SUPPORTING PRODUCT INNOVATION THROUGH KNOWLEDGE AUDIT

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ABSTRACT

Knowledge audit is considered as one of the first steps towards designing a knowledge management strategy for an organization. Knowledge audit opens up the eye of an organization in terms of understanding its current knowledge capabilities, future knowledge requirements and critical knowledge gaps.. This paper focuses on how various knowledge audit tools can be used as an effective mechanism for organizational innovation process, specially understanding market needs, assessing knowledge capability and partnerships with external knowledge networks thus contributing to the development of new products or services.

Keywords: Knowledge Audit; Knowledge Capability, Knowledge Mapping, Product Innovation, Innovation Process, Knowledge Management

I. INTRODUCTION

Knowledge driven collaborative management is the key in today's economic survival. How fast an organization can adapt to the changing market demands and how fast they can make decisions to offer better solutions to its customers are the predominant factors to remain competitive and relevant in this current scenario. Adaptation and decision making both require a certain level of knowledge competency. Understanding socio-economic trends, demand scenarios, technology advancements and innovate based on the data analysis require an organization to think outside of the box.

Developing knowledge competency requires a systematic approach to collect, transfer, and apply previously acquired knowledge throughout the organization and continuously create new knowledge from existing projects. Such systematic approach is labeled as 'Knowledge Management' in various literature which is a complex discipline dealing with a number of factors in order to be successful. Knowledge generation is a human centric task that requires collective contribution of an organization's key individuals followed by sharing this knowledge through a proper collaborative mechanism. Therefore, any successful knowledge management initiative entails leadership direction, cultural readiness, learning habits of the employees, rewards and efficient IT infrastructure. Impactful knowledge management strategy needs to be clearly scoped, embedded in the business processes and tactfully implemented.

There are four areas that need to be focused when implementing knowledge management programs. These include understanding what the knowledge sources are; measuring where and how knowledge flows in the organization; getting knowledge to flow rapidly in the key decision making process and reinforcing knowledge with supportive collaboration (Hafeez-Baig *et al.*, 2012). To understand what type of knowledge is required and how knowledge in the organization progress, the mechanisms of knowledge audit are devised.

Knowledge audit is a systematic exploration and assessment of organizational knowledge, which examines the current and future knowledge needs of an organization, identifies existing knowledge assets/ resources, knowledge flows, knowledge gap as well as the behavior of people in sharing and creating knowledge. In one way, a knowledge audit can reveal an organization's knowledge strengths, weaknesses, opportunities, threats and risks (Cheung , *et al.*, 2005). A knowledge audit includes an examination of the organization's strategy, leadership, collaboration and learning culture, technology infrastructure in its various knowledge processes. One important feature of a knowledge audit is that it places people at the center of concerns: it aims to find out what people know, and what they do with the knowledge they have (Serrat 2010).

A knowledge audit could be conducted in order to develop an effective knowledge strategy for an organization and transform it into a knowledge-based learning organization. Knowledge audit provides the current state of knowledge capability of an organization and a direction of where and how to improve that capability in order to be competitive in this knowledge era (Zack 1999).

Knowledge audit helps an organization to clearly identify what knowledge is needed to support organizational goals and activities, gives tangible evidence of the extent to which knowledge is being

effectively managed and indicates where improvements are needed (Chowdhury 2006). Knowledge audit also explains how knowledge moves around in, and is used by, that organization, provides vital information for the development of effective knowledge management programs and initiatives that are directly relevant to the organization's specific knowledge needs and current situation. Knowledge audit explored opportunities for sharing common knowledge across various departments thus enhance collaboration among staff and entities. Prospects for innovation rises by identifying the future customer needs as well as internal knowledge gaps of an organization to address those needs.

Innovation can be of different types- product, process, organizational, market presence, networking and branding However, the product innovation can lead to innovations in other areas, i.e. organizational processes, marketing and branding. Product innovation can be defined as the process within an organization to develop and commercialize new products, goods and/ or services (Adams *et al*., 2006).

Innovation processes are comprehensive and start with an finding an existing problem of customers or trying to solve future anticipated problems by having an innovative idea, which usually goes through a number of validation process before developing prototype, testing and later commercializing for mass market.

Product innovation enables firms to achieve competitive advantage by differentiating their products or services from their competitors. Therefore, product innovations are market driven (Utterback *et al.*, 1975) and should consider market trends and socio-economic issues facing the target population.

