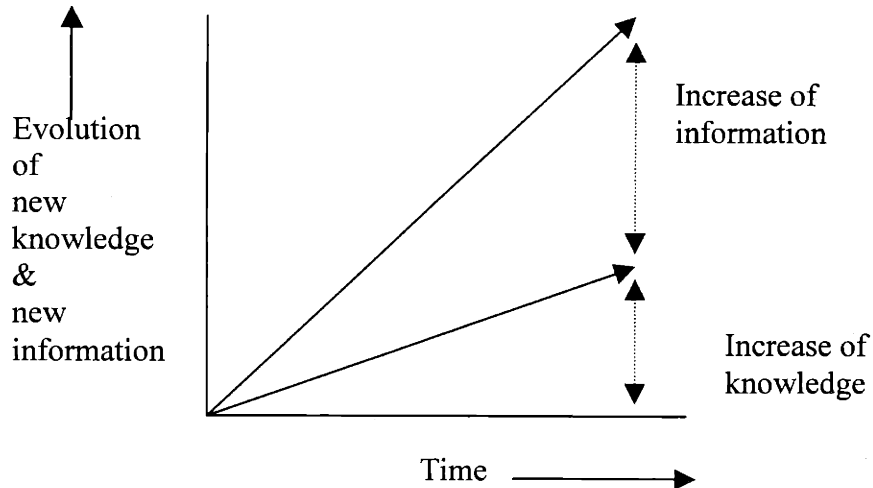


Fig 2-1 Discrepancy of increase in knowledge and the increase of information [4]

This leads into discrepancy between the evolution of new knowledge and new information [Figure 2-1]. As knowledge is not directly transferable into the form of information, which can be codified, but the vice versa is possible. Hence, the evolution of new information is always more than evolution of new knowledge. Since the quantity of knowledge and information is steadily expanding, the organization and retrieval of information has become relevant in the Information Age. Providing the user with access to information was thought to be significant enough to let the individual make good decisions. The coming years will not be about whether a person has access to information. The concern is going to be on the quality of information and how relevant it is to the job the individual wants completed. There is going to be a transformation of the Information Age into the Knowledge Age. The world will move from the *Network-Centric Era* to the *Content-Centric Era*.

2.2 Content Centric Era: "The Knowledge Age"

The Information Technology (IT) Industry since its exponential growth beginning in the 1970s has been going through tremendous changes. The changes are transforming the social, economic and business fabric of the society. The 1970s saw the System Centric era in which stand alone systems were used by only corporations or big research institutions for data processing. The Apple and IBM PC brought in the PC-Centric Era where desktops became the norm and the birth of knowledge workers took place. Today we are going through the Network-Centric Era. The Networks are transforming how information flows and transforms into other forms for use and reuse. The Internet although a boon has become an "Information Overload" curse. Instead of being able to access the right information and knowledge at the right time, people are overloaded with too much information to sieve through for making an information-based decision. The coming century will see the birth of the Content-Centric Era.

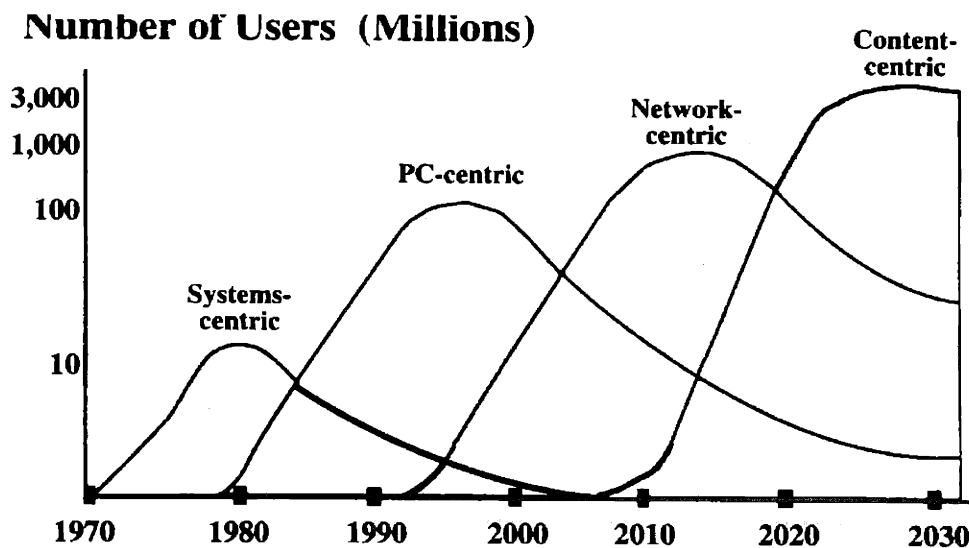


Figure 2-2 Stages of Growth in the IT Industry [5]

The content centric era will have content providers as the key players in the IT Industry. Content will become more relevant and information portals will need to be able to cater to the needs of individual users. Individuals needing specific content will not want to spend their time and effort on generalized content providers and would need to be

serviced by specialized content providers. This is one of the primary motivations for the concept of Knowledgemediaries (web-based inter organizational knowledge management tool focused on a niche topic). An appropriate mix of human effort and technology will provide such user specific content based service. Surfers have already started preferring specific sites based on the services and the content provided by the websites. Nearly half the online consumers say that they will not pay for content and less than that say that they never have paid for content. In order for content to carry value, it must focus on a niche market, be exclusive and have net value, i.e. it must offer users greater depth or functionality than it does in other media or through other information portals [6]. Presently the Internet is relatively less used for business intelligence, education or knowledge sharing. The internet is still believed to be primarily an entertainment medium, source of information and a cheap form of communication.

There are companies which have started paid content subscription for specialized information services. Services like Yahoo or Ask.com are getting integrated into the information systems of companies and big organizations. Knowledge workers in these companies will be pioneers in capitalizing on the strength of the web for increased productivity. Knowledgespace.com is a company started by Arthur Andersen and it defines its business model as "KnowledgeSpace is a knowledge service designed to help improve business performance. It integrates Arthur Andersen's business resources with daily news and insights to help business professionals find answers to their key business issues." This site leverages the trust Arthur Andersen carries in the Industry in association with a web based information services model. The focus of this tool is on knowledge workers who need to learn and educate themselves. Users of this tool can come from two perspectives.

- 1) Employees within one industry who might use it as individuals or access it through the knowledge management tools of their company. Such individuals are the knowledge workers of today's world.
- 2) People from different industries/companies interested in the same topic who would like to learn and educate themselves while leveraging the expertise of Arthur Andersen as well as sharing their knowledge with other individuals having similar interests. This

community based sharing of knowledge was called Communities of Practice (CoP) during the industrial age. Today in the networked world where CoPs do not need to be geographically co-located they are called Networked Improvement Communities (NIC)

2.3 Networked Improvement Communities (NIC) or Communities of Practice (CoP)

2.3.1 Knowledge Management and Communities of Practice (CoP)

A community is a group of people who are willing and able to help each other. Knowledge Management has traditionally existed within communities of workers or employees who share their knowledge and experience to help solve each other's problems and share new ideas. Today's economy runs on knowledge, and most companies work assiduously to capitalize on this fact. They have cross-functional teams, product focused business units and work groups to capture and spread new ideas and know how [7]. Lave and Wenger in 1991 first described CoPs as ".. a set of relations among persons, activities, and world, over time and in relation with other tangential and overlapping CoPs". They further went on to describe CoPs as "an intrinsic condition for the existence of knowledge". Communities of Practice are groups of people informally bound together by shared expertise and passion for a joint enterprise, e.g., engineers engaged in deep water drilling, consultants who specialize in marketing, etc. CoPs have always been prevalent but within organizations and that too in an informal manner. The future will see the growth of CoPs, which will cut across organizations. This will be possible through the use of the internet which brings low cost of communications integrated with information sources. People attending conferences and trade shows often are people having specific needs and they are looking to share and learn from others irrespective of whether they belong to the same industry or another. Informal sharing of knowledge does take place at conferences, but there is usually less follow up after a conference. It is either done via emails or through conference calls. The web technologies are not being leveraged to continuously keep sharing and updating the knowledge. People tend to go back and try new ideas till they come back and learn something new again. The web, through

discussion groups and mailing lists, has had some effect in this area but this has been minimal in nature and the future will see a growth in this form of use of the internet.

Communities of Practice (CoP) which cut across organizations and are open to sharing and learning from each other can be classified as Improvement Communities (IC). The Lean Aerospace Initiative (LAI) is one form of an IC where the government, industry and educational institutions have come together to share and learn from each other on issues such as manufacturing processes, supply chain management, product development and enterprise level management across the whole aerospace community. These communities or initiatives are very large and widespread. This makes the transfer and sharing of knowledge very difficult. Improvement Communities will need to start using web based technologies to reduce the cycle time to share, capture and transfer their knowledge and it is then that they will be classified as Networked Improvement Communities (NIC)

2.3.2 Web-Weaving Improvement Communities (IC) into Networked Improvement Communities (NIC)

The First virtual communities debuted in 1970s with the advent of network computing. In the 1990's, the convergence of email, GroupWare, WWW and other technologies has given many more people the experience of participating in groups [6]. Traditionally the concept of virtual communities has been either thought about as being within one global or highly distributed organization. Online communities have only in the past few years taken formation for recreational terms by people not within a specific organization, e.g., online clubs or advanced discussion groups being provided by a host of web companies. Virtual communities of people have a common interest in one topic or subject. Such groups have existed for a long time in terms of discussion groups or mailing lists. This is one of the powers of the web, which unlike academia, the business world has been slow to catch onto. Individuals within organizations are coming to realize that they can leverage from knowledge sharing across organizations with others doing similar work and facing similar problems, even if they are from separate industries. Organizations of the future will function more like a dynamic set of interrelated communities than a rigid

series of top down hierarchies. We have already moved from a system of companies managed in isolation and assumed to behave in a static manner, to a system of real time interactive companies or enterprises, in a dynamic system. If one thinks of interacting companies as a network, we perceive the emergence of companies interacting in a network, where isolated nodes existed before [8].

2.4 Knowledgemediarities

2.4.1 Knowledgemediary: The Broad Definition

A Knowledgemediary is a web-based inter-organizational knowledge management tool focused on one or a specific set of niche topics/subjects to sustain and develop a Networked Improvement Community (NIC). This web-based tool will facilitate knowledge sharing, capturing, transferring and dissemination across the NIC. Along with the use of web technologies Knowledgemediarities will also leverage the knowledge of experts to organize, index, review and qualify the knowledge content ready for dissemination.

2.4.2 Motivation for Knowledgemediarities: Knowledge Worker in the Content Centric Era:

Knowledge as such is in the minds (tacit knowledge) of the knowledge workers. Although explicit knowledge is possible to be codified, shared and distributed, the need for tacit knowledge is developed through informal networks. People have started using web-based tools to capture expert advice from across the globe and find solutions to the problems they face. Technologies are moving towards a model whereby people will be able to locate the expertise in terms of captured knowledge or a person through special networks. Presently such networks are very distributed and informal. The basic needs of a knowledge worker in the content centric era can be condensed as

Needs of a Knowledge Worker

a. Knowledge Requirements:

- Require knowledge to answer questions, solve problems and situations;

- Desire to learn new things;
- Desire to help others and also see that there is something in it for them;
- Receive feedback on new ideas and thoughts;
- b. Operational requirements:**
 - Operational tactical and/or strategic knowledge specific to the job profile
 - Ease of capturing and sharing their ideas
 - Ease of getting in touch with their community of practice for advice and feedback
 - Minimize time of searching the right information and reduce time on absorbing the knowledge, and maximize time spent to make a decision.

Knowledge requirements of a worker, even if fulfilled, might need to be made easy for the worker to access and use. Otherwise he/she does not see a high opportunity cost in terms of searching, understanding and finally using that knowledge. In the market for knowledge and information, the number of sources and suppliers of information as well as the amount of information, is much larger than the single knowledge worker can handle. Individual knowledge workers cannot contact every possible information source, nor can they estimate the accuracy and true value of the information they have received. Knowledge workers have also realized that knowledge is personalized, and in order for one person's knowledge to be useful for another person, it must be communicated in a manner as to be interpretable and accessible to the other individual. This implies two main causes for a need for intermediation in markets for knowledge [2]. These should be along the lines of **amount** of information and the **domain** of knowledge.

Amount of information [adapted from 2]:

- Contacting the original producer of information is consuming and expensive
- Information concerning a particular topic is distributed across different sources, each requiring special access technologies and /or search capabilities. Each of those sources may be using a different type of representation for information and a different organization for information.

- Only a small part of all information available is relevant to the problem or question under consideration and information may be provided redundantly, i.e., as multiple representations of the same information.

The **Domain of Knowledge** [adapted from 2]:

- Knowledge and special competencies are necessary to access appropriate information sources.
- The solution of complex problems usually requires knowledge and information from several thematic domains, e.g., different scientific disciplines.
- The representation of knowledge may be inadequate for the end-user
- The end-user might not be able to clearly specify his/her demands for information.
- Knowledge experts are needed to qualify the knowledge and help generate trust in knowledge disseminated to the users.

Knowledge Management Systems can offer a systemic and specified process of acquiring, organizing and communicating both tacit and explicit knowledge of employees. This can help the employees to become more effective and productive in their work. Knowledge Management Systems do not integrate knowledge external to the organization. Knowledgemediaries, which will be web based niche topic/subject focused sites, will complement the internal systems of an organization by seamlessly integrating external knowledge and resources into the Knowledge Management Systems.

2.4.3 Knowledgemediary: A System

The fundamental structure of a Knowledgemediary System should consist of the below described five sub-systems:

1. Knowledge Process: The Knowledge Process would involve receiving, processing, parsing and dissemination.

2. User Needs and Knowledge Gap Analysis: An analysis of the type of users catered to by the Knowledgemediary and the type of problems they are facing and the type of knowledge they want and are willing to share in the NIC.
3. Knowledgemediary Engine: The Technology backend of the Knowledgemediary System (KS). This will involve the interface design and organization, the database backend, new technologies like Aggregators and Software Agents, and the connectivity systems.
4. Knowledge Expertise Team: The team, which carries the expertise in the domain of knowledge that the KS is catering to. They will be involved in knowledge classification, organization and developing the knowledge sharing in the NIC.
5. Community: The distributed members of the NIC, which would be knowledge workers needing knowledge in the specific domain the Knowledgemediary caters. These will be individuals who will either be stand alone individuals or individuals representing another community, company or organization.

Networked Improvement Community (NIC)

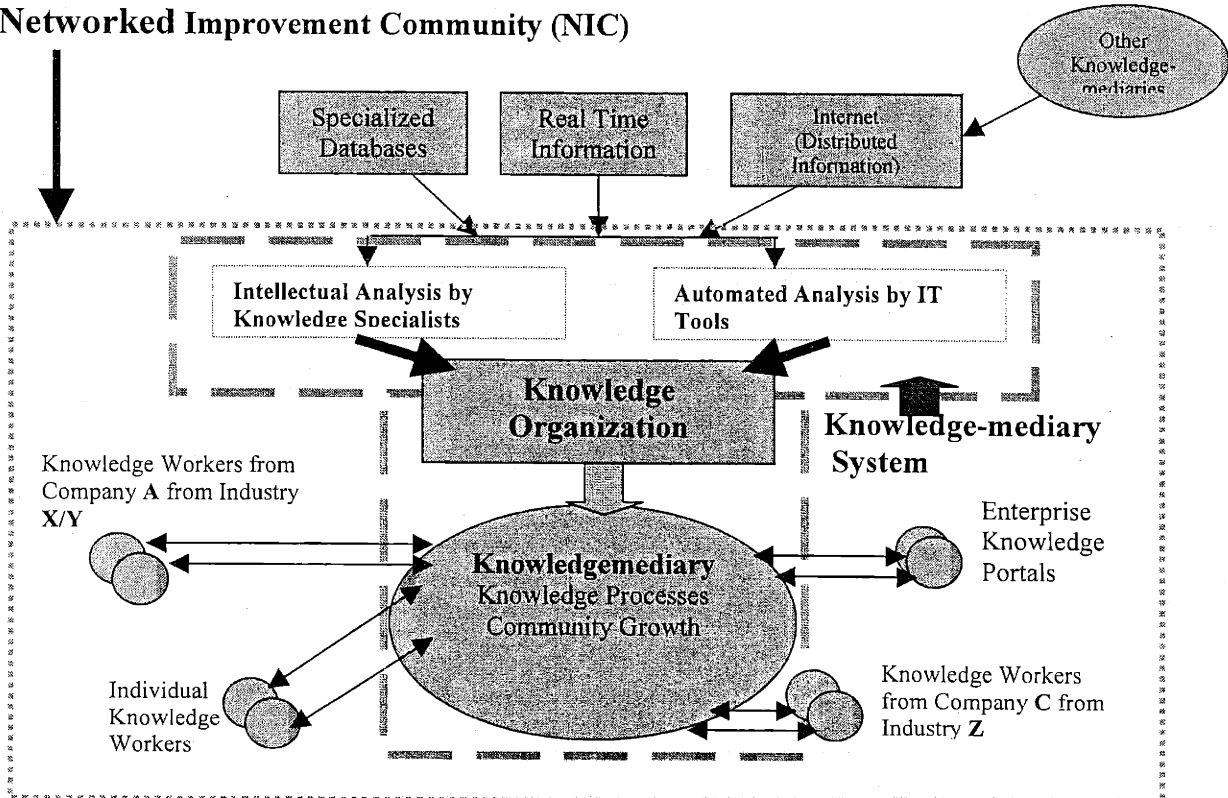


Figure 2-3 Architecture of a Knowledgemediary System

Figure 2-3 shows the structure of a Knowledgemediary in relation to a networked improvement community. The systems in a Knowledgemediary will be involve Intellectual Analysis, Automated Analysis, Knowledge Organization and lastly a web-based tool for knowledge sharing and dissemination.

2.4.4 Knowledgemediary: Issues and Challenges

The Knowledgemediary, unlike Enterprise Portals or other Knowledge Management Systems (detailed differences discussed in chapter3), cater to individuals or NICs which might be across industries and/or companies. The System as such would need to be aware of issues which will be required for smooth functioning of the company. Some of the issues are highlighted below.

- **Knowledge Sharing & Incentives:** Human beings by nature believe that "Knowledge is Power" and hence are not open to sharing ideas. Sharing knowledge across organizational boundaries might prove to be difficult. The Improvement Communities are rising up in huge numbers and hence it is becoming even more important for companies to be able to share knowledge and information. The Knowledgemediary Systems although only web-based will need to develop a community, which believes in knowledge sharing. The community will play a big role in content generation, feedback on new ideas and thoughts and long term sustainment of the Knowledgemediary.
- **Trust in Content Information/Knowledge Levels:** The Knowledge Management Systems usually have a team employed by the company to classify the information in knowledge management systems. Trust for the knowledge in KMS comes from the fact that the Knowledge Management System and its team are internal to the company. Knowledgemediaries on the other hand will have an expertise team which is not internal to any specific company. Users need to be able to trust the content

being generated and disseminated by the Knowledgemediary. This will be another key factor for growth of trust in a Knowledgemediary.

- **Balance between automated analysis and intellectual analysis:** Knowledgemediary Systems will need to find a synergy between the knowledge expertise team and automated analysis of information sources. The expertise of the team should be leveraged to provide the best analytical processing of information to help create value added knowledge products for the users.
- **Content Generation Policy and Issues:** The content centric era will involve aggregation of content, value addition and reorganization of content. Content generation has traditionally been centralized. This was mainly to control the quality of content. The rate of information generation is increasing enormously and this is going to create hassles if the content generation is all centralized. There are various methods through which content generation can be done: centralized, semi-distributed and distributed. Each of them has its own set of trade off in terms of quality of knowledge, etc. This thesis will discuss this issue with respect to five case studies.

3. Understanding Knowledgemediary Systems (KS) in the context to Knowledge Management Systems (KMS)

3.1 Knowledge Management and Knowledge Management Systems (KMS)

Knowledge management as a vast concept can be described as the process to effectively capture the knowledge, share it, and exploit it for commercial benefit. This might indirectly mean an increase in innovation, reduction in the number of times the wheel is reinvented, and increased productivity of employees. Knowledge Management has traditionally been done via word of mouth, face-to-face interactions and/or via Communities of Practice (CoP), but in recent years Information Technology has brought a new dimension to the way corporations think about Knowledge Management. Knowledge Management today involves a blend of people based and information technology based systems. A Knowledge Management System can be described as a system of people based interactions, and information technology based support systems to capture, share and disseminate explicit and tacit knowledge within an organization.

Although Information Technology is very helpful for exploiting and capitalizing on explicit knowledge, it is still not the best medium to capture, share and disseminate tacit knowledge. Companies usually keep a balance between codified knowledge management, i.e., Information Technology based Knowledge Management and people based knowledge management. Depending on the strategy and the business need, the knowledge management system is structured for a specific organization.

3.2 Structure of Knowledge Management Systems (KMS): Information Technology Perspective

Four key functions for building a technology based knowledge management capability within an organization are [9]:

- Knowledge Content
- Processes
- Organization
- IT-Engine

3.2.1 Knowledge Management System(KMS) Content

Knowledge Management Systems need to evaluate the users and the type of problems they are trying to solve. The evaluation of the user can be based on the type of knowledge needed and the methodology in which the user might interface with the KMS to solve his problems. The KMS should analyze their own knowledge content and identify knowledge gaps. This will help identify more appropriate sources for users and how the system should be structured. The range of users of KM Systems can vary from strategic thinkers to people facing operational tasks. Each one of the users could be a novice or an expert in his or her field. This will influence the kind of information and knowledge the user needs and the way he or she would like to navigate the system to reach the specific piece of knowledge. Knowledge Content and its analysis has some key features which KM Systems should follow as key areas of focus [9]:

1. Users Involved
2. Knowledge Required
3. Gaps
4. External and Internal Sources of Knowledge

3.2.2 Knowledge Management System(KMS) Process:

The key to effective knowledge management is defining what knowledge is important to the organization and then creating processes to put that knowledge to work [8].

Unfortunately people are not only the content owners and the key enablers in using knowledge for competitive advantage, they are also the major constraint. As highlighted by numerous researchers, this might be because the possession of knowledge is thought to give a person competitive advantage and knowledge creation is difficult; people may be reluctant to share it without recompense. Recompense might be in terms of peer recognition, monetary rewards or better evaluation. The processes should be focused such as to facilitate Creation, Sharing, Use, Collaboration and Improvement of knowledge within the organization. Processes will either be newly developed or old ones will need to be modified. Examples of the processes include incentive structures for participating in the knowledge management system, evaluation mechanisms for the person's contribution to the knowledge management system as a user and contributor, return on investment of knowledge management systems, constant evaluation of the changing needs of the employees, evaluation of usability of the tool, etc. Two major areas of focus within the Process structure of KM Systems are:

1. Develop Processes, which create processes to help people to:
 - *Create* knowledge and information, which will be useful for themselves as well others using the KMS.
 - *Share* their implicit and explicit knowledge through online communities, chat rooms and other forms of codifying tacit and explicit knowledge.
 - *Use* the KMS for their own benefit in terms of higher productivity.
 - *Collaborate* with each other to brainstorm new ideas and give feedback to others ideas, which will help generate new ideas and knowledge.
 - *Improve* the knowledge through continuous updating and refining from new experience.

2. Structuring Knowledge to Provide Content and Usability: The knowledge can be reorganized to focus on reuse and the user who might be looking for only some insights and knowledge rather than every piece of information.

3.2.3 KMS Organization

Knowledge Management Systems (KMS) need to be supported from a range of departments within an organization to become successful. KMS need extensive collaboration between Human Resources, Information Technology, Knowledge Domain experts and Senior Management. Successful knowledge management projects require cultural, organizational and technology transformations in parallel. There can be centralized teams or distributed teams for managing the knowledge management process and they need to be supported by knowledge domain experts. Rules and incentives that govern knowledge processes are as vital as the organizational framework itself. Rewards and incentives need to be made broader, encouraging people not to compete with one another, but to share and work together. Some of the methods discussed in the literature vary from integrating the citations of the person's contributions into his annual performance evaluation, and/or to give a small monetary incentive for each contribution made to the KMS. The below mentioned four areas are key focus areas for a KMS organization.

1. Explicit ongoing change management: This is needed for successful knowledge management because using the Information Technology systems to share knowledge and to get feedback on ideas is not developed into the human nature. People prefer face to face interactions where they can directly see the acknowledgement for any piece of knowledge they share with another individual.
2. Knowledge Management Core Team: The knowledge management system needs a core team to evaluate the knowledge gap analysis, coordinate with the IT department for developing the systems and understanding the changing user needs.

3. Rewards and incentives for helping people get motivated to share knowledge and learn from others through other means besides only face-to-face interactions.
4. Culture Changes to help create a knowledge sharing environment among the people. They should value contributing to and using the Knowledge Management System.

3.2.4 Knowledge Management System Information Technology Engine

The technology infrastructure provides the necessary tools to enable the creation and sharing of knowledge. Usually a corporate Intranet architecture based on the technology of the Internet, has become the regular standard of most Information Technology engines in knowledge management system. Although the intent is to get a global technology standard, it also helps in integrating external sources into the same tool for use by the employees. A number of organizations have now started utilizing the strength of the worldwide web and created Corporate Portals or Enterprise Information/Knowledge Portals. The focus of knowledge management systems has usually been on availability of the information and data. The IT aspect has not been traditionally developed keeping in mind the user and the problems faced by the user. Very rarely do KM Systems have knowledge experts indexing the information. Non-experts also index external information, hence creating information overload rather than knowledge management. Some of the key features to be kept in mind for an IT-Engine are listed below [9]:

1. Software that will help capture, share and document the knowledge and which can integrate with the internal information systems.
2. User Access and Network as to how can the users be able to access the knowledge if he is not on the premises and what tools are available for him to access the knowledge when he is on premises of the organization.
3. Database Design of how the indexing needs to be done for the knowledge repository based on user needs and how users usually seek for information.
4. Security such that based on the individual's access rights he gets the information and access to documents and employees are not able to breach security.

5. Human Interface to make the process of knowledge access and use much easier and user friendly.

3.3 Issues in Knowledge Management Systems (KMS):

- **Does it cut across organizations?**

Knowledge Management Systems have always focused on knowledge within an organization or between different units of the same organization (global or local organization). The concept of sharing knowledge between organizations in the same industry as well as across industries has remained confined to conferences and workshops. One of the most exciting aspects of knowledge management today is the way in which so many disparate groups are finding common ground. Museums, archives, libraries and even Web site developers are discovering that they have problems in common and can learn from each other. While much of the discussion of "knowledge management" still revolves around "information management," knowledge management is truly much broader. [11]

- **Can Knowledge Management Systems be everything to everybody?**

Users need to update their knowledge at shorter cycle times to perform better in their work. KMS with their restricted internal resources will always be constrained in terms of being able to sustain the need for the organizations educational, informational and knowledge needs. As quoted by the knowledge management guru, Peter Drucker, "I've lost count of the number of times that I have commiserated with indexers who were bemoaning the problems of dealing with new kinds of information. I usually point out that if knowledge were static we would all be out of jobs. If it were possible to organize knowledge and develop a structure for it once and for all there would be no need for this conference. Fortunately, that's not the way the world is, and therein lie our challenges and what keeps our professional lives interesting [11]." Users face a range of problems, which

can vary from structured to unstructured problems. Knowledge management systems usually tend to focus on internal information systems. They do not have the skill set to leverage and update external knowledge and information. Knowledge Management Systems will need to become more integrated with external systems, which will help complement the internal knowledge being provided by the knowledge management system. The sudden growth of Enterprise Information Portals signifies this change in knowledge management systems.

3.4 Enterprise Information Portals (EIP):

The Enterprise Information Portals enables business users to access any information object without having to know its location or format or access methods. Furthermore, users can subscribe to objects that the business portal delivers at a predefined time or interval in the requested format. Users can also “publish” information objects to the business portal repository for others to view, fostering collaboration [15].

EIPs have been forecasted to increase employee productivity by decreasing the amount of time spent searching the web, increasing effectiveness by providing the needed information and fostering collaboration that helps decision making, and decreases overall cost of information by lowering the cost of its delivery. Literature review and companies providing knowledge management services forecast EIPs to provide interactivity for developing the ability to answer questions and share information on user desktops. EIPs will increasingly become integrated with external information sources. Although the integrated systems of internal and external information might be helpful, the information overload still exists in EIPs. There is already an outcry about information overload and knowledge management systems are adding to the chaos rather than reducing the entropy. Even as the internet evolves into an information behemoth and the knowledge management systems are integrating the internet sources into their systems, it does not solve the fundamental problem of right knowledge at the right place for the right user. It

is far easier to manage knowledge if you know what it is and how it differs from data or information [9].

Knowledge content and focus on user needs is increasingly becoming an important factor in successful knowledge management systems or the enterprise information portals. Such systems should be structured based on the type of users and the type of problems being faced by the users.

3.5 Knowledgemediary Systems (KS)

The Knowledgemediary systems will be structured and organized [Figure 3-1] somewhat similar to knowledge management systems in terms of conceptual organization. Sub-processes or functions will vary because of the difference in users and type of knowledge content being captured, shared and disseminated. Figure 3-1 is a detailed version of figure 2-3. This shows the organizational architecture for a Knowledgemediary system.

KNOWLEDGEMEDIARY ORGANIZATIONAL ARCHITECTURE

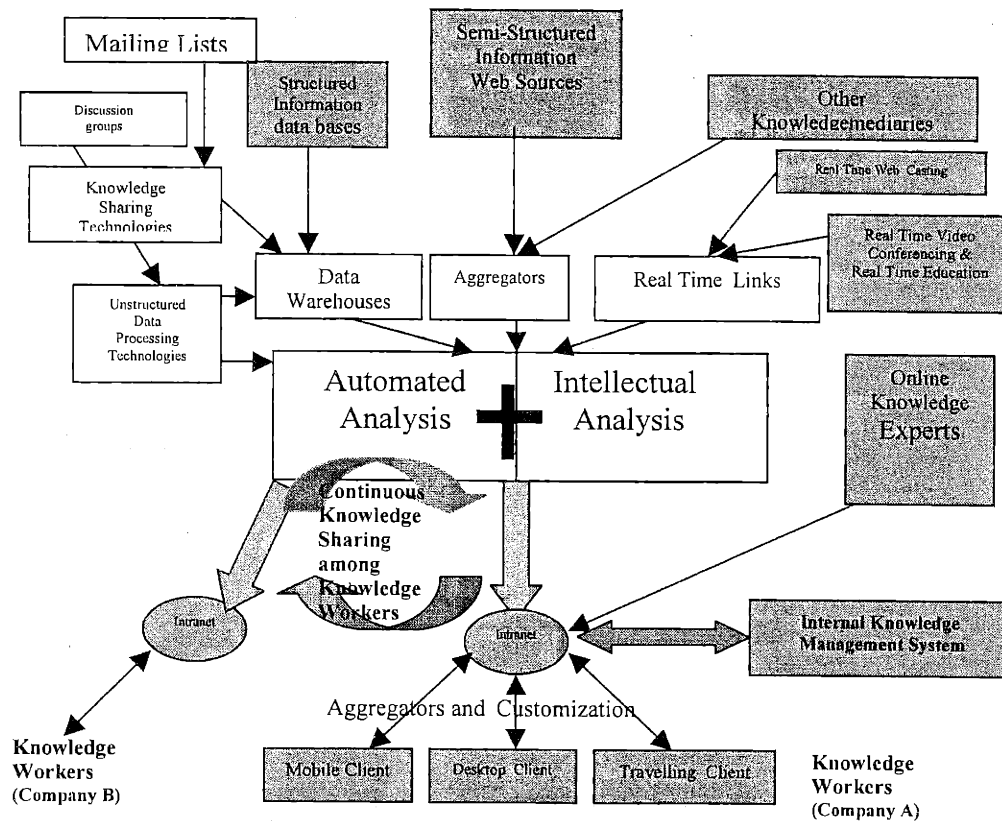


Figure 3-1, Knowledgemediary Organizational Architecture

3.5.1 Processes in a Knowledgemediary [Figure 3-2]

The main objective of a Knowledgemediary would be to receive, process and reorganize information through automated and intellectual analysis. This processing of information will generate the needed knowledge to be disseminated by the Knowledgemediary. The diagram shows a linear flow in the process when it might not exactly follow the process as shown in Figure 3-2, Knowledgemediary Process Architecture.

The key Knowledgemediary processes are:

- Analysis of the information needed and user needs
- Analysis and selection of information resources

- Search and evaluation of information
- Information processing, knowledge generation and reorganization
- Knowledge representation
- Use and feedback by NIC or the knowledge worker
- New content generation by NICs

Each of the processes needs basic competencies for completion of the process and it has an input process and an output process. The inputs can come from the previous process or as a feedback from another process. For example, the process "Information Processing, Knowledge Generation and Reorganization" needs the following two competencies:

1. Expertise in knowledge domain
2. Understanding User Needs

The process gets its input from the previous process of "Search and Evaluation of Information (Intellectual and Automated Analysis)". It also gets feedback from itself and from the process "New Content Generation By NIC/Knowledge Worker(knowledge sharing tools)".

Similarly the rest of the processes are shown in figure 3-2

3.5.2 Knowledgemediary Expertise Team

This is the team of experts who focus on a specific knowledge domain. They will be involved for a range of activities and functions. The knowledge experts will need to work in synergy with technology tools to create value for the users. Teltech Resource network Corp., a Minneapolis based company, specializes in providing highly technical knowledge to its 2000 corporate and government clients. For example, Teltech's experts and 1600 technical databases and "skilled knowledge analysts" help clients get the technical answers sought after by the clients. The company blends interactive human services, technical search tools and a comprehensive knowledge of human information – gathering behavior into a knowledge management environment. The Knowledgemediary expertise team will need to work on similar lines although direct interaction with the client might not be as high as it is in a company like Teltech. This is because the access to databases and distributed systems have become standardized and cheaper to use through

the internet. New technologies help structuring information based on user needs. Some broad functions of the Knowledgemediary expertise team include:

- Conduct knowledge gap analysis
- Understanding the user needs
- Selection of appropriate information sources
- Ontology and Classification in the databases
- Transforming information into knowledge
- Intellectual analysis of user generated content
- Help in community involvement and growth

3.5.3 Knowledgemediary Management and Technology Team

This is the team that will be the backbone of the Knowledgemediary. They will provide the technology skills and the support to the knowledge expertise team. This team will work as an integration team for bringing technology, users and the knowledge expertise together. Some broad based functions of the Knowledgemediary team include:

- Understand user needs
- Technology upgradation and maintenance
- Automated analysis of information sources
- Sustain community growth
- Develop Knowledgemediary Policies

3.5.4 Knowledgemediary Technology Engine

As shown in the Knowledgemediary organizational architecture [Figure 3-1] the Knowledgemediary will require a technology focus in two aspects:

1) The End-Users:

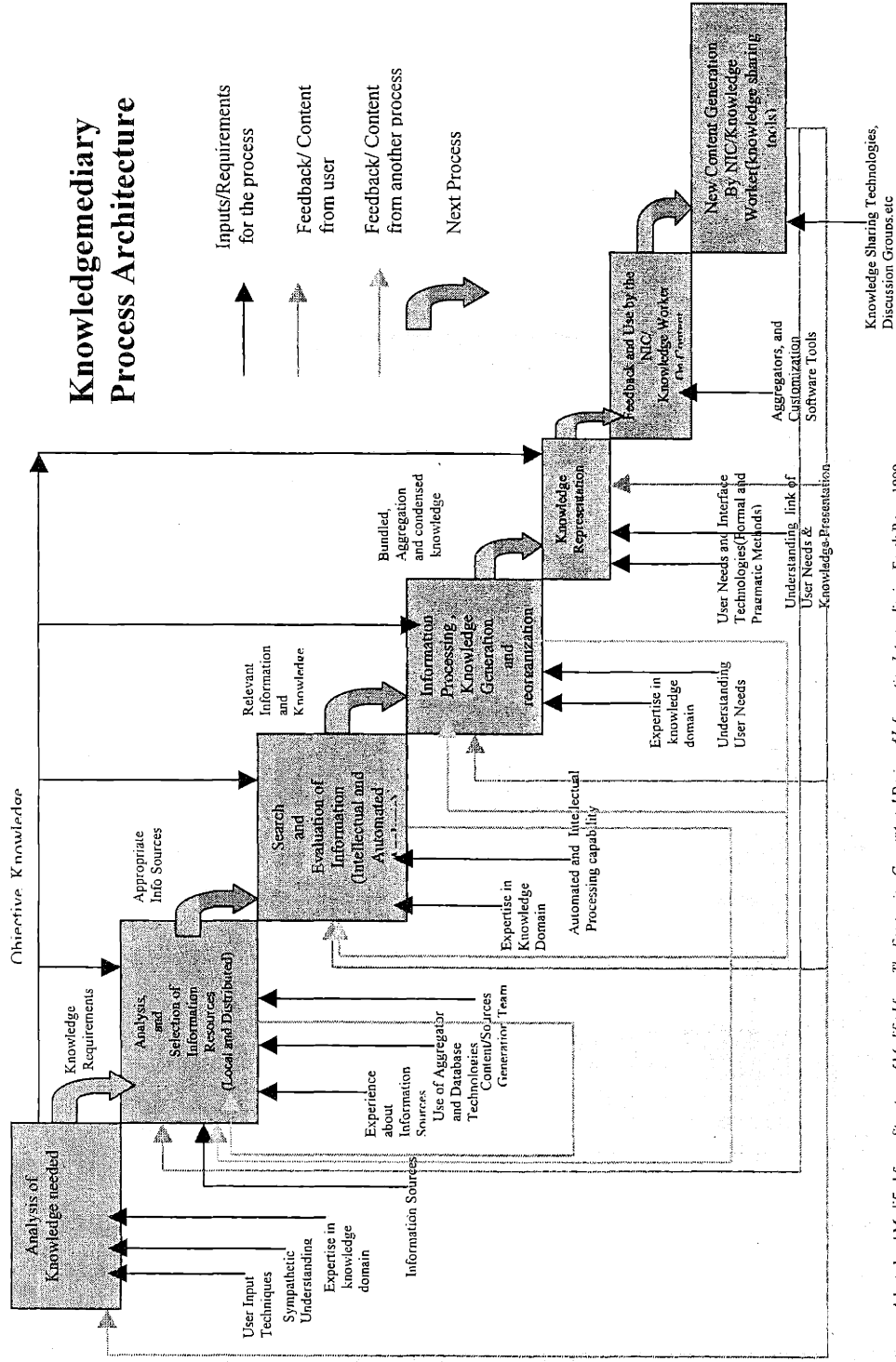
Some of the key areas of focus for an end-user would be

- Human Interface for Information Seeking (IS)
- Software for the community interaction and content generation
- Database design for content (local and distributed)

- Accessibility of network to the user (Desktop/mobile/other)
- Knowledge sharing technologies

2) The Knowledgemediary as a customer for information

- Aggregation Software for distributed information sources
- Database Design for content (local)



Adapted and Modified from: *Structure of Modified from The Economics, Concept and Design of Information Intermediaries*, Frank Rose, 1999

Figure 3-2, Knowledgemediary Process Architecture

3.6 Differences between Knowledge Management Systems(KMS) and Knowledgemediary Systems(KS)

The basic sub-systems are similar in both systems. There are key differences between Knowledge Management Systems (KMS) and Knowledgemediary Systems (KS).

Table 3-1 highlights these differences across several dimensions.

Parameters	Knowledge Management System(KMS)	Knowledgemediary System(KS)
Type of Process Focus	Intra-organizational	Inter-organizational
Type of Knowledge Focus	Operational and Tactical Knowledge	Strategic and Tactical Knowledge
Type of Internal Team	Generalized Technology and Knowledge Analysts	Knowledge Domain Experts and Technology Experts
Need for Critical Mass	Not Necessary	Necessary
Type of Problems	Structured, Semi-Structured	Unstructured and semi-structured
Technology and People Interaction based	Yes (CoPs and Technology together)	No (May combine with associations)
Content Source	Internal	Distributed
Content Generation	Centralized/Semi-Centralized	Central/Semi-Central/Distributed
Information System Design Approach	Information Retrieval Approach	Information Seeking Approach

Table 3-1 Differences between Knowledge Management Systems and Knowledgemediary Systems

Some of parameters chosen above will be used as a framework for analyzing the chosen case studies in chapters 4 and 5. One of the key features of all knowledge centric systems is knowledge sharing. A KMS focuses on knowledge sharing within an organization where the level of trust amongst users would be high compared to the KS where the knowledge sharing is across organizations. The incentives for knowledge sharing in both systems will be quite different.

3.6.1 Differences between KMS and KS in Knowledge Sharing Structures and Systems

Facilitating sharing of knowledge has always been one of the key challenges of any knowledge management initiative. People identify the less tangible things as almost a part of their identity. They are willing to share the tangible documents and programs because they belong to the organization. Although people are equally willing to share both, their motivation for sharing the less tangible information is markedly different [16]. Little personal benefit comes from contributing to a database that is accessed by others with whom the person contributing might have no personal connection and from whom he is not likely to hear. This strong focus on motivation is not only one of the key factors leading to the success of knowledge management projects, but it also clearly distinguishes such initiatives from those which merely use data or information. Although economic incentives do matter, numerous other systems have been successful to create an open knowledge sharing environment in organizations. Jessica Lipnack, President of the Networking Institute in West Newton, Mass. is also a co-author with Jeffery Stamps of *Virtual Teams*. He maintains that the trick in encouraging knowledge sharing lies in designing reward and recognition systems that stimulate sharing of all kinds: goals, tasks, vision, and of course knowledge.