The paper suggests knowledge audit as a systematic process that can help make the organizational innovation process more effective. It defines knowledge audit as a process of 4 stages: Knowledge need analysis, Knowledge inventory analysis, Knowledge Flow analysis, and Knowledge mapping. The paper claims that once followed this process can support the product innovations process. The author mapped the knowledge audit and the product innovations to show their complementarities.

II. COMPONENTS OF KNOWLEDGE AUDIT

Gartner Group argues that a knowledge audit needs to be undertaken during the initial stages of the KM (Knowledge Management) program. The audit should identify the knowledge requirements of all processes that are heavily dependent on intellectual assets (Perez-Soltero 2007). It is imperative that a detailed study needs to be done on the organizations strategic goals, objectives and core operational activities. Such study will provide understanding on how to formulate a knowledge audit.

The recent KM Framework developed by American Productivity and Quality Center (APQC) suggested that knowledge management evolves in four stages (as per the image below) APOC 2013. In state one, an organization needs to identify the value proposition for enhancing the flow of knowledge within the organization, figure out critical knowledge needs and gaps, align KM practices to the overall business goals and get management buy in before developing the KM strategy. Knowledge audit plays a crucial role in this first stage of any KM venture.

Figure 1: APQC Knowledge Management Roadmap

From the literature review (Liebowitz, *et.al.,* 2000) it is found that a knowledge audit normally has the following components (not necessarily need to be in order):

A. Knowledge need analysis
B. Knowledge inventory analysis
C. Knowledge Flow analysis
D. Knowledge Networks Analysis

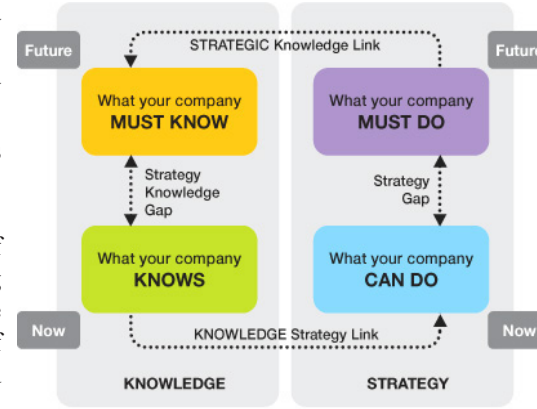
Recently, a new components of knowledge audit is emerging that focuses on mapping the knowledge networks (external) of an organization in order to build business specific partnerships and facilitate co-creation.

A. Knowledge Need Analysis

The major goal of knowledge need analysis is to identify what knowledge an organization would require in the future in order to meet its strategic objectives and goals. The need analysis also looks into the current knowledge people and team possess and identify gaps.

Knowledge need analysis can also help an organization develop its future knowledge strategy. Tiwana (2002) suggested the following figure to explain the Knowledge-Strategy link. Knowledge strategy will be developed based on the ambition of an organization-what an organization needs to know to achieve its goal, what knowledge is existence at the moment and where the gap is (Tiwana 2002).

The knowledge need analysis can also determine the staff skills and competency needs as well as opportunities for training and development, corporate knowledge culture-practices such as knowledge sharing attitude, collaboration, team spirit, rewards and recognitions and staff relationship with their superiors, peers and subordinates. Please refer to



Appendix I for a sample questionnaire.

Figure 2: Strategic Knowledge Gap Analysis

B. Knowledge Inventory Analysis

Knowledge inventory is a knowledge stock taking to identify and locate current knowledge assets throughout

the organization. This process involves counting, indexing, and categorizing of corporate explicit and tacit knowledge (Sharma and Chowdhury 2007).

Knowledge inventory analysis comprises of 2 entities: Physical (Explicit) Knowledge inventory and Corporate Experts (sources of tacit knowledge) inventory.

a. Physical (Explicit) Knowledge are documents, databases, intranet websites, online subscriptions etc., which are located at various places and in various systems of an organization. By analyzing this explicit knowledge inventory, organization can understand- how these knowledge sources are organized and how easy it is for people to access it, the purpose, relevance and quality of the knowledge as well as usage of the current knowledge assets.

b. Corporate Experts (sources of tacit knowledge) inventory lists down all the staff profiles with their academic and professional qualifications, skill & core competency levels and experiences in current and previous work. This inventory helps to formulate Communities of Practice, identifies future leadership potential, learning opportunities for younger staff. Organizations can also build an expert network of global experts in the same industry and exchange information, facts and knowledge on various issues.