Incentive Structures for Knowledge Sharing in Knowledge Management Systems:

Some of the common schemes, for investigating knowledge sharing drawn from recent literature on knowledge management systems, are listed below [16,17]:

- Make sure that it can be done as a normal part of the job
- Know that promotion is dependant on it
- Receive thanks and recognition
- Receive thanks from peers
- Receive news of how others used the contribution (feedback on your knowledge contribution)
- Know that it is an expected part of the culture of the organization
- Focus on the aspect of reuse rather than collecting and storing the knowledge

- Paying people to share knowledge does not work as well as giving peer recognition and rewards. This inculcates higher standard of teamwork.

Some of the identified barriers to knowledge sharing in the KMS [16,17]:

- Enterprises cite lack of time to record knowledge as the factor most likely to bring about a knowledge management project delay.
- Fear of asking questions and appearing ignorant
- Ignorance about whom to direct the questions towards
- Department vs. Department rivalry
- Knowledge Hoarding
- Information Overload
- Technology is only part of the cure, changing behavior and fixing cultural barriers is more important.
- Not updated with new ideas

Basic questions to be addressed when thinking in context of a knowledge management system for knowledge sharing and usage of the tool [18]:

- Business Context: what is the business mission and strategy? Is it understood? Are tasks aligned with it?
- Organizational: What are the key performance factors?
- Structure and Roles: How are people organized to support performance?
- Processes: What are they supposed to do?
- Culture: What social and political factors affect performance?
- Physical Environment: Where do people perform?
- Individual: What are critical performance factors?
- Direction: What guidance do people receive?
- Measurement: How are they measured?
- Means: Do they have the tools to enable performance?
- Ability: Do they have the skills and knowledge to perform?

- Motivation: Will they perform?

Knowledge sharing in Knowledgemediary Systems (KS):

The people who will be using the network of the Knowledgemediary must see value in it; otherwise they will not use it. One can accomplish this by creating a network that helps people find answers to questions and solutions to problems, that teaches them new things and enables them to help one another. At the same time it should stimulate and motivate them by generating recognition from their peers. Some key focus areas for sharing in Knowledgemediaries are listed below [18, 2].

- Knowledge Focus: Does it create an excessive need to share and learn from each other? For example software is one such field where it is necessary to share and learn to remain ahead of the latest developments.
- Recognition of Contributors: Whose content has been reused ?
- Feedback: How good was the reuse of the content provided by a user ? Are users willing to provide feedback ?
- Trust: How is the system generating trust amongst the users ?
- Means: Do the users have the tools enable use and contribute to the system ?
- Community: Does the site support a community-based approach and feeling?

Some of the barriers identified for KMS might act as enablers for KS. A list of such enablers for the KS are given below:

1. Knowledge Hoarding: Users of a Knowledgemediary do not see any value to knowledge hoarding with people from other organizations as long as the knowledge is not critical or very specific to an organization.
2. Ignorance about whom to direct the questions towards: As users interact with others whom they might never meet in person, the fear of looking ignorant will not exist.

3. Department vs. Department rivalry: This does not exist in inter-organizational knowledge sharing, i.e., a Knowledgemediary..

3.7 Summary

This chapter highlights the basic sub-system similarities between KMS and KS. Therefore, Knowledgemediary Systems can pick numerous best practices which have been developed in Knowledge Management Systems. As highlighted, knowledge sharing incentives will be different for both systems. Some of the disadvantages in one system might help increase the usage of the other systems. For example, "Fear of asking questions and appearing ignorant" is identified as a barrier in KMS but it might be an incentive for KS because the KS involves asking and sharing ideas with people the person might not necessarily know. Parameters, which are usually chosen for evaluating a Knowledge Management System (KMS) might be applicable for evaluating some aspects of Knowledgemediaries. The following chapter develops a set of frameworks to evaluate Knowledgemediaries. Some of the frameworks are methods used to analyze Knowledge Management Systems.

4. Knowledge Organization and Information Processing in Knowledgemediaris

4.1 Frameworks and Case Studies for Analysis:

This chapter introduces four frameworks used to analyze the following four case studies:

1. Global System for Sustainability Development (GSSD)
2. Process Hand Book Project
3. www.knowledgespace.com
4. Netscape Open Directory project

The Lean Enterprise Model (LEM) is the primary case study, and will be analyzed in chapter five. Suggested enhancements for the LEM based on the results of analysis of the above listed four case studies are presented in chapter six. The frameworks cover a range of perspectives of evaluating Knowledgemediary systems like the LEM. The frameworks focus on the user problems and the methodology of structuring the KS to cater to the needs of the user. Knowledge Organization can be defined as a set of practices to organize knowledge such that it is made easier for the user to learn and developed a cognitive association while navigating through the system. The frameworks presented after Types of Information Processing are a form of Knowledge Organization.

4.1.1 Types of Information Processing:

This framework has been taken from a thesis developed to evaluate Information Intermediaries. There are three types of Information Processing [2]:

1. Synthetic Information Processing:
 - Collection of information from different information sources. The information is bundled to a new information product from heterogeneous sources and hence might have duplicate information.

2. Synoptic Information Processing:

- Categorization of information according to a given set of criteria. No redundancy check is done.
- The selection of information aims to filter information from the set of available sources according to a predetermined search criteria. No cross-referencing to other relevant information that does not directly fit the search criteria is done.
- The rearrangement of the information selected from different sources is done and then the process eliminates redundant information to produce a new information product.

3. Analytic Information Processing:

- The Analysis of the information additionally checks the consistency of the information that was gathered. The inference of new search criteria from the information to refine the selection or to find related information is another possible result.
- The interpretation of information relates the information gathered so far to other preexisting information, domain specific knowledge, and environmental conditions and derives conclusions.
- Appraisal relates the information gathered and processed so far to a decision problem, evaluates alternative actions, and recommends a decision for the particular situation.

Based on the type of user the Knowledgemediary might be indulging in either one or a mixture of the three above described information processing mechanisms. The thesis will use the framework to observe the kind of information processing being conducted by the chosen case studies and see if a correlation exists between the users, focus of the Knowledgemediary and the type of information processing.

4.1.2 Types of Problems faced by Users:

Within a Knowledge Management System well-structured, semi-structured, and unstructured problems are capable of being solved. However, knowledge tends to be more useful with the second two problem types, while information is generally sufficient for well-structured problems. A problem is said to be well-structured if all of its elements can be identified and quantified in order to determine an answer. The time frame is typically short, e.g., a production allocation problem [4].

A problem is semi-structured if it contains both well-structured and unstructured elements. The time frame can range from short run to the long run, e.g., an investment problem that concerns determining a specific portfolio is considered to be semi-structured. This would require data, information and analysis and further the judgement of a knowledgeable person who has experience in that area. If the significant parameters of the problem can not be identified precisely, it is said to be unstructured.

4.1.3 Types of Knowledge Focus [4]:

The term Knowledge Focus is used in a much broader framework for acquiring , disseminating, and in general, managing knowledge. To assist operational managers and their support staff at different levels of the organization during the coming days, weeks and months, *operational knowledge* is employed. At the next higher level for lower and middle level managers and their staff *tactical knowledge* is useful for overseeing the overall performance of their functional areas during the coming years. At the highest level, *strategic knowledge* is useful for top level managers and their staffs for combining pertinent external knowledge with internal knowledge for future periods, say for two to five years and beyond, for accomplishing an organization's strategic plans as they relate to its objectives and goals [See Table 4-1]. There does exist a correlation between the type of knowledge needed based on the person's job profile.

Users/ Levels of Knowledge	Lower Level Manager	Middle Level Manager	Top-Level Manager
Operational Knowledge	*	N/A	N/A
Tactical Knowledge	N/A	*	N/A
Strategic Knowledge	N/A	N/A	*

Table 4-1 Knowledge Focus vs Level in Management

Operational Knowledge

Typically operational knowledge is related to the operational control of day to day operations in specific departments so that these can be controlled effectively. For example, a manufacturing supervisor has to know if material wastage is exceeding the standard, if costly overruns that exceed the ordinary are in the making and if the standard time allocated for a job has been exceeded. Here the accuracy of detailed past knowledge is particularly important at this level of managerial activities, since lower level managers may find it necessary to take on the spot action to rectify upcoming unfavorable situations. Essentially the time frame for operational control relates to daily operations but can also be related to weekly, monthly or quarterly operations.

Tactical Knowledge

At the tactical knowledge level, there tends to be a mix of external as well as internal sources. Whereas the sources of operational knowledge are based on internal sources for an organization, tactical knowledge tends to be a blend of the two. Lower and middle level managers and their staffs use tactical knowledge to help these managers oversee their functional areas and use this knowledge to give direction to their operations in the future. The time frame is generally confined to the coming year and slightly beyond. Because tactical knowledge can come from both external as well as internal sources, marketing managers, for example, are concerned about the overall sales performance of their regions versus competing firms. They therefore need internal information and knowledge on quarterly and yearly sales as well as external information and knowledge about the competitors.

Strategic knowledge

Strategic knowledge represents the highest level. It is oriented towards many sources that are based outside the organization. From this viewpoint, there is a relationship between a company's critical success factors, which are generally related to a specific industry, and being successful in that industry. In turn these factors help top management and the corporate planning staff to determine the strategic direction the company should take today and, more importantly, tomorrow. In this case human intuition and judgement are generally needed to reach a decision. Typically, the rationale for the inability to identify specific parameters in the problem is the time frame is too long-for example beyond five years. Consider the problem of determining the company's personnel needs ten years hence.

4.1.4 Belkin's Information Seeking Process Model [19]:

Belkin provides a view of the information seeking process, described as Information Seeking Strategies (ISS). Information Seeking is a process in which the concentration is on the user. IS also focuses on understanding the heuristics and dynamic nature of browsing through information resources. It implies that information is sought to increase knowledge and allow the user to follow a more opportunistic, unplanned strategy. This also involves recognizing relevant information and developing an interactive approach to make browsing easy.

This view has been described as a more task oriented overlay of two other information seeking models, i.e. Kuhlthau and/or Ellis [19]. Belkin defines the following four categories of the Information Seeking Process Model:

- A) Browsing:** Scanning or searching for a resource
- B) Learning:** Expanding knowledge of the goal, problem, system or available resources
- C) Recognition:** Identifying relevant items (via system or cognitive association)
- D) Meta information:** interacting with the items that map the boundaries of the task

Based on the four frameworks detailed above, the following four case studies will be analyzed. The case studies chosen for the thesis are not homogenous to each other or to the LEM. The heterogeneous nature of the case studies helps in highlighting features, which might be helpful for developing recommendations for the LEM as a future Knowledgemediary. The order of the case studies is given below:

Case Study A: Netscape Open Directory project (ODP)

Case Study B: www.knowledgespace.com

Case Study C: Process Hand Book (PHB) Project

Case Study D: Global System for Sustainability Development (GSSD)

4.2 Case Study A: Open Directory Project(ODP)

4.2.1 Introduction to Case Study A

The **Open Directory Project's** goal is to produce the most comprehensive directory of the web by relying on a vast army of volunteer editors. Little more than three years old, the ODP is leading a resurgence of human-compiled web directories, and in the process, toppling spider-compiled search engines from their dominant positions as principal gateways to the Internet. As the web continues to grow at staggering rates, automated search engines are increasingly unable to turn up useful results to search queries and editorial staffs at commercial directory sites can't keep up with rate of submissions and control of quality and updating the old links. Today, the ODP boasts of more than 27,000 editors, with over 240,000 categories. The **Open Directory** is a self-regulating republic where experts can collect their recommendations, without including noise and misinformation. Originally developed on the Open Source idea, it was initially called Gnuhoo, later it was called Newhoo and finally ODP after it was acquired by Netscape Communications. The site is at www.dmoz.org, which comes from the Mozilla Directory.

4.2.2 Netscape Open Directory Project : Analysis

Type of Information Processing:

ODP is an example of Synoptic Information processing. The processes conduct a form of categorization with rearrangement making sure that the directory is comprehensive and not redundant in any manner. This means that the same link could be in two categories but not twice within the same directory.

Type of Problem Faced by the User:

The user for the ODP can face any of the previously three explained types of problems, structured, semi-structured or unstructured. The ODP gives the possibility of conducting a global search and narrowing to some comprehensive sites rather than focusing on one type of problem or user.

Type of Knowledge Focus:

As there is no focus on the end user, the discussion of problems faced by the user are not relevant for this specific case study. Although with the variation of end users and the number of search engines using the ODP as their back end, the problems could vary from strategic, to tactical to operational data. People within organizations who need strategic and tactical information have numerous methods to access the information. One of them happens to be the internet, but most people are not likely to have a niche sites or services like the Knowledgemediaries which cater to their needs.

Type of Information Seeking Process Model

The ODP comes under category A (browsing) of the information seeking process model. It helps the user to focus on searching and scanning resource. It does not increase the knowledge goal when the user is indulging in resource selection. The ODP is hierarchically structured [figure 4-1] and it does not help the user to create recognition or expand knowledge about the domain problem. The aspect of cognitive association is missing in terms of graphical representations in the ODP.

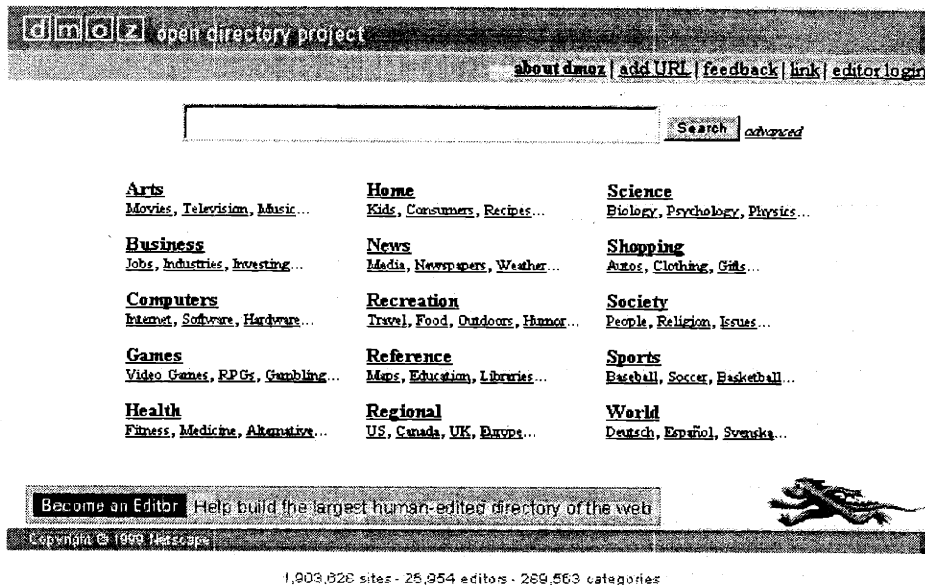


Figure 4-1 Open Directory Project (www.dmoz.org)

4.3 Case Study B: Knowledgspace.com

4.3.1 Introduction to Case Study B

KnowledgeSpace is a knowledge service designed to help improve business performance. It integrates Arthur Andersen's business resources with daily news and insights to help business professionals find answers to their key business issues. KnowledgeSpace can be entered by choosing one of the vertically-focused sections, e.g., Finance, Internal Audit, General Counsel, Energy and Utilities, Technology, Media and Communications, Healthcare, E-Business. This is a mixture of focus between industry types and function types across a set of industries. The member can enter his profile, which will intersect a function and an industry and hence provide the user with focused information in one specific area. Arthur Andersen has an internal vision for its own firm with respect to the knowledgspace.com service. Thomas Hopland, general manger for Knowledge space, describes the internal version of the KnowledgeSpace as "an opportunity for anyone in the firm to contribute to the client engagement experiences and advertise various personal skills: the network also offers a space for designated experts in the firm to elucidate firmwide technologies in an effort to embed knowledge sharing

practices". Hence, along with being of the form of a Knowledgemediary, it is also helping create knowledge sharing within the organization.

The user is provided with three focus areas of information [Figure 4-2]:

1. News

This portion provides links to latest news and/or information in the chosen field of the user. The subdivisions under this section are

- **Quotes and Portfolios:** This provides the stock quotes for companies which are big players in that industry.
- **Hot Issues:** Customized news based on the profile of the user is available from a range of sources. The sources are picked by the KnowledgeSpace consultants and indexed based on the industry focus.

2. Resources

This sections refers to complementary information which might be useful for the user and contains the following subdivisions:

- **Global Best Practices:** A web based Enterprise Process Architecture Tool which provides the user with Best Practice information for the section of the Enterprise he operates and also with an assessment tool for evaluation of how his division is performing as an entity in the whole enterprise. This tool is on the same lines as one of the tools being developed at LAI called the LESAT (Lean Enterprise Self Assessment Tool).
- **Methodologies & Tools:** This is a repository of tools and methodologies used within an enterprise and can have applications either across the enterprise or within a specific division of an enterprise. The tools/methodologies can be accessed either via name or by topic of use of the tool.
- **Reference Sources:** This includes reports on the same topic by market and economic outlook companies, e.g., Gartner Group and Self Generated reports and tools

- Books & Beyond : Links and references of books in this area of focus.
- Learning : Virtual Learning Sites which have been linked for online real time education and learning.
- AskNetwork: This is strategic tie-up with online information and knowledge consultants. They have a range of services, which can help the user find more focused information as well as help him in making a better decision.
- Store: Provides a service to buy latest research reports by Arthur Andersen online.

3. Connections

- Online Broadcasting: One can view latest as well as archived online broadcasts of professors, consultants and other relevant speakers or conferences. The user can choose his preference by topic or industry and view the broadcasts.
- Discussions: This is the knowledge sharing or only interactive portion of the site. A user can join a discussion group or he can create one of his/her own.
- Conferences and Events: Provides latest information on conferences and events taking place in that industry or function. The user can choose his preference by topic or industry and find out the latest conferences going on in that industry.

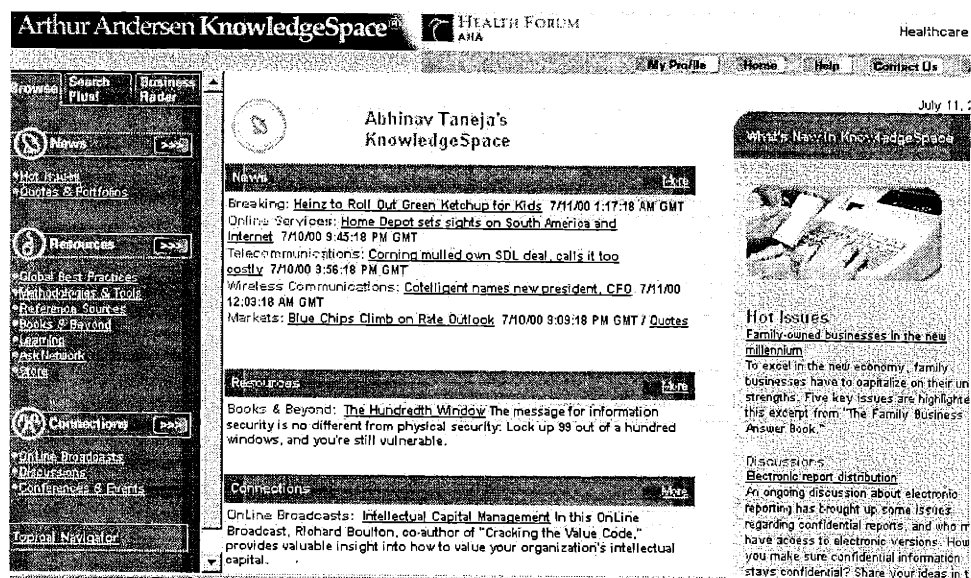


Figure 4-2 www.knowledgespace.com

4.3.2 Analysis of Case Study B

Type of Information Processing:

Synoptic Information Processing: Categorization of information according to a given set of criteria. Rearrangement is done and no redundancy of information exists, which means links of external sources are not listed twice on the same page. They might be cataloged again at some other relevant portion in the entire knowledge architecture. The categorization of information is based on what the expertise team within knowledgespace thinks relevant. There is no value addition or analysis done by the experts except for choosing the relevant news, references, and online broadcasts.

Type of User Focus:

The site caters to providing a business environment scan for the users. The information is either on strategic issues or some tactical issues. Hence the focus is on strategic knowledge and tactical knowledge. The site also includes an assessment tool for the separate sections of the enterprise. This tool is more on the lines of a tactical tool to be used by middle and lower level managers in an organization.

Type of Problems faced by the User:

The users are tactical thinkers and/or strategic thinkers who are looking for external information to scan the environment in order to learn about the latest developments in their field of work and employment. They will be facing a number of unstructured and semi-structured problems. The assessment tool is one such example, which helps solve a semi-structured problem for the user.

Type of Information Seeking Process Model

The knowledgespace.com service is a mixture of Category A (Browsing) and Category B (Learning). As one goes through the site, the user expands his knowledge about the goal, problem and system. Only in the assessment tool under the global best practices section is there some kind of cognitive association in the information seeking process model. This

tool helps the user evaluate or assess his/her organizations competency in comparison to Global Best Practices.

4.4 Case Study C: Process Hand Book (PHB) Project

4.4.1 Introduction to Case Study C

The MIT Process Handbook is a tool for sharing and managing business knowledge. It organizes this knowledge using two key dimensions: the different *parts* of business processes and the different *types* of business processes [22].

The two key focus areas of the PHB are:

- (1) Developing new concepts to understand, analyze, and invent business processes and
- (2) Developing software tools and databases to help improve and manage knowledge about processes. The approach of the project has been to acquire a growing repository of business process templates, to organize this repository in a way that facilitates finding relevant templates, and to develop tools and methodologies that help one use this information effectively. The project has also been launched as a company called Phios Corporation. The Process Handbook, in addition to storing process maps (internally or externally to other sites/databases), can be used to organize process documentation, "best practice" libraries, measurement and benchmarking data, software configuration and change data, linkages to relevant web sites, and many other kinds of knowledge.

The tool does not focus on a process being specific to any one industry, but allows you to access cross industry processes, which might be applicable in your industry. Although presently still a research tool, it has approximately 5000 processes templates, organized using several key principles and based on the notion of activity decomposition. A process is viewed as being made up of different parts: collections of sub-activities that themselves can be decomposed into other sub-activities. The project also relies heavily on two novel concepts:

- **Specialization of processes:**

The Handbook organizes process templates into a functional taxonomy, with abstract processes (generalizations) on one end and more detailed specialization on the other. Sibling processes in the taxonomy can be collected into bundles that compare the relative merits of these alternatives using a tradeoff table. A key advantage of this approach is that it allows people to explicitly represent the similarities (and differences) among related processes and to easily find or generate sensible alternatives for how a given process could be performed.

- **Dependencies and Coordination Mechanisms:**

Processes are viewed as being made up of activities that are inter-connected via dependencies along which resources flow. There are several kinds of dependencies including flow (one producer to one consumer), fit (many to one), and sharing (one to many). Dependencies can be associated with coordination mechanisms, which are simply processes whose purpose is to manage that dependency. Dependencies and coordination mechanisms represent a powerful abstraction mechanism for revealing the key features of a process while hiding implementation details.

4.4.2 Analysis of Case Study C

Type of Information Processing [Figure 4-3]:

Although presently the tool focuses only on developing and entering the processes into the knowledgebase, it does not link to other documents, sites (external sources of information) etc. This process would fall under synoptic information processing whereby categorization of the information is based upon fixed criteria, and rearrangement will be done to remove redundancy. The entire tool is cross-referenced, and it does have the capability to use the information links in their cross-references, although the external links will not be exactly cross-referenced.

Type of Knowledge Focus:

Business process knowledge is a tactical knowledge tool, which requires knowledge from within an organization as well as understanding the best practice being followed. Users will be people who are faced with the task of optimizing or creating a new business process. They will use the knowledgebase in association with internal information about the present processes. The site caters to providing a business environment scan for the users. The information is either on strategic issues and/or tactical issues. Hence the focus is on strategic and tactical knowledge. The site also includes an assessment tool like the LESAT (described in chapter 6) or the Global Practices Tool (from knowledgespace.com) for the separate sections of enterprise. This tool caters to tactical knowledge users.

Type of Problems faced by the User:

The problem of business process reorganization or optimization is a semi-structured problem because the user has some available data and understanding of the present process. He will be a middle or high level manager in charge of the operation and will have to club external and internal data to solve the semi-structured problem he faces. The problem could also be unstructured depending upon the situation.

Type of Information Seeking Process Model

The PHB falls under category B (learning) and Category C (cognitive association /recognition). This is because it does help expand the knowledge of the goal, problem or system through selection, as well as provides a form of cognitive recognition, even though it is a text based cognitive association and not graphical. See the example [Figure 4-3] where the user chooses one of the representations of the processes to drive down towards ones goal and expand his knowledge base. On further drilling down on a specific process, the following options are given

To different *parts* of the activity, click on **Subactivities**.

To see the activities of which this one is a *part*, click **Uses**.

To see the different *types* of the activity, click **Specializations**.

To see the activities of which this one is a *type*, click **Generalizations**

If the user wants to conduct a comparative analysis across generalizations and specialization, the tool has the capability to do so.

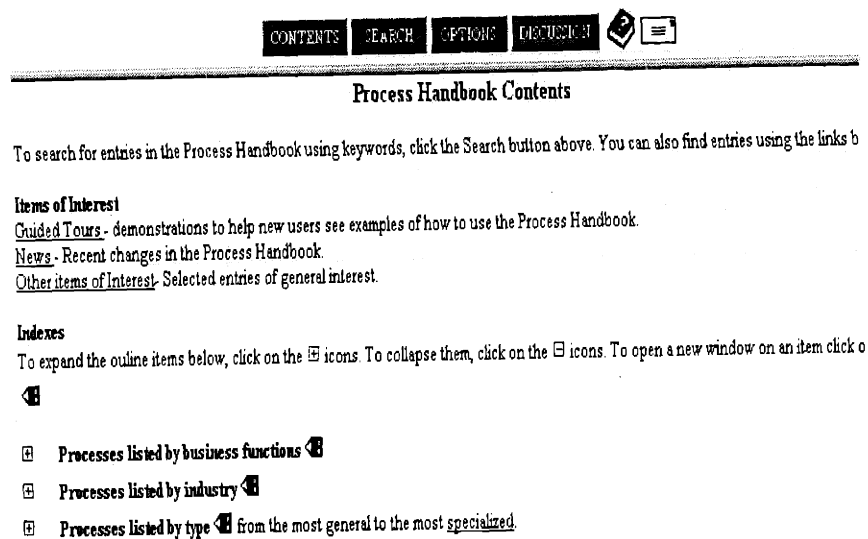


Figure 4-3 Processes Listed by Functions/Industry or Type

4.5 Case Study D: Global System for Sustainable Development(GSSD): Knowledge Meta-networking for Decision and Strategy

4.5.1 Introduction to Case Study D

GSSD is the acronym for the Global System for Sustainable Development, a dynamic, knowledge-based meta-networking system for supporting decision and policy, and representing stakeholder expression and interest. The Global System for Sustainable Development (GSSD) is a multi-dimensional knowledge networking system of public

and private networks, based on an integrated framework and an evolving quality controlled (discussed in chapter 5), cross-referenced knowledge base. Updated regularly, the GSSD knowledge base consists of Internet holdings for over 200 institutions. GSSD is an adaptive and evolving global knowledge system dedicated to sustainable development based on distributed networking principles and practices. GSSD is focused upon helping evolve knowledge about sustainability and make it more accessible to agents of change for public policy, business strategy, and/or creative ventures. It also helps facilitate knowledge-sharing on sustainability through customized search engines, quality-controlled knowledge-mining tools, and multilingual capacities. GSSD provides a leadership and vision for advanced use of communication technologies by strengthening capacities for knowledge access and informed decision-making.

4.5.2 Analysis of Case Study D

Type of User:

GSSD lists the following as a probable set of users:

- public sector, at national, international, inter-governmental levels,
- private sector, for commercial and non-commercial uses,
- national and international professional groups,
- decision-makers, at diverse levels, contexts, and institutions,
- policy leaders, for agenda setting, consensus-building,
- knowledge providers, who seek to use the system to diffuse their knowledge base etc,
- system developers who use the intellectual architecture of GSSD as a standard and platform for their own products, which may be distributed subsequently through GSSD.

This diverse user-base represents different purposes, extents, forms, etc., thus representing different stakeholders in the global system. On the whole all of them are facing unstructured problems on sustainability where they need to make informed decisions, thereby needing to scan the environment for information and knowledge before decisions can be made. According to the framework described above, the GSSD has users

who are faced with unstructured and semi-structured problems due to the fact that they need to be constantly updating their knowledge to make the best possible decisions.

Type of Information Processing:

Synthetic Information Processing: Collection of Information from different information sources and those sources (public and private) are linked into multiple categories.

Synoptic Information Processing is also done for categorization of the information source and rearrangement to remove redundancy. The GSSD team is not involved in analytic information processing and besides providing an abstract and information on how and where it fits in the structure of GSSD knowledge organization, there is no additional analytical analysis of the external links. Individual entries in the GSSD knowledge base are text indexed and cross-referenced in order to provide quick and efficient search facilities.

Type of Knowledge Focus:

As described by the GSSD literature, most of their users are likely strategic decision makers or change agents who will need knowledge and information about the activities in other places from those facing similar issues. The knowledge focus of the tool is on strategic and tactical knowledge.

Type of Information Seeking Process Model:

GSSD supports a **Consistent Conceptual Framework** whereby the knowledge base is searchable by fourteen issue areas (slices), five problem/solution (rings), and many sub-concepts as well as by region of the world, knowledge type, and user-specified combinations. This structure of graphical navigation does not expand the users knowledge when moving through selections which is relevant for Category B (Learning). It does help create a cognitive association model in the users mind and hence the information seeking model fits Category C (Cognitive Association). As mentioned by

Belkin, his model is non-linear in nature, which means a Category C could exist without the existence of any other category. GSSD is a strong example of Belkin's statement of non-linearity. A user can choose to drive down to [see Figure 4-4]

- All GSSD Holdings by Ring (Problem/Solution)
- All GSSD Holdings by Slice (Issue Area)
- All GSSD Holdings by Cell (Intersection of Issue Area and Problem/Solution)

Search GSSD

Click to Browse the Entire GSSD Knowledge Base Using the Following Searches:



Search by Sustainability
Problems & Solutions



Search by 14 Sustainability
Subjects



Search by Intersection of
Sustainability Subject and
Problems & Solutions

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Figure 4-4, GSSD Graphical Browsing Methods

	Type of Problem solved	Type of User Focus	Information Seeking Process Model(Belkin's Models)	Content Generation	Information Processing	Knowledge Organization	Content Quality Control	Interactivity on the Site	Links/ Size	Critical Mass Exists
GSSD	SS/US	Tactical/ Strategic Knowledge Users	Category C (Recognition) and Category A (Browsing)	Semi-Decentralized	Synoptic	Hierarchical, Graphical and Search Based	Strong Monitoring	Does not Exist	2500 Abstr acts/ Links	Yes
PHB	SS/ST	Tactical Knowledge Users	Category B(learning) and partially Category C (Recognition)	Centralized / Semi-Centralized	Synoptic/ Analytic	Hierarchical	Strong Monitoring	Does not Exist	5000 Processes	No
ODP	ST/SS/US /No Focus	No Focus	Category A (Browsing)	Totally Decentralized (27,000 Editors)	Synoptic/ Syntactic	Hierarchical and Search Based	Weak Monitoring	Partially Exists	1.5 Million Sites	Yes
Knowledge space	US/SS	Strategic Knowledge Users	Category A (Browsing) and Category B(learning)	Centralized	Synoptic	Hierarchical	Moderate Monitoring	Exists	Not Provided	No

SS =Semi-Structured
US =Unstructured
ST =Structured

Table 4-2 Consolidated Results of Analysis of the Four Case Studies

4.6 Summary:

The consolidated analysis of the four case studies is shown in table 4-2. The consolidated table includes some general parameters for comparison. The analysis highlights some important points, which will be used for recommendations in the LEM.

Some of the lessons learned from the above analysis are:

1) **Non-Linear Navigation:** Unlike the other three case studies, the GSSD allows the user to navigate through numerous interfaces. The user can choose to be very specific by choosing a "cell" or the user can remain on a broad level by choosing a concentric circle or a sector. The user is also given the opportunity to navigate through a test or hierarchical form of the interface. GSSD is the only tool which can be classified under Belkin's category C (recognition) and allows the user to navigate the site in a non-linear manner. In information seeking systems like Knowledgemediary Systems the capability to navigate to the resources in a non-linear manner is useful. This is because users often know what they want from specific sites and the type of users can vary from novices to experts. The non-linear navigation allows the user to reach to the needed knowledge as soon as possible.

2) **Critical Mass is a must:** Upon interviewing an executive at knowledgespace.com it was found out that the site will be shutting down their services and integrating it into the Arthur Andersen main website. One of the reasons for the site not being able to sustain itself, was the non-existence of community or a critical mass. A number of analyses can be done to suggest the reasons for failure, but the most obvious answer is that the operations never had a critical mass or community growth and involvement. This is also the case for the Process Hand Book (PHB) which has gone commercial but is still looking for a critical mass in terms of users. ODP on the other hand has the required mass in terms of editors as well as users.

3) Need for Experts in Domain Knowledge: All the case studies have knowledge experts in the specified field. The GSSD has experts in a distributed manner, while for the ODP they are totally decentralized. The LEM, which will be analyzed later, also has a set of knowledge experts, i.e., the LAI Team responsible for the LEM. Successful Knowledgemediaries will need knowledge experts for intellectual analysis of information, and information sources. This is one of the key sub-systems for successful Knowledgemediaries (also discussed in chapter 3).

The LEM is analyzed in chapter 6 and the consolidated results with inclusion of the LEM are available in Appendix C. Chapter 6 includes recommendations for the LEM based on the analysis and frameworks discussed in chapters 4 and 5.

5. Content Generation and Quality Control in Knowledgemediaries

5.1 Methodology of Content Generation and Quality Control:

Content updating and generation is one of the key issues now challenging a number of the web companies. Keeping up with generating and updating the content can be a highly resource consuming task. Amazon is a prime example of having moved partial content generation to its users with its service for entering comments for books or CDs being bought by the consumers. This reduces the workload of the company on content generation for specific items as well as creates a sense of community among the consumers. There are three major methods in which content can be generated based on sited examples and case studies. Each one has its own advantage and disadvantages. The major trades off are between:

1) Time needed to generate new knowledge

Vs.

2) Time needed to develop a comprehensive knowledgebase

Vs.

3) Quality of knowledge.

The case studies which have been chosen for this thesis are heterogeneous in nature in terms of content generation and quality control. This analysis hopes to get a broad understanding of the varied content generation mechanisms and apply or suggest them for future changes to the Lean Enterprise Model (LEM). The case studies will be analyzed based on their content generation mechanism, which could be centralized, semi-centralized or decentralized in association with the quality control process followed by the Knowledgemediary. The analysis will also briefly explore the ideas about content generation by users via feedback mechanisms or online knowledge sharing tools.

5.2 Decentralized Content Generation: Open Directory Project (ODP)

The Open Directory Project is an online community of voluntary editors who index and categorize sites into the ODP. Today, the ODP boasts more than 27,000 editors, with over 240,000 categories. The editors are distributed across the globe and can vary in their own criteria of standards for indexing links. Although the work is distributed in terms of content generation and indexing, the quality does become a primary concern. As impressive as the ODP's growth has been, it's only natural to question how a loosely-knit organization with tens of thousands of contributors can maintain strict quality control measures and avoid the problems faced by companies like Yahoo. Yahoo has not been able to keep up with indexing the links being submitted into its site. The categorization is maintained by a set of indexers who are not domain experts for the categories they index. It might be interesting to take note that Yahoo has recently started using Google.com as a backend search engine, which in turn uses ODP as their support database. The two fundamental concerns for any Web directory are the knowledge and skill of the editors who compile the directory, and the quality of the links they create.

5.2.1 ODP Editors and Quality Control

Initially ODP exercised little formal quality control. Editors simply chose a category and started populating it with links. Similarly, there were few editorial guidelines other than to pick the "best" links for a category. In a press release issued in mid-summer of 1998, Tolles, an executive at ODP quoted, "This won't be stable and static. I'm sure there will be pissing contests between editors and so forth. But the whole thing is self-governing. It will even itself out." That did not exactly happen and hence ODP was forced to take stricter quality control measures recently.

The core concept of quality control for the Open Directory Project is that of peer review. ODP grants a very small slice of initial control to a new editor, after he has gone through an initial set of screening. The new editors have to prove themselves before they qualify for additional categories within the directory. Also, there are often multiple editors within the same category cross checking each other's work. The peer review process is

supported by various mechanisms, including subject-based forums that are restricted to ODP editors, and email between editors and the hierarchy. The forums have had more than 100,000 posts in the year that they have been available to editors. Although the process seems to be self-governing, some editors impose stricter guidelines, while others might be biased towards a specific set of links under a specific category. ODP focuses on developing a system of checks and balances, which will help make the ODP a self-governing and regulated body.

5.2.2 Selecting an Editor:

As described by the executives at the ODP, "The goal of editors should be to produce useful resources for the web public. We do not bar editors with business affiliations, since those editors with their own sites usually know their competition and related sites better than anyone else. This knowledge can be ideal for helping build an authoritative directory. However, we will not tolerate editors who only add their own sites, or maliciously interfere with others' listings in the directory."

The selection process for accepting new editors for the directory has also become more rigorous. The editorial application process is indeed selective, and the ODP is currently accepting less than 20% of the applications they get. Major set of criteria for selection is:

- The number of editors in the category at the time of application
- The ranking in the hierarchy
- The qualifications listed
- The quality of the application

5.2.3 ODP: Quality Control

Editors can indulge in preferential listing of sites, which might be because of their bias, or because of a conflict of interest if they are conducting or maintain a business site relevant to the category they are editors. There are numerous discussion boards citing their complaints against the ODP project for biased indexing or in other case removal of good links by editors.

Although the ODP has taken the approach that the responsibility of the ODP team is to improve the system of checks and balances so that the ODP becomes a self-regulating body, there have been complaints about the lack of representativeness and lack of transparency. This is because one does not precisely know what are the criteria for acceptance as an editor, or for that matter criteria for progress through the ranks. The Open Directory's procedures for accepting new editors or accepting site submissions are no more open or transparent than they are at private companies like Yahoo and/or Looksmart. Although ODP might get numerous complaints, the fact that it has become the backend to Search Engines like Google.com and Yahoo.com shows the strength of decentralized content generation and in some manner the self-regulating mechanism does seem to be working for now.

5.3 Centralized Content Generation: Lean Enterprise Model (LEM)

The Lean Enterprise Model (LEM) is a hierarchy of Lean Principles [Figure 5-1], Practices and Metrics to help LAI (Lean Aerospace Initiative) members identify and assess the leanness of their own organizations. In addition, the LEM is the repository of MIT research and other reports from external data sources that provide useful examples of lessons learned, success stories and applied research in specific areas of the LEM. The LEM is an example of centralized content generation mechanism. There are basically three areas where updating needs to take place at a regular basis although one has a longer cycle time compared to the other two.

5.3.1 Content Generation and Updating:

LEM Architecture: This is the knowledge structure/conceptual framework of the Lean Enterprise Model. Twelve Overarching practices having 4-8 Enabling Practices each and further each Enabling Practice having a set of Supporting Practices is the basic framework. [see figure 5-1]

LEM Architecture

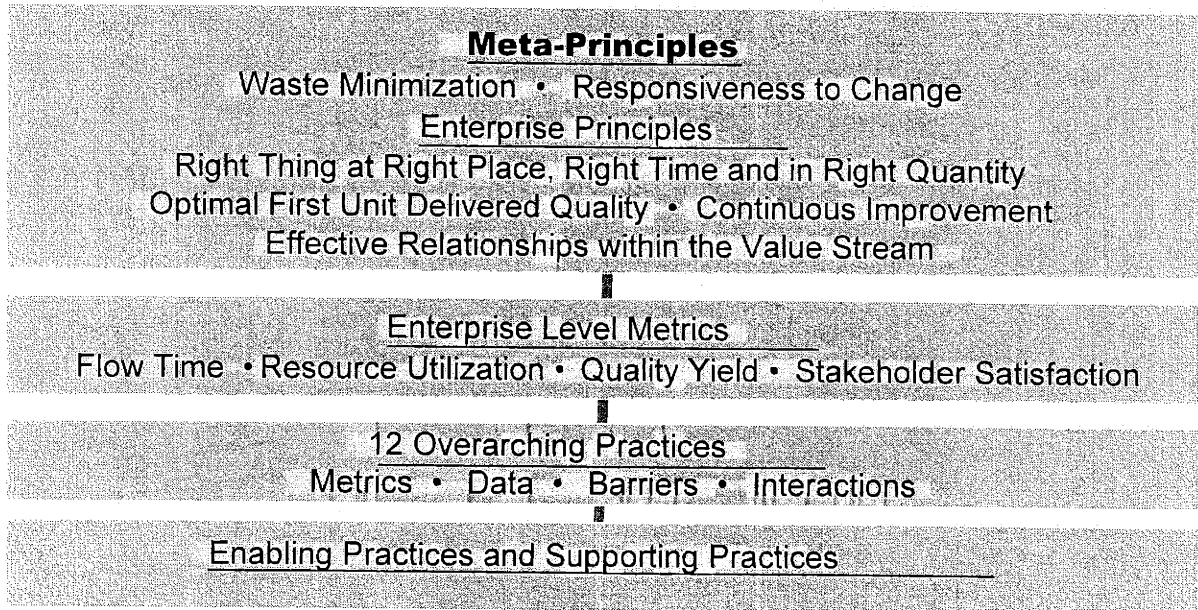


Figure 5-1 Lean Enterprise Model (Architecture)

Data-sheets: These are 5-10 page sheet documents containing the crux of the research conducted by students as well as professors at LAI (Lean Aerospace Initiative). These need to be updated with new research as well as update the old data sheets with new data.