The knowledge inventory analysis may involve a series of surveys, interviews, fact finding as well as self-participation from staff to populate content for the expert directory. By making a comparison between the knowledge inventory and the earlier analysis of knowledge needs, an organization will be able to identify gaps in their organization's knowledge as well as areas of unnecessary duplication.

C. Knowledge Flows Analysis

The knowledge flow analysis examines knowledge resources that move around the organization- from its current state to where it is needed. In other words, it is to determine how people in an organization find the knowledge they need, and how do they share the knowledge they have. The knowledge flow analysis looks at people, processes and systems (Sharma and Chowdhury 2007):

a. Analysis of people: Observing and understanding of peoples' attitude, habits, behaviors and skills concerning knowledge sharing, knowledge usage and knowledge creation.
b. Analysis of process: Observing and understanding of how knowledge seeking, sharing, usage and dissemination happen in the organization. This analysis also studies existence of policies and practices concerning information and knowledge flow, sharing (access control), publishing and usage of information and knowledge. For example, are there any existing policies such as on information handling, management of records, web publishing etc.? Or are there other policies in existence that may directly or indirectly affect or relate to knowledge management, which may act as enablers or barriers to a good knowledge practice? (Sharma and Chowdhury 2007).
c. Analysis of system: Examines the technical infrastructure: for example, information technology systems, email system, portals, content management, taxonomy, content accessibility and level of usage. It also determines to what extend those existing systems facilitate knowledge sharing and flow, and help to connect people within the organization.

Analysis of knowledge flows highlights examples of good practices that can be built on, as well as blockages and barriers to knowledge flows and effective use. Knowledge flow analysis shows where an organization needs to focus its effort in order to achieve the right knowledge sharing culture.

Knowledge audit is called labelled as Knowledge Mapping, which in general helps an organization to identify various knowledge sharing opportunities amongst the internal departments/entities. A detailed knowledge map can also exploit the knowledge and skill competencies of an organization's staff in order to perform their day to day operational activities. Therefore, there can be few categories of knowledge maps: Enterprise knowledge maps, Cross-functional knowledge maps, Process knowledge maps (APQC 2005). Knowledge maps can be created for job roles, peoples' expertise and competencies.

Following can be an example of an Enterprise Strategic Knowledge Map for a beverage company:

Figure 3: Sample Knowledge Map

Strategic Focus Areas	*What type of knowledge is needed*	*What competency/ expertise required*	*What we have currently*	*Any knowledge Gaps*	*Location of current knowledge*
Reduce production cost	Competitors analysis Supplier cost Future cost structure Operating Loss figures	Cost Analysts Financial Analysts Market Analysts Business Process Analysts	Financial analyst Cost analyst Market researcher	Innovative process thinking Competitors Analysis	Intranet portal Finance Department COPs
Develop new Product-Smoothie	Market and consumer trends Nutrition facts of new raw fruits and nuts (i.e. Chia Seeds)	Product development skills Research skills Food Scientists	Product development skills Researchers	Nutrition facts of various nuts and seeds Food Scientists	Company portal Tacit knowledge within researchers

E. Knowledge Networks Analysis

Knowledge networks are collections of individuals and teams who come together across organizational, spatial and disciplinary boundaries to invent and share a body of knowledge. Knowledge networks can be internal (connecting people and team from different geographical locations) or external (bringing experts and teams outside of an organization who share common goals). For companies like ConocoPhillips, knowledge networks are used to create new products or drive efficiencies. It has more than 10,000 unique network members in multiple networks in just over 100 global networks (Pugh and Prusak 2013).

To establish external knowledge networks to facilitate co-creation, organizations first need to identify external knowledge sources (i.e. customers, suppliers, various social groups, NGOs, business entities and even competitors). Following identification, evaluation of potential partnership is crucial before exploring ways to collaborate. This process is very important for high investment partnerships like mergers and acquisitions or joint ventures. (Frost 2010). Once evaluation is done, organizations move into establishing the partnership by defining policies, procedures, common goals etc. Some external knowledge networks require

fee-based partnerships, for examples, the think-tanks or knowledge services providers (i.e. Gartner, IDC, Shell Global Solutions). Knowledge integration and collaboration happen when organizations embark upon a new project or product development. The knowledge networks can provide only knowledge inputs or closely work with the internal team to develop the product.

Like Social Network analysis, knowledge networks can be also analyzed visually and quantitatively. The analysis of knowledge network is normally used for the identification of knowledge flows and sharing bottlenecks in the networks (Helms and Buijsrogge). The analysis also involves how effective the networks are in achieving the goals defined during the partnership stage.