External Links [See Figure 5-2]: These are the external information sources, which have been integrated into the LEM in a catalog fashion. These links need to be made sure that they are not dead and the latest links need to be integrated into the LEM. Some of the external information sources are BMP (Best Manufacturing Practices), IW (Industry Week) etc.

The categorization of the datasheets and external links is based upon the following:

- Source (LAI/MIT, Best Manufacturing Practices (BMP), Industry Week (IW) etc.)
- Metrics (List of 45 possible metrics)
- Keywords
- Type (Benchmarking/Lessons Learned/Best Practices)

5.3.2 Quality Control:

Presently all data-sheets go through a review process by the focus leads at the LAI Consortium. They are given a rating by each of the reviewers and then based on the criteria for rating, they get entered into the LEM or are sent for a rework.

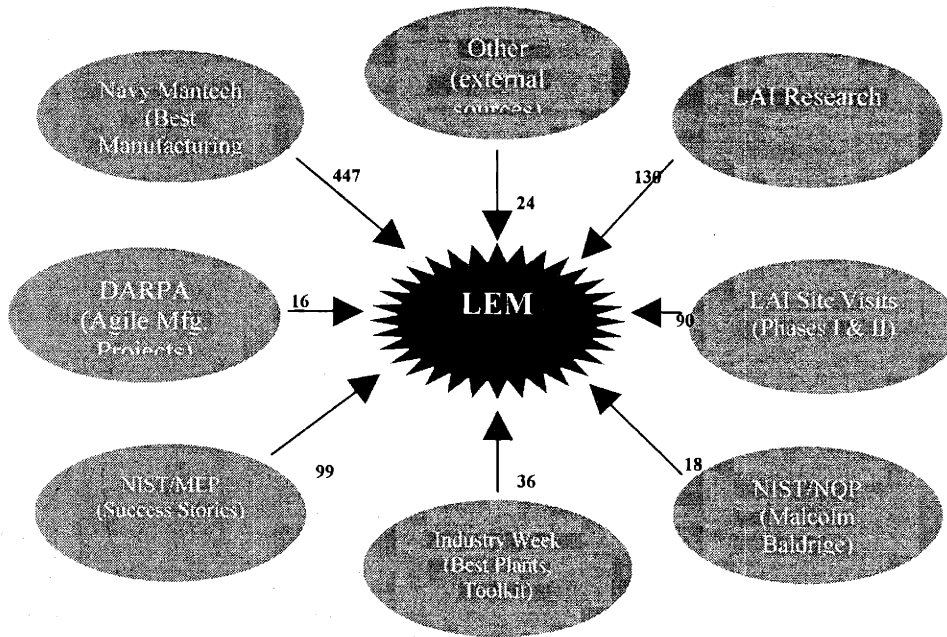


Figure 5-2 Sources of Information, Knowledge and Data for the LEM

Presently the entire process is centralized and there is one person responsible for reviewing the external sources of information and integrating them into the LEM. Although the process can be biased because only one person is involved, the case study highlights another methodology of content generation. Although the process is slow and takes time, it does keep a check on the quality of information and knowledge being released. This assures a certain amount of trust in terms of the quality but the users usually face a very long cycle time for knowledge updating.

5.4 Semi-Centralized Content Generation: GSSD

Semi-centralized content generation is the mechanism adopted by the Global System for Sustainable Development (GSSD). The GSSD has linkage with other research organizations across the globe who help to scan the vast set of information sources and aggregate the sources relevant for indexing into the GSSD. This gives the users a one-stop shop for knowledge and information on sustainability. GSSD does not create any internal documents like the LEM. The GSSD also does not need to update its conceptual architecture or framework as it is based on time-independent objects and ideas. GSSD plays the role to authenticate and validate the sources of information and knowledge being submitted for indexing into the system. People entering the site submission also create abstracts for the site as well as the right indexing position they want the site to be entered into. The sheer size of the World Wide Web (WWW), the distribution of content over various Web nodes, and the varying quality of content, may compromise the usability of this facility, unless some forms of coherence, quality control, and tracking methods are applied in a reliable and consistent manner. Hence rather than finding sources, GSSD works upon the principle of maintaining quality control over the meta-networking knowledge principles. One of the major strengths and capabilities of the GSSD is described as the modality of wide-area knowledge management, sharing and networking, across cultures, languages and disciplines.

The knowledge base of GSSD consists of abstracts of selective materials on the WWW provided by a range of institutions, national and international, both private and public. Each abstract is subjected to a cross-referencing process. The content of each entry in the knowledge base is represented by:

- title,
- abstract
- descriptors
- Pointers to facilitate intelligent retrieval.

5.5 Process Hand Book (PHB):

The process handbook is a repository of the best business processes. This is a knowledge management repository and works on the principle of supporting people looking for best business process practices. Today there are approximately 5000 processes entered into the system by researchers, industry people and scientists. The research-based project has gone commercial via Phios corporation, which will need to be updated with new business processes regularly. The process handbook has a web-based interface. This makes it possible for the entry of new processes to be made from any web compatible system. Unlike the ODP this will never have that huge demand for indexing and the users will be very low compared to search engines, hence the self-regulated control mechanism might not exactly work. If and when the Phios corporation develops into the role of a Knowledgemediary where they become the one-stop shop for the knowledgebase on best business processes across the globe, then the issue of quality control and regulation will come into play. Today the tool leverages the name of MIT for creating a trust in having a knowledgebase consisting of best business processes.

5.6 Knowledgespace.com

As described in chapter 4, knowledgespace.com works on the principle of combining external and internal information to provide the clients with the latest information. Thomas Hopgland, general manager for Knowledge space, describes the internal version of knowledgespace as an opportunity for anyone in the firm to contribute to the client engagement experiences and advertise various personal skills. The network also offers a space for designated experts in the firm to elucidate firmwide technologies in an effort to embed knowledge sharing practices. Knowledgespace.com is trying to satisfy clients with a richer experience of knowledge and information. The knowledgespace team has a review team, which evaluates the long-term links being integrated into the service. Examples of links may include a report, which has been generated by the parent company or a white paper written by an expert in a specific field. The team has its own internal knowledge analysts who are experts in that domain or field and who are responsible for

assessing the needs of the customer and providing him with the required information through internal web links or external links. The content is not internally generated, except in cases of reports developed by the holding consulting organization, which is Arthur Andersen. The tool has a set of experts who review the required links to be integrated into the service and hence in a manner maintain a quality control on the news and updated information being given.

The analysis of the case studies shows that based on the type of users, the focus of knowledge and the technology, one might need to choose a specific content generation methodology.

5.7 Summary

Knowledgemediarities can have a range of content generation mechanisms. Each of the mechanisms has a trade off between quality control and time to update the knowledge. The following chapter will take the learning and analysis from the case studies to suggest some enhancements for the LEM. Based on the consolidated results in Appendix D, the key factors in content generation and quality control for successful Knowledgemediarities will be:

1) **Semi-Centralized or Decentralized Content Generation:** Sites like GSSD and ODP can be classified as fairly successful. This is because the reach for GSSD is global, it has a tie-up with numerous research institutions and has recently gone into multi-lingual knowledgebase which replicate the GSSD in different languages. ODP can also be called successful as search engines like Yahoo, Google, Alta Visa, etc are using it. Both these tools have semi-centralized or decentralized content generation (discussed in detail in chapter 5).

2) **Peer review based quality control:** The ODP example of peer review has had numerous criticisms, although on the concept of peer review across 27,000 voluntary editors seems to be successful based on the usage of the ODP database in other search engines. If we take a specific branch in the hierarchy of the ODP then, the peer review

group is a very small set of people who are interacting with each other to index sites as well as evaluate each others indexing. In the LEM, the LAI team reviews only internal datasheets. GSSD in comparison reviews the links and abstracts through a semi-distributed review system. It is not exactly a peer review system like the ODP. Successful Knowledgemediaries will involve review from several experts for analyzed information.

Based on the observations made from the analysis in chapter 4 and chapter 5 suggestions for the next steps for the LEM are recommended in chapter 6.

6. LEM as a Knowledgemediary

6.1 Lean Enterprise Model (LEM):

The Lean Enterprise Model (LEM) is a systematic framework for organizing and disseminating MIT research and external data source results of the Lean Aerospace Initiative (LAI). The Lean Aerospace Initiative (LAI) was formally launched in 1993 when leaders from the U.S. Air Force, Massachusetts Institute of Technology (MIT), labor unions, and defense aerospace businesses forged a partnership to improve efficiency across the aerospace industry. The LEM encompasses lean enterprise principles and practices and is populated by MIT and external data derived from surveys, case studies and other research activities.

LEM Architecture

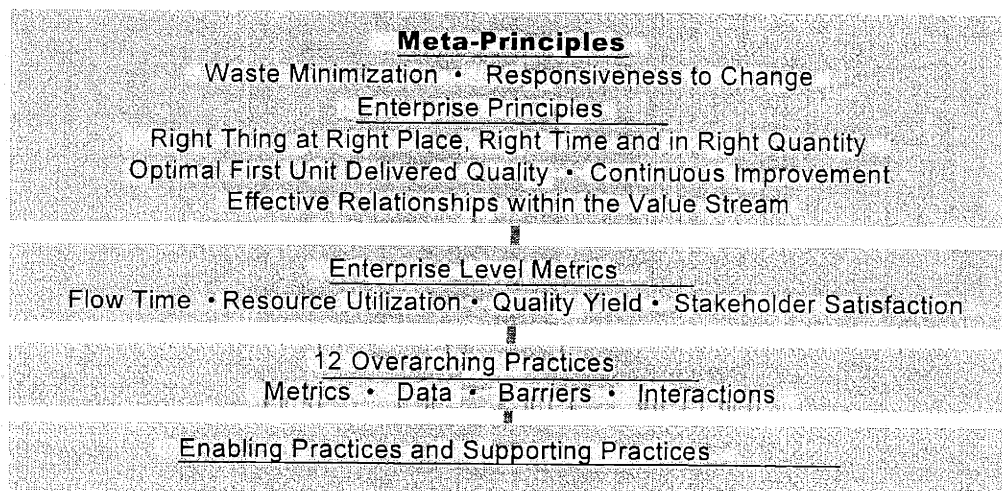


Figure 6-1 LEM Architecture

The Lean Enterprise Model (LEM) Architecture is a hierarchy of Lean Principles [Figure 6-1], Practices and Metrics to help LAI (Lean Aerospace Initiative) members identify and assess the leanness of their own organizations. The datasheets and external links are embedded into this hierarchy based on their relevance and fit into that level within the hierarchy. The current LEM has two Meta-principles, branching into a set of Enterprise Principles and further into 12 Overarching Practices (OAP). Each of the OAPs has 4 to 8

Enabling Practices. Each Enabling Practice is further supported by a list of Supporting Practices [Figure 6-1]. The LEM was originally developed as a wall chart by a team from LAI and later transformed into a web-based tool [Figure 6-2].

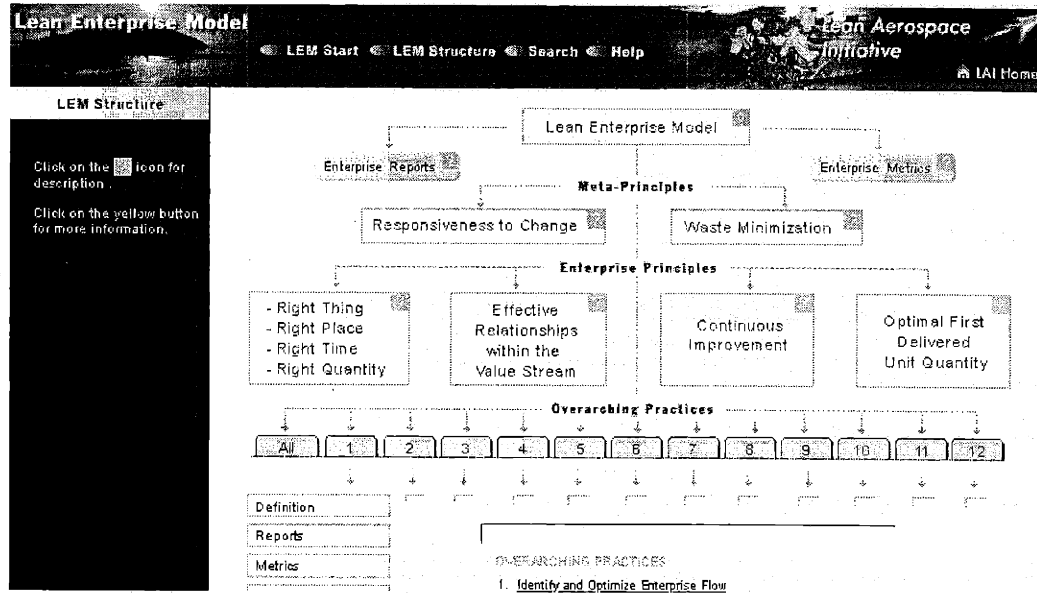


Figure 6-2 The web based LEM Interface

6.1.1 Case Study: LEM Analysis

Type of Information Processing:

The LEM is an example of analytical and synoptic information processing. The internal datasheets are developed and checked for consistency of information and presentation of the ideas. The external links are categorized and embedded into the LEM architecture. The process of embedding is a form of interpretation of information that relates the information gathered so far to other pre-existing information, and domain specific knowledge. Implicitly the appraisal is also conducted when it is structured into the LEM in a specific area of the knowledge organization. No redundant links are integrated into the LEM. Although the datasheets get classified under multiple categories, in which case the datasheet is made available at both places. This is not redundancy because the

datasheet is seen as relevant to more than one places in the architecture and is not present twice at the same place in the LEM architecture.

Type of Problem Faced by the User:

"Lean" pertains to the elimination of non-value added activities. Although it focuses on the operational efficiency of an enterprise it does not directly focus on everyday activities. The problems faced by the users of the LEM tool are unstructured and/or semi-structured problems. The users need to understand their internal operations in relation to the principles and practices of lean as well as the knowledge given in a datasheet or external link. The users are mostly middle managers and high level managers who have either taken upon themselves the task of implementing lean principles in their divisions or have been given the responsibility to transform the division into a lean system.

Type of Knowledge Focus [see Table 6-1]:

The LEM provides strategic knowledge as well as extensive tactical knowledge. Overarching Practices (see table 6-1) are an example of strategic knowledge. Overarching Practices (OAP) are for directing the strategic thinking of an organization trying to become lean. The overarching practices are relevant to the strategic thinkers in a company. Sometimes strategic thinkers might use enabling practices. This makes enabling practices equally likely to fall under strategic and/or tactical knowledge depending upon the user and his needs. Lower level managers or people who are actually implementing the principles of lean will require tactical knowledge. This means they will need benchmarking data, best practice information, lean implementation issues. For example, the enabling practices (EPs) under the OAP2 (Seamless Information Flow) are

1. Make Process and Flow Visible
2. Establish Open and Timely Communications
3. Link Databases for All Key Functions
4. Minimize Documentation while Ensuring Traceability

These are specific practices, which are more relevant at lower levels in the organization, where managers are implementing and testing out lean practices. Tactical knowledge is available at the Enabling Practice level and at lower level, i.e. Supporting Practice level.

Overarching Practices(OAP)	Title
1	Identify and Optimize Enterprise Flow
2	Assure Seamless Information Flow
3	Optimize Capability and Utilization of People
4	Make Decisions at Lowest Possible Level
5	Implement Integrated Product and Process Development
6	Develop Relationships Based on Mutual Trust and Commitment
7	Continuously Focus on the Customer
8	Promote Lean Leadership at all Levels
9	Maintain Challenges of Existing Processes
10	Nurture a Learning Environment
11	Ensure Process Capability and Maturation
12	Maximize Stability in Changing Environment

Table 6-1 Overarching Practices (OAP) in the LEM

Type of Information Seeking Process Model

The LEM is a prime example of category B (Learning) in the Belkin's Model as described in Chapter 4. Although the association between overarching practices and enabling practices is relevant through the hierarchical structure, it doesn't create an aspect of cognitive association or recognition. The model helps the user expand his knowledge about the problem while he/she is sorting through the selected resources. For example, a manager wanting to gain knowledge about the information flow in his division might enter the LEM through Overarching Practice 2 (Seamless Information Flow). On navigating to the next link, which lists the enabling practices, the manager gains knowledge about a range of lean practices to enable this specific overarching practice, e.g. ,“Link Databases for All Key Functions”. On further exploring he gains access to a list of datasheets and external links. This process of navigation expands the users knowledge about the problem while reaching to the appropriate set of datasheets and links.

6.1.2 LEM Survey & Analysis

Primary observations from SPSS Analysis

A LEM Survey [see Appendix A] was conducted via email and web-based database form in Dec'98-Jan'99. The survey was sent out to around 300 people who are involved in the LAI consortium. Simple statistical analysis was conducted to calculate the Pearson's value and chi-square values. The survey results [see appendix B] in the form of the interpretation made from the input provided by the 54 respondents are listed below.

- Web Page and Foldout Charts are the primary mode of usage for the LEM. The Foldout Chart was described as the most used method to explore the LEM. The Foldout Chart was given a higher level for rating by employees who are at strategic levels in the company. Lower level management made use of the web based LEM rather than the Wall Chart, which was more, used by higher level management.
- People at lower levels in the management used the web based LEM to look up specific information and/or data while higher level management uses it to enhance understanding. This shows a direct difference between the user needs at different levels in an organization.
- Ease of navigation is less important to higher level and more important to the lower level management. This correlation exists because the higher level management usually does not drive down to the datasheets and supporting practice. They use the tool at the OAP and maybe the EP level and to improve their strategic understanding. Lower level management uses the tool to search relevant tactical data and hence the ease of navigation is more important to them.

The inference that can be made from the LEM survey analysis is that lower level employees who are implementing lean will need tactical knowledge which means they need access to benchmarking data, best practices and other knowledge embedded within the LEM. Strategic thinkers subconsciously restrict themselves at the OAP Level for

strategic understanding. The web-based tool is more important for tactical knowledge users as they use the web-based LEM tool much more than strategic thinkers.

6.1.3 Conclusion from the LEM Survey and Case Study Analysis:

Focus the Tactical Knowledge User

The result from both the analysis (LEM Survey and Frameworks in Chapter 4) highlighted that the LEM tool distinctly has two levels of focus, strategic and tactical. Tactical knowledge users use the web-based model and need easy access to the datasheets and tactical knowledge, which is embedded in the hierarchy of the LEM. Unlike the tactical knowledge users, strategic level knowledge users do not use the web extensively. Strategic level users are satisfied with the foldout charts of the LEM.

The LEM tries to focus on both strategic and tactical knowledge, rather than focusing on the user of the tool. A person using the LEM for finding tactical knowledge might not find it very user friendly to navigate through high level strategic principles. He/she might want to search the LEM through his or her process (e.g. manage quality systems) or functional (e.g. financial control) division or through a specific metric (e.g. cycle time).

The analysis based on frameworks discussed on chapter 4 highlight that based on the type of users the usage might vary from browsing at the OAP level to actually finding a datasheet under a specific Enabling Practice (EP). The LEM survey corroborated this analysis. The survey showed that people who use the web-based tool more are tactical knowledge users who navigate to find specific information. The same set of users also find the LEM interface difficult to navigate. One of the reasons might be because tactical knowledge users need to navigate through the OAP levels which is not of direct value to them.

Based on the above interpretation, the LEM should change its efforts from balancing the knowledge focus between strategic and tactical knowledge users to developing capabilities and focus on needs of the tactical knowledge users.

6.2 Needs of the Tactical Knowledge User who is implementing "Lean":

Suppose the LEM were to focus mainly on tactical knowledge users. The needs of the tactical knowledge have been identified below. These needs have been identified based on literature review of knowledge workers and their needs. Although the needs of tactical knowledge users on any topic would be similar, some of the needs identified below are because the focus is on the topic of "lean".

1. Need for information and knowledge about internal processes and systems of their own organization.
2. Need for external knowledge about best lean practices for specific processes and systems.
3. Need to share insights and ideas on lean with people facing similar challenges
4. Need to get feedback on ideas from experts
5. Need to get the latest knowledge on lean
6. Need to educate oneself on new lean practices
7. Need to assess the present state of leanness
8. Need to understand how to transition from one stage of leanness to another
9. Need for benchmarking information and data

Some of the above needs will be fulfilled through knowledge management systems (KMS), and Communities of Practice (CoP) within the organization. Conferences and Workshops might fulfill some other needs. The LEM is one such tool that can help fulfill some of the above identified needs.

6.2.1 Needs of a tactical knowledge user using the LEM

Table 6-2 explains the needs of a tactical knowledge user of the LEM. The table lists the needs fulfilled by the present state of the LEM.

It also lists the steps which can be taken to fulfill those needs. The steps identified in the third column lead to some of the recommendations for the future LEM, or the Lean Knowledgemediary.

Table 6-2

Need	Fulfilled by LEM?	Can the need be fulfilled through enhancements?
New and updated datasheets	Partially. The LEM is upgraded in terms of architecture and the datasheets regularly although the process is slow	Yes. The cycle time can be decreased based on new or changed content generation methodologies, e.g., semi-centralized system
Easy access to author of datasheet	Partially. In LEM2000 enhancements where the authors name is given in all datasheets	Yes. For the next steps the datasheet can include the email address and full contact information. LEM 2000 included the author's name.
Access to datasheets / reports/external links through "Metrics"	Yes.	Enabled in LEM 2000 where the datasheets and external links are also indexed via metrics
Access to datasheets / reports/external links through "Functional Division" and/or "Process "	No.	Yes. The LESAT Tool is developed based on processes in an organization. The integration of the LESAT tool with the LEM will enable this need to be satisfied
Access to datasheets / reports/external links based only on a strategic practices (OAPs).	No	LEM 2000 has the capability to role up all embedded datasheets and external links to any OAP level in the LEM architecture.

Access to Enabling Practices based on Process and/or Function	No	Yes. Develop an interface which integrates the LESAT with the LEM Architecture and Data
Assess the state of leanness supported by real like data to transition to the next state	No	Yes. Develop an Interface which integrates the LESAT with the LEM Data
A roadmap to transition to the next state of leanness supported by real life data or knowledge	No	Yes. Develop an interface which integrates the TTL with the LEM.
A tool to help the user evaluate the state of leanness, develop a roadmap for transition to the next states and provide supporting insights, and benchmarking data	Partially. Provides the enabling practices and supporting datasheets	Yes. Develop an interface which integrates the TTL, LEM and LESAT.

Table 6-2 Tactical Knowledge User needs mapped to present and future LEM enhancements
(Cont. from page 84)

6.3 LEM 2000: Enhancements and Analysis

6.3.1 Enhancements made in LEM 2000

1. **Datasheets Indexing on Type, Source** [Figure 6-3]. For example, when a user gets a list of reports and/or links, he might specifically want only datasheets created by MIT or specifically from any other information source. The user also gets the option to choose the type of information, i.e., benchmarking information, best practice or lessons learnt.
2. **Access to Datasheets through "metrics" at all levels.** [Figure 6-4]. For example, the user can choose "cycle time" as a metric and get all links and datasheets indexed by "cycle time" irrespective of which OAP and/or EP they were traditionally indexed or available.
3. **Roll up of datasheets and links to higher levels in the hierarchy, without needing to navigate to lower levels.** For example, under any one specific Overarching

Practice (OAP), all the reports and links under that OAP can be accessed all at once without actually needing to choose a specific EP (Enabling Practice).

4. **Name of the author is included in the datasheets.** The mentioning of the author sometimes took place if the person's thesis was mentioned as a reference. Sometimes the datasheets are created by professors/researchers from a student's thesis. Including the name makes it a form of incentive for the author. It also makes it easier for the user to contact/correspond with the author.

6.3.2 Advantages of the enhancements in LEM 2000 include:

Some of the advantages of the LEM 2000 include:

Type of Knowledge Focus: Increased focus on tactical knowledge user.

The access to datasheets based upon metrics allowed tactical knowledge to be made more easily available. A tactical knowledge user would probably enter the tool with the perspective of finding knowledge on "How to reduce cycle time?" He might want benchmarking or best practice information irrespective of where they are embedded in the LEM. The indexing enhancements made in LEM 2000 help the user to search on knowledge he might already have, e.g., metrics. He might further want only benchmarking information from LAI, which is also possible in LEM 2000.

Enhancements in LEM 2000 have shifted focus from only strategic knowledge users to tactical knowledge users.

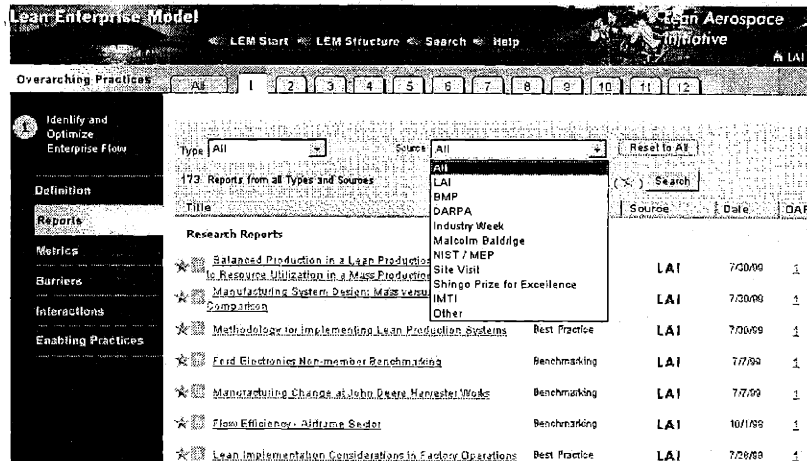


Figure 6-3 Reports at an OAP Level. Shows all datasheets irrespective of the EP. Allows selection by Source/Type

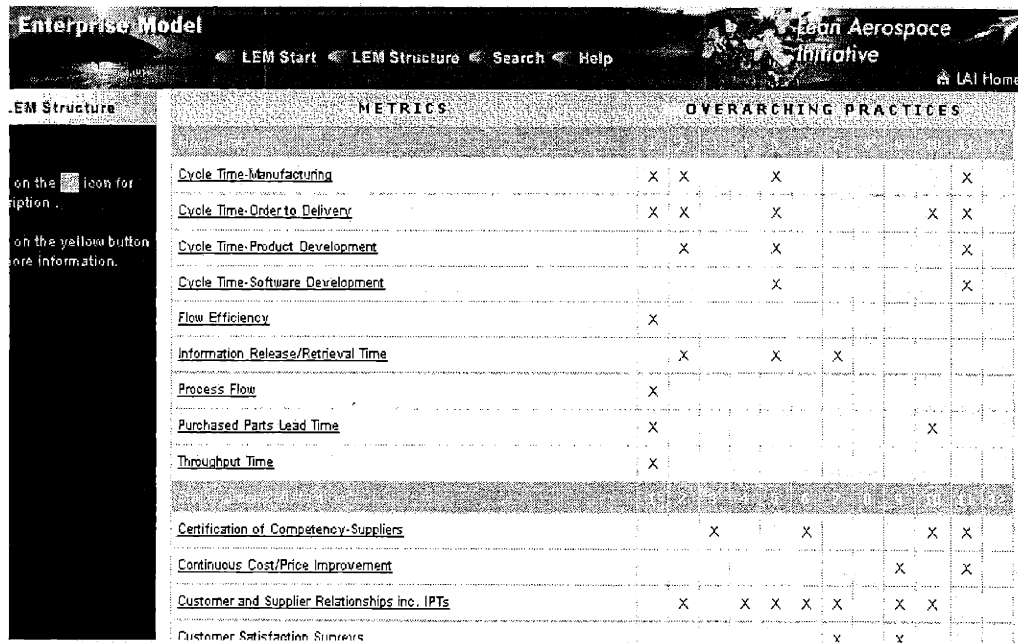


Figure 6-4 Access to datasheets via metrics

6.4 Present capabilities of the LEM compared to success factors for Knowledgemediaries

Chapters 4 and 5 have a set of key success factors, which have been identified based on analysis of the case studies. The present LEM is evaluated against the same set of key factors. Next steps for transforming the LEM into a successful Lean Knowledgemediary are also identified. Some of the steps identified in the third column are basis for recommendations made for the Lean Knowledgemediary [see table 6-3].

Key success factors for KS (from summaries of chapter 4 and chapter 5)	Does the LEM have this capability?	What steps are needed to develop or enhance this capability?
Non-Linear Navigation (Category C (recognition) of Belkin's Model)	No	Develop a Category C (recognition) Belkin's Information Seeking Process Model. This can be developed through a graphical interface described below.
Critical Mass	No	Focus on knowledge sharing between users, as well as with LEM Knowledge expertise team. Enhance feedback/interaction mechanisms between users of the tool and the core knowledge expertise team.
Presence of Experts in Domain Knowledge	Yes	The expertise can be extended to consortiums who are working on similar lines, e.g., LAI-UK.
Semi-Centralized /Decentralized Content Generation	No	Develop a system of semi-centralized content generation by using resources from LAI member companies and other consortiums involved in the "lean" efforts.
Peer Review based Quality Control	Partially. The LAI Focus Team reviews all datasheets being entered into the LEM. They do not review external datasheets.	A semi-centralized system with systems for peer review from different perspectives, i.e., industry, other universities, etc.

Table 6-3 Key success parameters for Knowledgemediaries vs LEM capabilities and enhancements

The suggested enhancements are described in detail as recommendations for the Lean Knowledgemediary. Numerous steps and enhancements can be suggested to achieve the

factors listed in the left hand side of the table. Only the first steps in each case are detailed out to help transform the LEM into the Lean Knowledgemediary.

6.5 LEM: New Challenges

Two new products are presently being developed by LAI . These are the Transition to Lean (TTL) Roadmap and the LESAT (Lean Enterprise Self Assessment Tool). Both of these products are being developed to be used at the strategic and the tactical level in the companies and government organizations, which are a part of the LAI Consortium. Both tools have the capability of being web enabled and integrated with the present LEM to develop the LEM into a Lean Knowledgemediary. A brief description of the tools is given below:

6.5.1 Transition-to-Lean (TTL) Roadmap:

The TTL project has the objective to provide a robust path that Enterprise Leaders can follow to transition their organizations to a new plateau of “leanness”. While the LEM provides a useful taxonomy of Lean practices, metrics and supporting data, it does not adequately address the practical question of “how to” become Lean. Nor does it provide guidance on the appropriate order or sequence in which to achieve an effective implementation of Lean principles and practices. The TTL Roadmap is also developed into a TTL Guide, which explains the roadmap and supports the explanation with references from the LEM and other sources. The roadmap is a conceptual framework which is intended to portray the overall “flow” of action steps necessary to initiate, sustain, and continuously refine an enterprise transformation based upon Lean principles and practices. The Enterprise Transition to Lean (TTL) Roadmap [Figure 6-5, Appendix D] was developed from an enterprise perspective, paying particular attention to strategic issues, internal and external relations with all key stakeholders, and structural issues that must be addressed during a significant change initiative.

The Roadmap has seven major steps [Figure 6-5, detailed in Appendix D] with each major step having sub-steps within them. There are a total of 23 sub-tasks. Each sub-task asks itself six questions, i.e., Why, What, Who, When, Where and How. It also lists enablers and barriers for implementing that task as well as lists a set of references from within the LEM as well as externally.

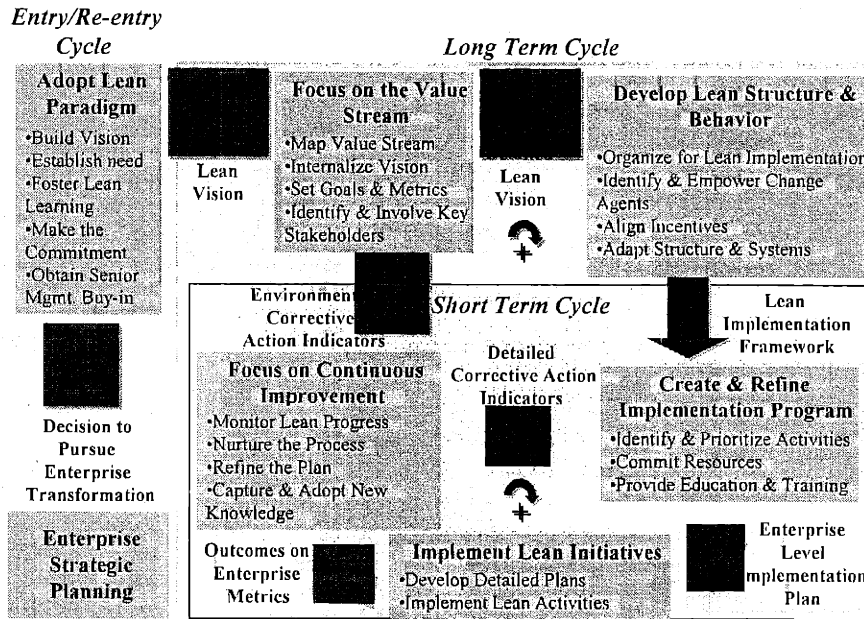


Figure 6-5 TTL Roadmap (Enterprise Level), also see Appendix D

6.5.2 Lean Enterprise Self Assessment Tool (LESAT)

The LESAT is a tool to assess an entity's level of leanness, which will help guide enterprises along the path identified through the Transition -to- Lean (TTL) Roadmap. The purpose of this tool would be to provide member organizations with a viable means to measure their own progress towards successful implementation of lean principles and practices. The emphasis of the LESAT will be on the "gap" between the "current" and "desired" process capability levels, keeping in mind that the intent is not to measure an organization on an absolute scale. A key component of the Enterprise Level LESAT will be the interaction and integration across processes. The Enterprise Level LESAT is

organized by the following 13 business processes covering both industry and government organizations:

0. Lead and Continuously Improve the Enterprise (38)
1. Provide Financial Control, Analysis, and Support (3)
2. Provide HR Capabilities and Admin. Services, Facilities (4)
3. Provide Information Technology Solutions (3)
4. Manage Quality Systems (3)
5. Manage Technology Innovation (5)
6. Define Program Requirements (3)
7. Provide Program Management (4)
8. Acquire New Business (4)
9. Design and Develop Products (9)
10. Manage Supply Chain (4)
11. Produce Product (5)
12. Provide Lifecycle Support (3)

Each process has a definition along with inputs and outputs. For each process, the numbers of enterprise level Lean Practices (LPs) are shown in parentheses. Each practice has 5 process capability levels.

There are two distinct sets of modules in the LESAT:

- Enterprise Level module (0) contains practices important to an enterprise leader. These practices reflect activities which interact with other processes at the enterprise level, or which are enterprise wide practices. This module is based on the seven major steps as shown in the Enterprise Level TTL Roadmap.
- Process Level Modules, which will consist of all modules from 1-12 above.

Integrating TTL-LESAT-LEM

Along with their specific objectives, both the new tools (TTL and LESAT) are also poised to highlight critical issues, barriers, and enablers to be linked to LEM best practices, metrics, case studies & reference material. The web-based LEM faces the

challenge of an interface and database backend, which will integrate the three tools into a Lean Knowledgemediary.

6.6 The Lean Knowledgemediary: Recommendations

In a consolidated form the Lean Knowledgemediary faces the following challenges:

- 1 Need to focus on tactical knowledge users (see table 6-1)
- 2 Need to integrate LEM, LESAT and TTL (see 6.4)
- 3 Need to develop capabilities (identified in chapter 4&5) to develop into a Lean Knowledgemediary (see table 6-2)

The recommendations for the LEAN Knowledgemediary is based upon integrating TTL, LEM and LESAT into a form, which will focus more upon tactical knowledge users and will also develop capabilities to become a successful Knowledgemediary.

The tool will help the users *learn* (by using all three tools), *recognize* (the associations among the tools) and *search* (datasheets and external links) knowledge about Lean.

6.6.1 Content Generation Methodology and Quality Control:

Content generation should be semi-centralized as described in the case study of GSSD.

This process will have two advantages:

1. Integrating external sources being integrated into the Lean Knowledgemediary will increase at a higher rate than in a centralized form. The work will be distributed in the semi-centralized system.
2. Quality Control of the reference data can be improved through a peer review system like that followed by ODP (Chapter 5). People involved in indexing the LEM in the semi-centralized content generation manner can be responsible for maintaining the standard of what they embed into the Lean Knowledgemediary as well as doing a peer review for external links and datasheets.

LAI teams led by researchers or professors can become the Knowledge Analysts who guide the distributed team on the changing needs of the user as well as set criteria for

selection of external sources to be embedded into the Lean Knowledgemediary. An example for such a criteria could be to exclude any links focusing on perishable consumer goods or grocery items. Or the criteria could be to focus on external links providing supplier integration information and knowledge specifically focused on the auto industry. The knowledge analysts will also be involved in reviewing the internal datasheets and updating the architecture across all three tools.

6.6.2 The Graphical Interfaces:

The Lean Knowledgemediary needs to not only be able to educate the user, but also to recognize the associations between the three tools (LEM, TTL & LESAT). For example, a user might see the need to develop capabilities in his division to focus on customer needs. His division could be "Manage Quality Systems". As a user he will need to assess his leanness and then get access to relevant EPs from the LEM. Such a need would require the integration of the LEM and LESAT. He might want to understand how to graduate to the next level of efficiency through a roadmap (TTL). The user will be learning as he navigates through the tool and will also develop an understanding of the association between the three tools.

The graphical interface described below helps solve some of the needs of users (explained below) and develops capabilities (as identified in chapter 4 and 5) for transforming the LEM into a Knowledgemediary.

1. **Integrates the LESAT, LEM and TTL:** This was one of the major challenges faced by the LEM and new LAI products. The graphical interface provides the user four methods to enter the Lean Knowledgemediary, i.e., LEM, LESAT, TTL and the LEM-LESAT interface.
2. **Develops the capability for Non-Linear Navigation** that is a key success parameter for Knowledgemediaries. Based on the critical success factors identified for Knowledgemediaries, non-linear navigation was one of them. The graphical interface

helps develop the Category C (recognition) of Information Seeking Process Model, which is a key to develop non-linear navigation techniques.

3. Fulfills some of the **needs of tactical knowledge users**. A tactical user might need to access datasheets, assess leanness and/or understand enabling practices based on any of the following methods.
 - **Process focus**. For example, a user might want to access all datasheets which provide data and information on Product Development irrespective of which OAP they are cataloged under. Another user might want to assess the "leanness" of the product development process followed by access to the appropriate enabling practices and/or datasheets.
 - **Strategic Practices (OAPs/LEM)**: The tactical user might want to access information about lean practices by reviewing the LEM OAPs and associated EPs.
 - **Process and/or Functional intersection with Strategic practices (OAPs/Process)**. For example, a user might want to "Optimize the Capability and Utilization of People" (OAP 3) within the "Financial Systems (Function)" of his/her organization.
 - **A specific step in the Transition to Lean Roadmap**: A user might need to assess his/her divisions capabilities based on a specific major step or sub-task in the TTL.

Based on the above highlighted user needs, the Lean Knowledgemediary needs to develop the capability Category B (Learning) and Category C (Recognition) Information Seeking Process Model. As seen in the figure 6-8, three potential entry points for the LEM-LESAT portion of the Lean Knowledgemediary are recommended to meet the above requirements. The TTL Roadmap graphical interface is also recommended to integrate the TTL with the LEM and LESAT. All the interfaces leverage the datasheets and external links embedded into the LEM.

Graphical Browsing Entry points for the Lean Knowledgemediary (like the GSSD)

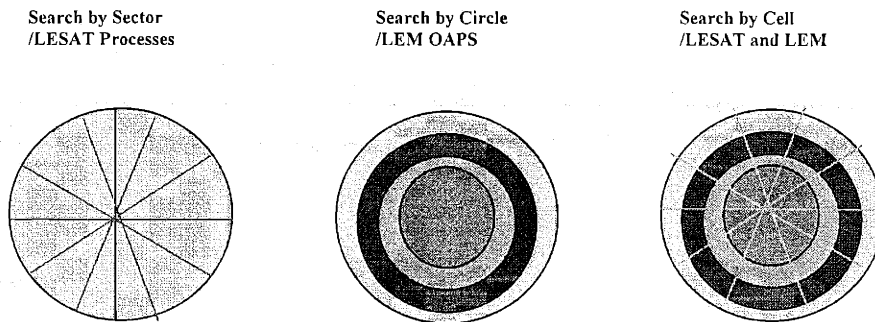


Figure 6-6 Graphical Browsing Mechanisms (Category C and B in Belkin's Model) for Lean Knowledgemediary

Search by Sector/LESAT Processes [Figure 6-6,6-7]: The LESAT tool is based on 13 Processes (as identified in table 6-1). The user can navigate the LESAT tool using the same graphical interface as used for the interface showing the intersection of LESAT and LEM (Type 1). This interface will divide the circle into 12 sectors, each of which would represent one of twelve processes. The first process, i.e., 0.0 (Direct and Lead the Enterprise) will be developed in association with the Transition to Lean (TTL) Roadmap Interface. Like the LEM this tool can also be developed into a text based navigation mechanism along with the graphical mechanism. Exactly like the GSSD (Case Study in Chapter 4&5), the user gets a choice to use this interface for navigating the LEM through a text based interface (Present LEM) or graphically.