III. DELIVERABLES OF KNOWLEDGE AUDIT EXERCISE

Common approaches and tools that can be applied to conduct a knowledge audit are: Site observation, questionnaire-based surveys, face to face Interviews, focus group discussion, forums. A knowledge audit can be divided into four phases: background study, data collection, data analysis and data evaluation (Chong 2004). So the deliverables of a knowledge audit could be:

1. A list of knowledge items (Knowledge needs & current knowledge assets in the form of spreadsheets
2. A knowledge network map which shows the flow of knowledge items
3. A social/knowledge network map that reveals the interaction among staff (internally) and partners (externally) on knowledge sharing and creation.

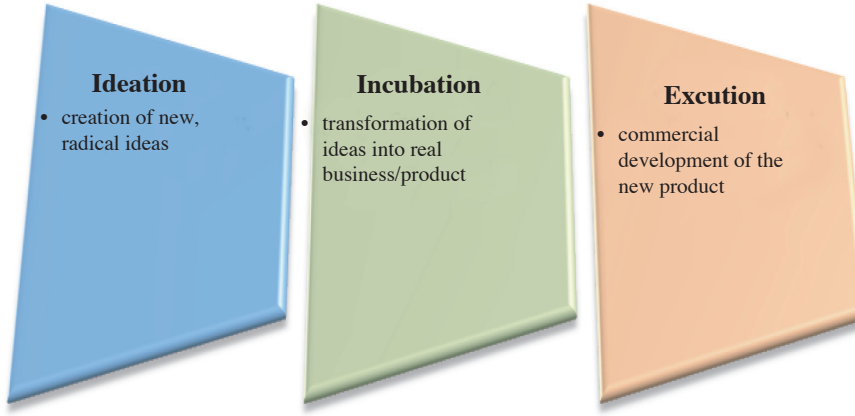
These deliverables will help an organization in identifying the gap between "what is" at present and "what should be" in the future from a KM perspective.

IV. PRODUCT INNOVATION PROCESS

Innovation is about creating a new product, service or concept that adds value to business operations or humanity at large. OECD defines innovation as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (OECD 2010). Value creation is the core in any new product/service development and that's why innovation is not an easy task. An estimated 46% of the resources that companies devote to new product development do not succeed - they fail in the marketplace or never make it to market (Gate 2011). Any product innovation begins with an idea and ends with the launch of a new product. The steps between these points can be viewed as a dynamic process. Successful new product development depends a lot on the ability to understand various technical and market knowledge embodied in existing products/services and adaptation of this knowledge for future product development. (Kohlbacher 2008). Therefore, knowledge creation and transfer within the organization as well as with external entities are critical in order to success in new product development. Any new product innovation process involves 3 main steps (Tiwari 2011) :

i. Ideation/Conceptualization
ii. Incubation/Implementation and
iii. Execution/Marketing

Figure 4: General Innovation Process



i. Ideation- in this first step, organizations need to focus on coming up with fresh ideas to develop an existing product and/or tap into a completely new market with a new product. A detailed work plan should be established that involves doing basic research, analyze market trends, understand future socio-economic landscape of the country or global scenarios, examine organization's own strength and weaknesses etc. Organizations at present involve customers/clients to provide feedback or share ideas to develop new products, work with external entities and even competitors to develop better products or services. This approach of working with various external entities, specially the customers is called, co-creation, which is getting high momentum in today's consumer industry. Co-creation allows a firm to 'outsourcing' innovation by transforming the customers into an active partner for the creation of future value. For example, Unilever's co-creation center involves consumers in creation of new concepts, packaging, advertising and activation (Roser *et al.,* 2009).

ii. Incubation- this is the second step, when a thorough business plan needs to be developed that highlights the business and operational risk, financial and human resource requirements, strategic implications etc. A team needs to be formed to build up the prototype of the new product. Testing can be done on a small scale with a specific market/target audience. This prototype development should be done carefully otherwise there is a high risk of failure during the commercialization stage. Companies like One Leap (a UK based innovation consultancy firm) tests prototypes very quickly with real customers in order to get data for decision making. They first test the prototypes within the company and then with real customers. Once prototype testing is done, they move into intensive data-driven analysis. The whole process takes six weeks (Altringer 2013). Some corporate incubators embed external contributors on their teams as catalysts to accelerate learning. These contributors are typically entrepreneurs or investors who bring diverse and fresh perspectives in the development process (Kornel 2014).

iii. Execution- in the last stage, when organizations go into mass production of the new product, focus on speed-to-market, launch marketing campaign, penetrate local and international market (if the scope allows) and regularly get clients' feedback for improvement.