LESAT GRAPHICAL INTERFACE ARCHITECTURE

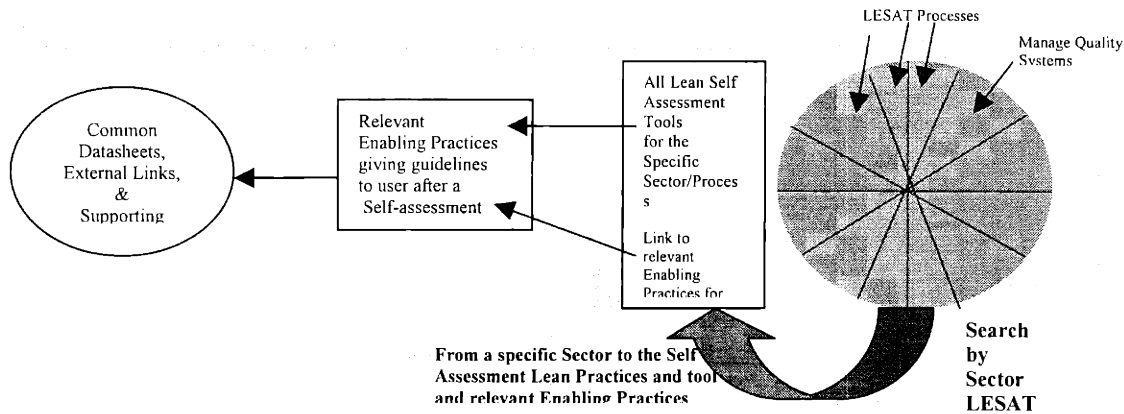


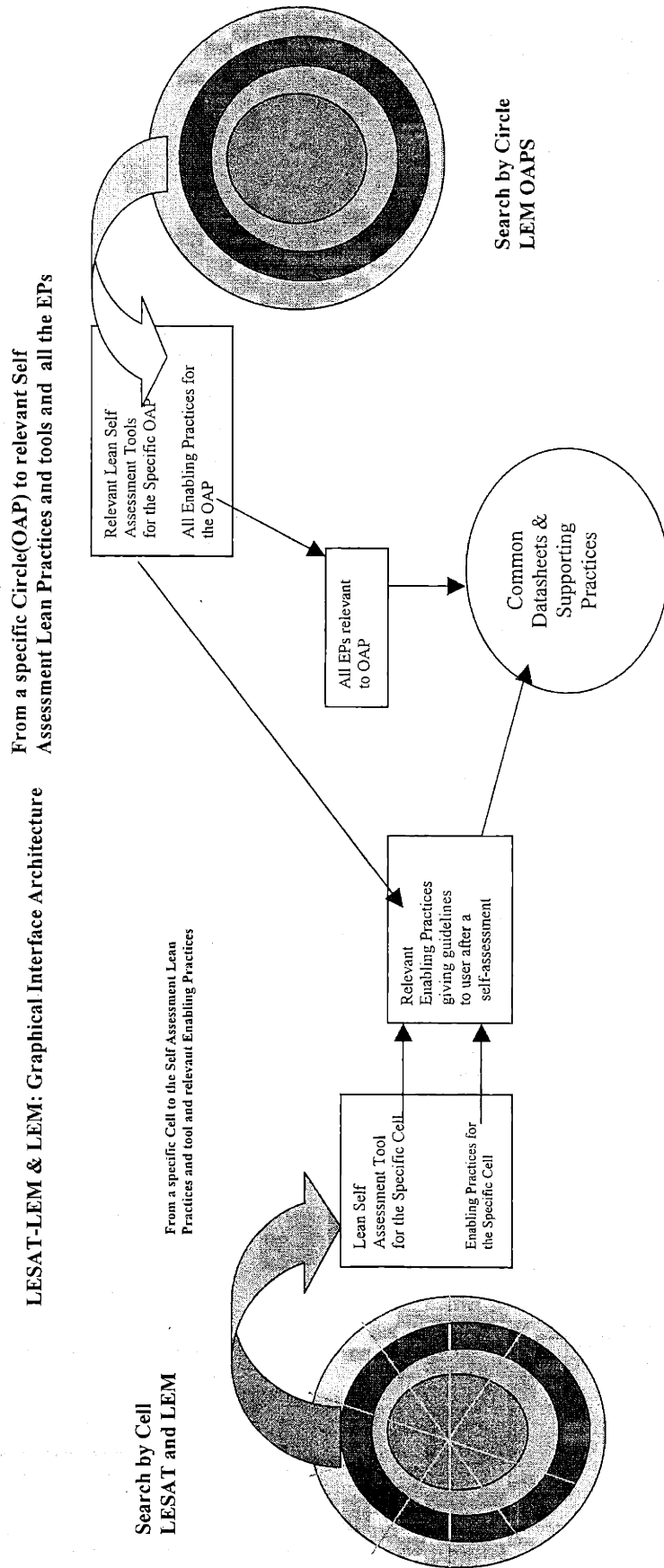
Figure 6-7 LESAT Graphical Interface Architecture

Navigate by Circles/ Navigate the LEM Graphically [Figure 6-6, 6-8]: Like the original LEM, in which the user can move through a hierarchical structure, the same structure exists here but the initial interface is graphical. The 12 OAPs in the LEM are the 12 Concentric Circles. Exactly like the GSSD (Case Study in Chapter 4&5) the user gets a choice to use this interface for navigating the LEM through a text based interface (Present LEM) or graphically.

Search by Cell /LESAT and LEM [Figure 6-6, 6-8,6-9]: This graphical interface helps a user to navigate into sections he/she sees integrating between the LESAT and LEM, For example, suppose a user would like to assess whether this division (Finance and Accounting) is focused on the customer. He would click on the cell which is an intersection between OAP 7 (Continuously Focus on the Customer) and the LESAT Process 1.0 (Provide Financial Control, Analysis and Support). This will lead him into a sheet showing relevant Lean Practices under the LESAT tool as well as relevant enabling practices from the LEM. Besides being able to help the user develop a cognitive association the tool will also help identify areas where practices might need to be developed or identified for enhancing the LESAT and LEM. The LESAT processes can be represented by sectors in

the circle and the concentric circles can represent the LEM OAPs [Figure 6-9 shows one such interface with steps for browsing through the prototype]. The prototype in figure 6-9 has the OAPs represented by concentric rings in different colors as shown on the left and right side of the webpage. The LESAT Processes (12 of them) are represented by the sectors shown in the circle.

Figure 6-8 Graphical Interface Architecture for stand alone LEM and LESAT-LEM combined



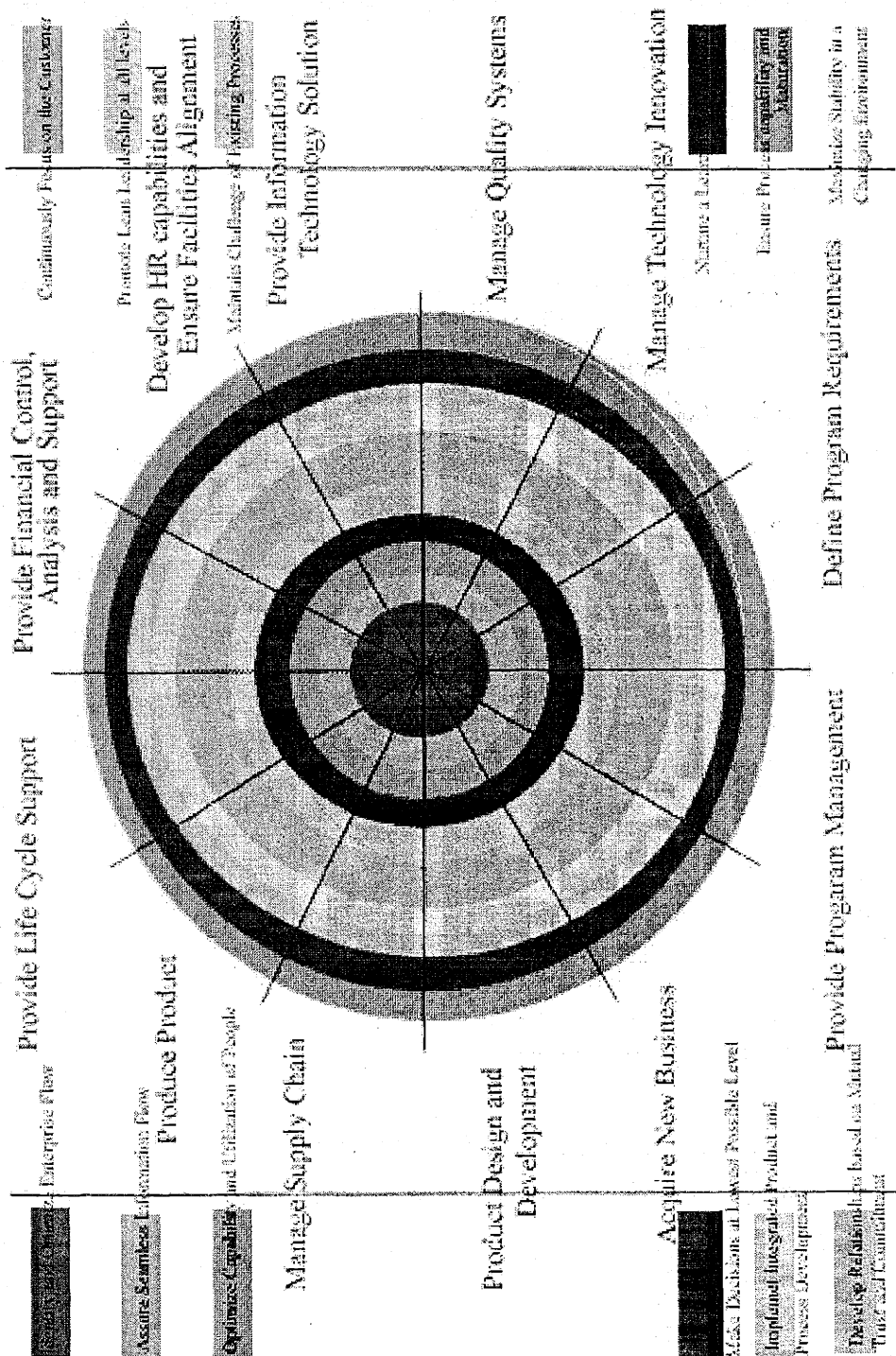


Figure 6-9 Snapshot of one of the graphical prototypes (Search by Cell/LESAT and LEM)
 Site: <http://leanair10.mit.edu/taneja/lemlesat/abhi.html>
 Step 1: Click on the Intersection of Product Design and Development and Integrated Product & Process Development (IPPD/Fifth Circle from inside)
 Step 2: Use the LESAT Tool for self-assessment and get guided to links in the LEM
 Step 3: Click on Enabling Practices to be directed to a set of datasheets relevant for IPPD and Product Development

Graphical Interface for TTL, LESAT (Process 0), and LEM [Figure 6-10]

The Transition-to-Lean (TTL) roadmap as described has seven major steps, each of which has sub-steps. The "0.0" Process (Lead and Continuously Improve the Enterprise) in the LESAT tools is based upon the 7 major steps in the TTL Roadmap, As an example Focus on the Value Stream has four underlying Lean Practices in the LESAT Tool.

1. Define Value Stream Metrics and Targets,
2. Map the multiple value streams and strategy of core processes (Ensure comprehensive involvement of the stakeholders),
3. Deploy the detailed vision,
4. Establish Value Stream Metrics

Each of the Lean Practices will have Capability levels defined and can have links to LEM Datasheets or external links useful for the user to gain insights for solving his problem. The Enterprise TTL guidebook has also identified associations with the LEM based on the sub-task being followed. The interface in the second stage can have direct LEM links if an association has been established as well as it might lead to a set of EPs which can lead to relevant LEM Links.

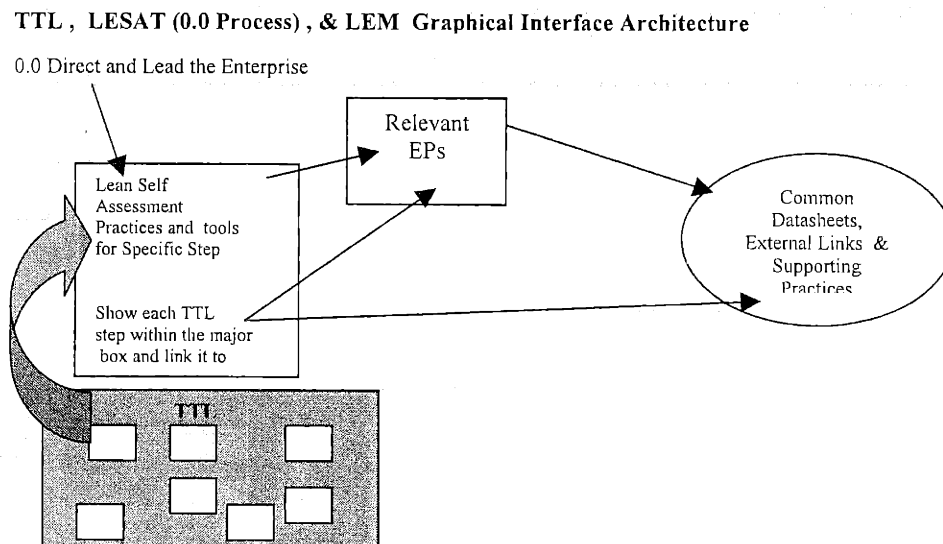


Figure 6-10 TTL, LESAT (0.0 Process), & LEM Graphical Interface Architecture

The Integrated Architecture of the LEM Knowledgemediary:

The above described four interfaces can be integrated into one tool having four entry points but all leveraging on the LEM as the foundation. The datasheets, and external links populated in the LEM can be useful to help integrate the 3 tools and leverage on the knowledge embedded in the LEM [see figure 6-11].

The four entry methods for the user are:

1. LESAT [figure 6-7,6-11]
2. LEM [figure 6-8,6-11]
3. LEM-LESAT [figure 6-8,6-9,6-11]
4. TTL [figure 6-10,6-11]

As shown in figure 6-11 all four of the entry points leads to relevant Enabling Practices, Lean Practices or directly to datasheets. Each of the enabling practices or lean practices can lead to datasheets or external links, from the LEM repository. This interface helps the user develop a cognitive model of association (recognition based information seeking process model) among the tools as well as learn while he is navigating through the links.

6.6.3 Database Organization for the Graphical Interface:

Based on the Architecture shown in Figure 6-11, the indexing of datasheets will need to be changed so as to accommodate the new interfaces and new navigation mechanisms. The user will also want to find external links and datasheets based on either OAPs, EPs, LESAT Processes or on a specific Lean Practice within a LESAT Process. Users might also want to get access to all the identified LEM links for a specific sub-task in the roadmap or a maybe a major step. The datasheets and the external links presently are already indexed by metrics.

Indexing Datasheets:

Indexing based on LESAT:

Depending upon how thorough the interactions between the LEM and LESAT are developed, the indexing needs to be done based upon user needs and the extent of detail within the LESAT tools. For example, the user might want all datasheets and links relevant to "Manage Quality Systems" irrespective of whether the datasheets are under a specific OAP/EP, Lean Practice or sub-task in the TTL. Another user might want to use the LESAT Capability Model and get only datasheets relevant to that specific capability model for a specific Lean Practice, e.g., A user under "Manage Quality Systems (4.0)" might want to assess the leanness of his firm for Lean Practice (4.1) based on the 5 capability levels [Table 6-4]. The user might then want relevant datasheets and external links to help him increase his understanding and foresee implementation issues.

ID	Lean Process	Capability Levels				
		Level 1	Level 2	Level 3	Level 4	Level 5
4.1	Ensure that the Quality System measures and controls, product and process variation	No evidence of understanding in the organization of variation concepts and their effects on customer satisfaction	Limited use of variation reduction tools and methods. Some evidence of variation understanding in parts of the organization	Variation reduction a formal part of the Quality System with plans and targets established	Thorough understanding by the enterprise of variation effects on all aspects of processes and products	Variation control is part of the culture with targets and plans and control methods in place for processes and products

Table 6-4 Lean Process 4.1 and Capability Levels (from the LAI LESAT Tool)

Similarly, there can be users who want access to specific datasheets and external links based on the sub-task they are exploring.

Indexing based on TTL:

Presently the TTL guide has LEM links identified for each of the 23 sub-tasks in the Enterprise TTL Roadmap. Users might want to go to relevant enabling practices rather than datasheets and hence the sub-tasks need to identify relevant enabling practices for each sub task. The indexing of datasheets and external links can be done based on the 23 sub-tasks. The 23 sub-tasks also need to be related to the EPs (in the LEM) and the relevant Lean Practices identified in Process 0.0 for LESAT.

Cross Referencing and Integration of LEM, LESAT and TTL:

As described in the architecture in figure 6-11, the user might want to pick any one interface and then browse through it, in such a manner that related EPs, and Lean Practices relevant to the problem he faces are identified. For example, a user entering through the interface shown in Figure 6-9 might want to focus on " Optimizing capability and utilization of people " (OAP3) within the process of Manage Quality Systems (Process 4.0 in LESAT)". The user might want to assess his leanness as well as get relevant EPs for helping him learn and understand his domain problem. He might also want relevant data and external information. To directly move to the relevant LPs or EPs, the user will click upon the third circle from inside within the Manage Quality Systems Sector(see figure 6-9). Navigation in this manner requires the identification of correlation between EPs & LPs, EPs & LESAT Processes, LPs & OAPs, TTL sub tasks & EPs, TTL Sub-tasks & LPs. Such matrices will help develop the database to index based on the interface the user uses to enter the Lean Knowledge mediary.

6.6.4 Feedback from the Users:

Feedback from the user of the tool is non-existent from the LEM. Knowledge sharing is much higher when the people generating and sharing the knowledge get a feedback on whether their input was useful or not and when they get recognized for having shared and helped someone else solve their problem.

- If a user has specific needs in terms of more questions or more data related to a specific datasheet, he/she might want to get in touch with the original authors. Each internal (MIT/LAI) datasheet should have contact information (email, phone etc) of the author.
- Feedback can also be solicited in form of a feedback form available on the LEM site rather than only on the LAI Website.

6.6.5 Navigation Instructions:

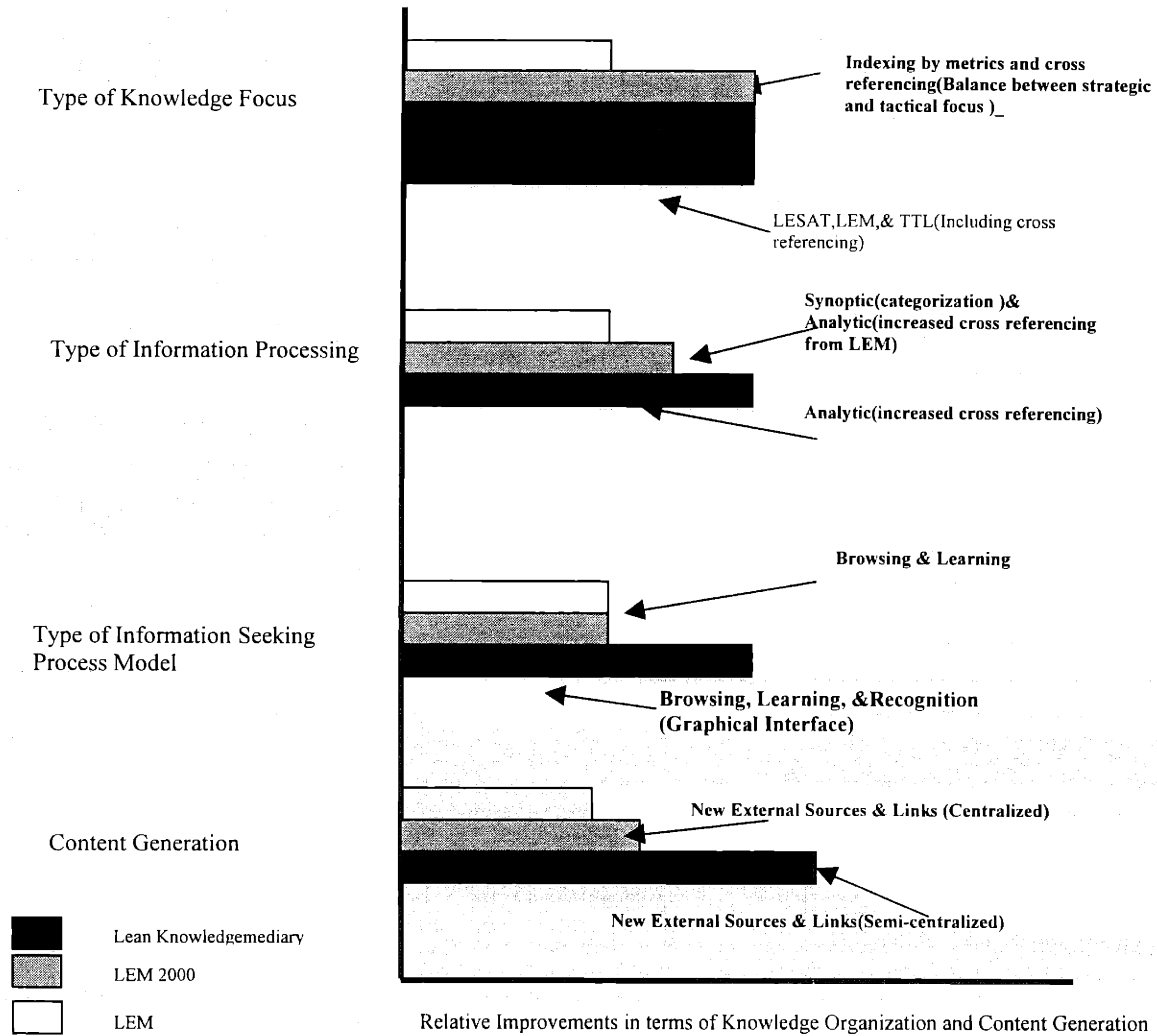
Users always face a learning curve in terms of understanding the structure and learning to navigate through a web site. The LEM is more complicated than any usual website. The GSSD tool has navigation instructions available on its site. Therefore instructions should be provided online on how to navigate and capitalize on the knowledge embedded in LEM. This should be developed for all new user interfaces, which might integrate the LEM, TTL and LESAT.