Commercialization / execution stage requires huge investment both in terms of producing and marketing the product. Many innovations do not reach to the commercialization stage due to the high requirements of financial and managerial resources. Considerations should be made in terms of profitability of the new venture/produce, organization's ability to protect intellectual property, acquisition of new technology needed to produce in large scale and degree of existing or anticipated competitions etc. (U.S. Congress 1995) .

In developing new products organizations need to establish linkages with sources of new knowledge, in order to- spread the costs associated with innovation among a number of organizations; gain access to new research findings, acquire key components of a new product or process; and gain access to complementary assets in manufacturing, marketing, and distribution (U.S. Congress 1995) . A strong linkage can only be established if the innovating organization build partnership with other companies in developing the new product- thus supporting co-creation.

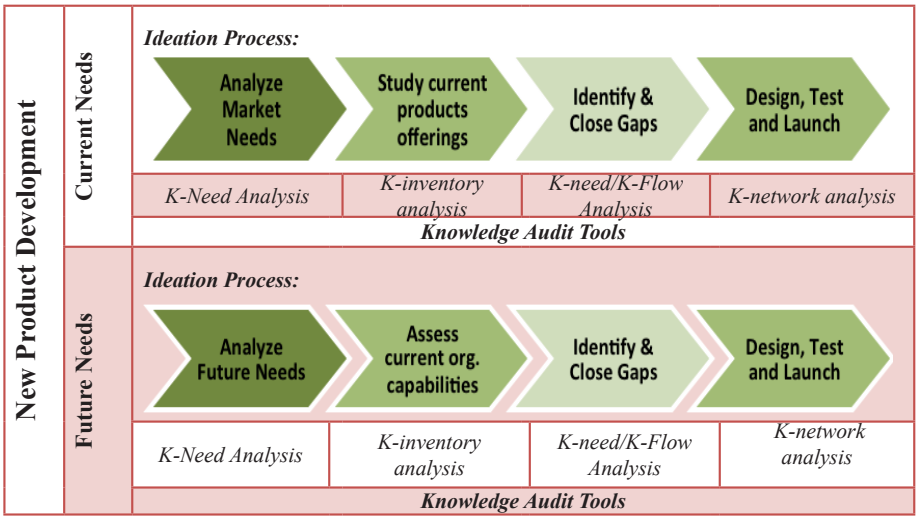
V. KNOWLEDGE AUDIT TOOLS TO SUPPORT PRODUCT INNOVATION

Knowledge audit helps in the identification of critical current and future knowledge needs and gaps of the organization. This identification is important for the ideation process of new product innovation. The ideation process can be divided into two groups:

Group 1: New Product development based on current needs:

i) Analyze the market that the organization is offering its products/ services to; understand the current requirements, up tapped demands, pain points of the customers
ii) Study the current product(s)/ service(s) offering of the organization. Analyze if the current product portfolio meets the requirements of the current market need.
iii) Identify any gap, if exists.
iv) Design, test and launch new products/services to meet the current market need.

Figure 5: Using Knowledge Audit tools in the Innovation Process



Group 2: New Product development based on Future needs:

i) Explore future market requirements by analyzing customer trends etc.
ii) Assess capabilities of the organization in terms of producing new products to meet future demands of the customers.
iii) Identify and close any capability gaps, if any and
iv) Design and develop new product to tap into the future market need.

Figure 5 shows a high level new product development process where every stage requires a number of activities to be undertaken. For example, analyzing the current market need requires market research (qualitative and quantitative data analysis of customers, competitor and industry), current business model analysis, socio-economic trends associated with the target customers etc. A product portfolio matrix needs to be developed to understand how efficient the current product offers is in comparison to the market demand. In order to understand future market demand and design new products, organizations need to conduct a scenario planning exercise, industry assessment, trend spotting, global economic assessment, reinventing the current business model etc. A knowledge audit can work as a compliment in this whole process. Knowledge audit is an effective tool not only to assess the knowledge capabilities of an organization but also the peoples' capability. For example, during stage 3 of the product development process, when companies need to identify any gap in terms of current market offerings, knowledge need and knowledge inventory analysis will be helpful to identify the organizational knowledge gap, both in the case of knowledge strategy, business intelligence, peoples' skill and expertise to deliver current demand. Knowledge Network analysis will help organizations a lot in closing any knowledge capability gaps by partnering with external think-tanks, researchers etc. The knowledge networks analysis will also help in identifying potential partners in designing the prototypes and testing them with a limited group of customers.

VI. CONCLUSION

The design and development of a new product requires an organization to examine its knowledge capability. An organization must need to know what type of new knowledge, expertise, tools, process and system it would require for developing a new offering. At the same time, it is also important to identify how knowledge has been flowing around the organization, the location of current knowledge and expertise and if there is any gap. Having a thorough knowledge audit exercise is always helpful in terms of understanding current knowledge requirements, judging strategic decision making capability based on the collective wisdom, minimizing operational risk caused by lack of knowledge and sharing experiences and explore opportunities to innovate.

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Short Bio of Naguib Chowdhury

Naguib Chowdhury has been working in the field of innovation and knowledge management for past 13 years. He is experienced in designing and driving business driven strategic collaboration internally and externally with clients and other stakeholders that enable knowledge creation, sharing and innovation to help the organization to transform. Naguib offers practical experience in conceptualizing and implementing value-based knowledge management, innovation and change management program yielding impressive results in both top-line and bottom-line efficiency.

Appendix: I

Some part of this appendix can be found in another article written by the same author.

1. Knowledge Needs/K-Flow Analysis

Objective – To identify the current and the future knowledge needs as well as knowledge flows in an organization

	At Present		Future
Organization- Overall	**Exists**	**Required**	**Required**
Objectives			
Key Deliverables			
Core competencies			

	At Present		Future
Organization- Division	**Exists**	**Required**	**Required**
Functions			
Key Deliverables			
Core competencies			

	At Present		Future
Organization Division- Individual Level	**Exists**	**Required**	**Required**
Types of Knowledge			
Sources of Knowledge			
Frequency of usage			
Key stakeholders			
Key Knowledge processes			
Knowledge deliverables			
Knowledge resources sharing partners			
Time spend in searching for knowledge			

Perception on Knowledge Sharing

No	Area: The overall environment of my dept.:	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	facilitates knowledge creation					
2	facilitates knowledge storage/retrieval					
3	facilitates knowledge transfer					
4	enables me to accomplish tasks more quickly					
5	enables the organization to react more quickly to changes in the marketplace					
6	speeds decision making					
Perception about Knowledge in the organization		***Strongly agree***	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
7	the specific knowledge that I need resides with the experts rather than being stored in the portal					
8	the knowledge stored in the portal cannot be directly applied without extensive modifications because of the fast-paced, dynamic environment in which my department operates.					
9	as the tasks of my department change frequently, I am always having to seek new knowledge that is not directly available in the portal or databases.					
Do you think the members of your department:		***Strongly agree***	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
10	satisfied by the degree of collaboration					
11	supportive for knowledge sharing & creation					
There is a willingness to:		***Strongly agree***	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
12	collaborate across organizational units within our organization					
13	accept responsibility for failure					
I always find the:		***Strongly agree***	***Agree***	***Neutral***	***Disagree***	***Strongly disagree***
14	the precise knowledge I need					

There should be reward system for		*Strongly agree*	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
15	creating reusable knowledge resources					
16	reusing existing knowledge resources					
17	contributing to a library of reusable knowledge resources					

2. Knowledge Inventory Analysis (Physical Knowledge)

Major goal: to identify and locate knowledge assets and resources throughout the entire organization.

	Current		Future
Organization Division	Exists	Required	Required
No. of databases			
No. of files in the system			
ERP			
Primary storage			
Decision Support System			
Filing system			
Groupware			
File sharing with other departments			
Physical file/report storage			
Achieving			

General audit

- Categories of knowledge available
- Total no. of files
- No. of new knowledge created by the staff
- No. of new knowledge collected from external sources
- Who are the owners of the various knowledge
- Monthly knowledge creation
- Monthly knowledge contribution in the portal
- Yearly statistics and comparative study

3. Knowledge Inventory Analysis (Human Capital)

Major goal: to identify and locate internal experts within the organization

	Current		Future
Organization Division	Exists	Required	Required
Staff and their expert areas			
Expert Databases			
Staff development plans			
Succession Planning			
HRM system			
List of ex-staff			
Database of External Experts			

General audit

- Expert categories
- Comparative analysis of staff placement to their expertise
- Analysis of Expert database- existing vs. future development
- Succession planning in the organization
- Knowledge capture of leaving experts- any procedures exists? Plans?
- Development of external industry experts – any databases?
- Plans for expert knowledge sharing on regular basis
- Development of best practices using experts