6.7 Conclusions on recommendations for the Lean Knowledgemediary:

The above recommendations for the next steps of the LEM have taken into consideration the range of challenges and issues faced by the LEM. Figure 6-12 shows the relative enhancements in the LEM since September 1998 and how it has helped to improve knowledge organization and content generation. The recommendations for the Lean Knowledgemediary are also shown relative to the original LEM and LEM 2000.

The type of problem faced by the user remains the same, i.e., "Lean", which is unstructured or semi-structured. However the user needs for knowledge and information

Figure 6-12, Relative Analysis of Enhancements based on Frameworks(in Chapter 4&5)



may change depending upon the users state of leanness. The recommendations for the Lean Knowledgemediary, which integrate the three tools into one interface, will help increase the knowledge content as well as provide knowledge to both tactical and strategic knowledge users. The graphical interface will help focus the tool on tactical knowledge users who can navigate the tool with more user-friendly options. The information processing remains primarily analytical (Information Processing Framework) but the cross-referencing between the three tools will increase the amount of analytic processing which is a value addition for the user. Category C (recognition) based information seeking process model is developed through the graphical interface. This interface integrates the category B (learning) model of the LEM to the Category C (recognition) model. Content generation would be higher in volume and the quality

control might be better if the peer review process is followed thoroughly in the semi-centralized content generation methodology. The Lean Knowledgemediary in its ideal state would be have more features and capabilities than those identified in this thesis, specifically chapter 6. The steps recommended in this chapter are feasible steps towards the goal of becoming a one-stop shop for "Lean".

Knowledgemediaries will face numerous challenges in the coming years and their definitions and outlook will change. Numerous policy, law and social issues are inherent in the concept of Knowledgemediaries. Chapter 7 touches upon some of the challenges faced by Knowledgemediaries and highlight some key features of successful Knowledgemediaries.

7. Future Challenges and Success Factors for Knowledgemediaries

7.1 Challenges for Knowledgemediaries

7.1.1 Trust in Knowledgemediaries:

There are a number of trust issues relevant for Knowledgemediaries:

1. Members should be able to trust the authenticity of knowledge and information being provided and generated by the Knowledgemediary.
2. Members should be able to trust that the Knowledgemediary will not misuse knowledge provided by them.
3. Members can be direct consumers, other Knowledgemediaries or other organizations using the resources as well as providing resources to the Knowledgemediary.
4. Members should trust that the knowledge and information is not biased towards a specific source or purpose.

Trust generation has been a major issue in the web world. E-commerce sites have started depending upon services like eTRUST or similar services who assure the authenticity of the site and its operations. As described by John Hagel III in his book *Net Worth*, trust generation in the web world will become possible in companies who pioneer the web revolution, i.e., Amazon, Yahoo, etc who can gather a critical mass and develop a community which help maintain the trust amongst the consumers. Web based companies who do not get enough critical mass might need to merge with traditional businesses like banks, and credit card companies which has been the care taker for sensitive consumer information and hence have the trust of the masses. Knowledgemediaries have a different role to play in the web world. They have to create trust in the knowledge they provide as well as knowledge provided by its members. The traditional role of Knowledge services has been under the role of Educational Institutions, Associations, and Consulting Firms. All three in some manner or the other generate and maintain a certain level of trust for people using their services. For example IEEE (Institute for Electronics and Electrical Engineers) is an association which is recognized across the globe and the knowledge that

IEEE provides is assumed to be unbiased and trustworthy. Knowledgespace.com, one of the case studies, has been pioneered by Arthur Andersen, a world famous consulting firm. A number of similar services have begun within some universities, who have taken it upon themselves to become a one-stop shop for knowledge sharing for all researchers and others who might be interested in a specific field. MIT recently started iprotocol.mit.edu, which as described in their own words "has become an innovative solution for bench-top researchers to enhance their scientific exploration. Serving as an open Platform for researchers to share their protocols and expertise, iProtocol is positioned to stimulate global scientific collaboration. Registered users represent some 30 countries in different parts of the world."

Web services, which foresee their role as a Knowledgemediary, should be looking to merge with the Associations famous in that field. Associations have the advantage of having a large membership, available copyrighted material, and expertise in that specific field or industry. Universities can also provide a trust base but they do not have the business acumen, and the membership database. The last option is to collaborate with consulting firms, who will be able to provide knowledge content to the Knowledgemediary complementary to their services. Consulting firms will be last on the three possible organizations because they might not be observed as being totally impartial or unbiased.

7.1.2 Context Issues in Knowledgemediaries

A context is the collection of implicit assumptions about the context definition (i.e. meaning) and context characteristics (i.e. quality) of the information. When information moves from one context to another, it may be misinterpreted (e.g., sender expressed the price in French francs and receiver assumed that it was in US dollars). Often each source of information and potential receiver of that information may operate with a different context, which often leads to large scale semantic heterogeneity [29]. Similarly in Knowledgemediary systems where there already is a blur between data, information and knowledge, context will play a major role.

As described in the Stuart Madnick's paper on context mediation [29], there are three types of context mediations:

Geographical: Things are interpreted differently in different countries

Functional: Within the same organization, different departments will use and interpret the same information and data in a range of methods.

Organizational: The understanding between two organizations even if within the same geography can vary, e.g., Credit Line can mean two separate things in Citibank and Chase Bank.

Knowledgemediaries as shown in the diagram in chapter two will be aggregating information from multiple sources. The aggregation will face context issues, specifically geographical as well as organizational issues. When Knowledgemediaries will be aggregating information and conducting analytic processing they will face context issues. Presently the LEM has internally developed datasheets and external links. External links are from a range of sources and they have data sets, which might vary from one link to another because they refer to different companies or each source speaks in a different context. These LEM datasheets which have charts and/or backend excel worksheets, may have different authors and references. For example "Cycle Time" in one datasheet might mean, time for product to be made during the manufacturing process. In another datasheet it could mean the total taken time from conceptual design stage to product development to manufacturing and finally shipping to the end customer. This is an issue which will become of increasing importance as Knowledgemediaries obtain information from a range of sources, which might be other Knowledgemediaries or other generated content, each which will create context definition issues.

7.1.3 Copyright and Intellectual Property

Knowledgemediaries will function on the principle of knowledge sharing, knowledge generation and knowledge recycling. Users as well as the Knowledgemediary, both will provide and use knowledge which is provided by the site or by some other user.

Intellectual property or copyright issues come up in two areas:

1. Individual Users and Copyright Laws
2. Knowledgemediaries and Copyright Laws

Individual Users and Copyright Laws: "Copies" are material objects, other than phonorecords (audio based recordings), in which a work is fixed by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.

Copyright protects "original works of authorship" that are fixed in a tangible form of expression. When a message is written on a message board, it becomes fixed in the form of zeros and ones and it is supposedly an original work of the author, assuming that he did not pick up the posted message directly from somewhere else. On the other hand a member does not have a copyright on the ideas, procedures, methods of systems etc identified in the message. He only owns the description, explanation and/or illustration exemplified in his message. Knowledgemediaries would either need to take the permission/license from the members to be able to modify and reuse their comments, ideas and thoughts. A similar example is on the issue of thesis distribution on the LAI Website. LAI has agreed to provide its members with thesis of research students for which MIT has a copyright. Special permission has been taken from MIT to allow only the thesis of LAI research assistants to be distributed through the LAI website.

There are also several categories of material which are generally not eligible for federal copyright protection. These include among others:

- Titles, names, short phrases, and slogans; familiar symbols or designs; mere variations of typographic ornamentation, lettering, or coloring; mere listings of ingredients or contents

- Ideas, procedures, methods, systems, processes, concepts, principles, discoveries, or devices, as distinguished from a description, explanation, or illustration
- Works consisting *entirely* of information that is common property and containing no original authorship (for example: standard calendars, height and weight charts, tape measures and rulers, and lists or tables taken from public documents or other common sources)

Knowledgemediaries and Copyright Laws: Knowledgemediaries will be using information sources, which are freely accessible as well as paid sites. Aggregator technology will find a lot of innovative use in Knowledgemediaries, Does the aggregation of specific pieces of information from a site infringe upon the copyright laws of the site? Anyone who violates any of the exclusive rights of a copyright owner is an infringer. For example, a Developer scanned Photographer's copyrighted photograph, altered the image by using digital editing software, and included the altered version of the photograph in a multimedia work that the Developer sold to consumers. If the Developer used the Photographer's photograph without permission, the Developer infringed the Photographer's copyright by violating the reproduction right (scanning the photograph), the modification right (altering the photograph), and the distribution right (selling the altered photograph as part of the multimedia work)[30]. Similarly for the Knowledgemediaries, as long as they have a license and they have not modified the material they have not violated the copyright laws.

The contractual agreement between the members and the Knowledgemediaries as well as other Knowledgemediaries and sources of information will be of importance for preventing infringement on any copyrights as well as creating trust amongst users that the knowledge and information they share will not be misused.

7.2 Critical Success Factors for Knowledgemediaries

Knowledgemediaries will face numerous challenges besides the few key issues highlighted above. Based on the Model architectures discussed in Chapters 2 & 3 for Knowledgemediaries, some of the critical success factors for Knowledgemediaries are

mentioned below. These success factors have been developed through a mixture of literature review, case study analysis, and the author's own inputs.

Basic requirements [adapted from 2]

1. Attraction of a critical number of users.
2. Provision of a personalized service.(Technology or Human Interaction based)
3. Provision of value adding services in addition to the service of information intermediary.
4. Focus on a thematic domain (Niche Market).

Core competencies [adapted from 2, 4]

1. Knowledge and possession of optimal search tactics.
2. Knowledge about potential clients and the knowledge and information needs.
3. Technological knowledge (expertise) in the focused domain of the knowledge.
4. Knowledge about information sources, their availability and quality.
5. Community growth and growth of involvement of community.

Business specific investments [adapted from 2 and based on Figure 3-3]

1. Trust in the market
2. Awareness of the service in the market
3. Relations with adequate (high quality) information sources.
4. Relations with Knowledgemediaries services in other focused domains of knowledge.
5. Technologies to access relevant information sources, e.g. , Aggregators
6. Information technologies for efficient information processing and the management of the knowledge, e.g., Analytical Processing tools

Although the challenges faced by Knowledgemediaries will be of numerous types, some key ones are discussed in this chapter and based on the case studies chosen, analysis of case studies and the literature review some key factors for the success of Knowledgemediaries are also mentioned. Although there are numerous examples of web based organizations moving into the role of Knowledgemediaries, the value that

Knowledge mediaries can help create will take some more years to be realized by the Industry as well as the knowledge workers. Knowledge mediaries will slowly integrate into the way knowledge workers communicate and it will transform the way knowledge is created, stored and shared across organizations.

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APPENDIX A: LEM SURVEY

Number of Participants=300

Number of Respondents=54

Survey Methodology: Email and Web Based Interface

Dec'98-Jan'99

This survey is designed to assess the extent and ways in which the Lean Enterprise Model (LEM) is being used by Lean Aerospace Initiative(LAI) Consortium members. The feedback from this survey will be combined with other information to aid in the design of future versions of the LEM and other products that facilitate increased understanding and ability to implement lean principles and practices. Please take a few minutes to complete this survey and return it to us. This information is very important to our ongoing efforts to help you and your organization in lean activities.

Thanks,

Earl Murman and Debbie Nightingale
Lean Aerospace Initiative(LAI), M.I.T.

The site address/URL for the survey form is:

<http://lean.mit.edu/lai/LEMsurvey.htm>

Alternatively, if you do not have access to the web and would like to respond to this survey via email, please complete the survey form below and "reply" to the sender's email address.

LEAN ENTERPRISE MODEL (LEM) Usage Survey

1) How frequently have you referred to the Lean Enterprise Model (LEM) in the last 3 months?

----Never

----Once or twice

----At least once a week

----Several times a week

If you responded "Never", go to question 6

2) What LEM format did you use? Select all that you used but indicate the one format that you found to be most useful.

Used Found Most Useful

---- World Wide Web version on the LAI homepage

---- World Wide Web version on the company Intranet

---- Diskette-based version

---- LEM handbook-

---- Fold-out chart of the LEM architecture

3)Choose the ONE response below that best describes your or your

organization's primary use of the LEM:

- Enhance your general understanding of "lean"
- Look up information on a specific lean topic or metric
- Do a self-assessment of your organization's overall state of leanness
- Assess the leanness of other corporate/company elements or suppliers
- Obtain data for benchmarking processes within your organization
- Develop training materials on lean principles or practices
- Obtain guidance to help in the implementation of lean principles or practices

4) Please estimate the relative contribution the information you obtained from the LEM made (relative to all other sources of information about lean philosophy and practices) to the activity you selected in question 3 above:

- LEM was the only source of information used
- LEM was the primary source of information, among several sources used
- LEM contributed about the same as other sources of information
- LEM contributed a small amount of information compared to other sources
- LEM contributed only background information
- LEM did not contain the relevant information

5) To what extent did ease of navigation affect your perception of the LEM's usefulness?

- Not at all
- Some what
- To a great extent

6) Which of the following best describes your functional role in your organization?

- Program management
- Engineering I Engineering support
- General management Manufacturing/Industrial engineering
- Manufacturing operations
- Staff
- Material analysis/management
- Information systems
- Procurement/Suppliers
- Finance
- Other (please specify):

7) What is your title? _____

To what level do you report in your organization?

- Group or team
- Supervisor
- Manager
- Director
- VP or higher

8) What is the type of organization you work for?

----Industry

----Government

9) Please identify your organization's primary product sector:

----Airframe

----Space

----Avionics

----Propulsion

APPENDIX B: LEM SURVEY RESULTS

Correlation Between Question 7 and Question 2					
	Count				Row Total
	Row Pct	Web Based	Disk/Handbook	Wall Chart	
	Col Pct	1	2	3	
Manager or Lower 1.00		8		6	14
		57.1		42.9	29.2
		50		21.4	
Director 2.00		3	2	9	14
		21.4	14.3	64.3	29.2
		18.8	50	32.1	
VP or Higher 3.00		5	2	13	20
		25	10	65	41.7
		31.3	50	46.4	
Column		16	4	28	48
Total		33.3	8.3	58.3	100
Chi Square		Value	DF	Significance	
Pearson		6.03367	4	0.19665	
Likelihood Ratio		6.84428	4	0.14435	
Mantel-Haenszel test for Linear association		2.49092	1	0.1145	
Minimum Expected Frequency - 1.167					
Cells with Expected frequency <5 - 5 of 9 (55.6%)					
Number of missing observations - 10					

Correlation Between Question 7 and Question 3						
	Count	Enhance Understanding	Look up Specifics	Self Assessments	Implementation	Row Total
	Row Pct					
	Col Pct	1	2	3	4	
						14
Manager or Lower 1.00		1	8	1	4	29.2
		7.1	57.1	7.1	28.6	
		8.3	61.5	10	30.8	14
Director 2.00		4	3	5	2	29.2
		28.6	21.4	35.7	14.3	
		33.3	23.1	50	15.4	20
VP or Higher 3.00		7	2	4	7	41.7
		35	10	20	35	
		58.3	15.4	40	53.8	48
Column		12	13	10	13	100
Total		25	27.1	20.8	27.1	
Chi Square		Value	DF	Significance		
Pearson		13.724	6	0.033		
Likelihood Ratio		14.211	6	0.027		
Mantel-Haenszel test		0	1	1		
for Linear association						
Minimum Expected Frequency - 2.917						
Cells with Expected frequency <5 - 5 of 12 (75.0%)						
Number of missing observations - 10						

Correlation Between Question 7 and Question 5					
	Count	Not At all	Some what	To A Greater extent	Row Total
	Row Pct				
	Col Pct	1	2	3	
Manager or Lower 1.00		6	6	2	14
		42.9	42.9	14.3	29.2
		42.9		18.2	
Director 2.00		6	6	2	14
		42.9	42.9	14.3	29.2
		42.9	26.1	18.2	
VP or Higher 3.00		2	11	7	20
		10	55	35	41.7
		14.3	47.8	63.6	
Column		14	23	11	48
Total		29.2	47.9	22.9	100
Chi Square		Value	DF	Significance	
Pearson		6.8618	4	0.14337	
Likelihood Ratio		7.4574	4	0.1136	
Mantel-Haenszel test for Linear association		5.007	1	0.02524	
Minimum Expected Frequency - 3.208					
Cells with Expected frequency <5 - 5 of 9 (55.6%)					
Number of missing observations - 10					

	Type of Problem solved	Type of User Focus	Content Generation	Information Processing	Knowledge Organization	Content Quality Control	Interactivity on the Site	Critical Mass Exists	Links/ Size
GSSD	SS/US	Tactical/ Strategic Knowledge Users	Semi-Decentralized	Synoptic	Hierarchical, Graphical and Search Based	Strong Monitoring	Does not Exist	Yes	2500 Abstracts/ Links
PHB	SS/ST	Tactical Knowledge Users	Centralized/ Semi-Centralized	Synoptic/ Analytic	Hierarchical	Strong Monitoring	Does not Exist	No	5000 Processes
ODP	ST/SS/US /No Focus	No Focus	Totally Decentralized (27,000 Editors)	Synoptic/ Syntactic	Hierarchical and Search Based	Weak Monitoring	Partially Exists	Yes	1.5 Million Sites
Knowledgepace	US/SS	Strategic Knowledge Users	Centralized	Synoptic	Hierarchical	Moderate Monitoring	Exists	No	Not Provided
LEM	US/SS	Strategic & Tactical Knowledge Users	Centralized	Analytic	Hierarchical, Partially Search based	Strong Monitoring	Does not Exist	No	800 Links/ Datasheets

SS: Semi-Structured
 US: Unstructured
 ST: Structured

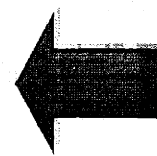
Appendix C: Consolidated Case Study Analysis

APPENDIX D: Transition to Lean (TTL) Roadmap

Entry/Re-entry Cycle

Adopt Lean Paradigm

- Build Vision
- Establish Need
- Foster Lean Learning
- Make the Commitment
- Obtain Senior Management Division



Decision to Pursue Enterprise Transformation

Enterprise Strategic Planning

Long Term Cycle

Initial Lean Visio

- Map Value Stream
- Internalize Vision
- Set Goals & Metrics
- Identify & Involve Key Stakeholders

Detailed Lean Vision

+

Develop Lean Structure & Behavior

- Organize for Lean Implementation
- Identify & Empower Change Agents
- Align Incentives
- Adapt Structure & Systems

Short Term Cycle

Environmental Action Indicators

Focus on Continuous Improvement

- Monitor Lean Progress
- Nurture the Process
- Refine the Plan
- Capture & Adopt New Knowledge

Outcomes on

- Develop Detailed Plans
- Implement Lean Activities



Detailed Corrective Action Indicators



Lean Implementation Framework

Create & Refine Implementation Program

- Identify & Prioritize Activities
- Commit Resources



Enterprise Level Implementation Plan