Emerging Trends and Technologies in Knowledge Management: A Holistic Vision

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Abstract- **The economies have been continuously evolving over the past sixty years and that even at a rapid pace in the last two decades. Intellectuals, scholars and think-tanks from disciplines as diverse as Economics, Information Technology and Management Science generally agree that knowledge has been the pivot of this transformation. Acknowledging the importance of knowledge management and the complexity of its nature, it will be very advantageous to try to comprehend the upcoming trends & technologies concerning knowledge and knowledge management. In an attempt to address this issue, this paper throws light on such interesting issues and views them closely. The aim of this paper is to investigate the current understanding of such emerging and existing knowledge management technologies.**

Keywords- **Enterprise 2.0, knowledge, knowledge management, information, semantic web (web 3.0), ubiquitous technologies.**

I. INTRODUCTION

Management caters to the critical issues of organizational adaptation, survival, and competence in face of increasingly discontinuous change in the environment. Essentially, it embodies those processes that seek synergistic combination of data and information processing capacity of information technologies, along with the creative and innovative capacity of the people involved [1]. Knowledge being a valuable asset to present organizations, greater emphasis is being laid to the concept of knowledge: what it is, how is it different from the concepts of data and information, and further, how to start creating, transferring, and making use of it more efficiently & effectively. Knowledge and knowledge management is an escalating interest to both practitioners within organizations and to researchers. Knowledge management is becoming a core competence that companies must develop in order to succeed in tomorrow's dynamic global economy [2]. It has been acknowledged that knowledge management is broad and multi-dimensional and covers most aspects of the firm's activities. Hence to be competitive and successful, firms must create and sustain a balanced intellectual capital portfolio. Managers may need to set broad priorities and integrate the goals of managing intellectual capital and effective knowledge process [3]. The increasing globalisation of business, the shift from production based to a knowledge-based economy (k-economy), the growth of information communications technology (ICT), the strive to become learning organisations and the emergence of knowledge workers (k-workers) [4] imply that an organisation's ability to effectively create, retain, communicate, use and manage its knowledge is critical for organizational success [5]. However, it is being observed that, while knowledge has been acknowledged as source of competitive advantage, it has not been managed well in organisations. The treatment of Knowledge Management needs to be done as a strategic issue and supporting the concerned organizations in challenges they face related to matters such as sustainability and growth of the organisation or innovation, etc. in the processes [6]. A significant transformation in the KM approach is in

the offing – from being technologically-centred to people-centred. The ultimate target is the development of procedures, processes and planning through which the 'people' function but still the current KM related work is more technologically oriented rather than having people as the focal point [6]. Before the paper carries on the discussion of the upcoming trends, it is important to review the definitions of data, information, knowledge and KM.

II. DATA, INFORMATION, KNOWLEDGE

Data, Information and *Knowledge* are the basic building blocks of Information Science. These are considered to be the different levels of abstraction. Data becomes the basic building material for information, and the blocks of information form the base of knowledge. It is commonly seen that data is very frequently substituted for information, and information is wrongly used for knowledge. Datum is the representation of concepts or other entities, fixed in or on a medium in a form suitable for communication, interpretation, or processing by human beings or by automated systems [7]. Quantified and/or qualified facts and figures belong to this category. The verb 'inform' normally is used in the sense to communicate (i.e., to report, relate, or tell) and comes from the Latin verb *informare*, which meant to shape (form) an idea. Data is persistent while information is transient, depending on context and the interpretation of the recipient. Information is data received through a communication process that proves of value in making decisions [8]. Information can also be known as organized data which can answer queries like what?, when?, who?, and where?.

Knowledge should not be confused with data. It consists of facts, prejudices, beliefs, and most importantly, heuristic knowledge. Thus, we can say that knowledge includes and requires the use of data and information. But it is more. It combines relationships, correlations, dependencies, and the notion of gestalt with data and information [9].

Knowledge involves both data and the relationships among data elements or their sets. This organization of data based on relationships is what enables one to draw generalizations from the data so organized, and to formulate questions about which one wishes to acquire more data. That is, knowledge begets the quest for knowledge, and it arises from verified or validated ideas [8].

Knowledge is said to be transformed from information by humans through methods of

- *comparison,*
- *consequences,*
- *connections, and*
- *conversation.*

For instance, when a person makes a comparison of some information with another situation previously encountered, knowledge is derived [10]. Knowledge is having a familiarity with language, concepts, procedures, rules, ideas, abstractions, places, customs, facts, and associations, coupled with the ability to use these notions effectively in modelling different aspects of the world [9].

Knowledge can be required for content of study and may be objective or subjective. It may be required for policy formulation, decision making, or for some administrative or management based decision. Collection of proper input, selection of quality attributes, and focus on output is very important for knowledge. Both knowledge and information are context specific and relational; however, information is moreover factual, whereas knowledge is a true justified belief. The following table contains a comparative view of the data, information and knowledge definitions as provided by Davenport and Prusak [10], Brooking [11], and Wikipedia.

TABLE I

Definitions of Data, Information and Knowledge

	Davenport and Prusak	**Brooking**	**Wikipedia**
D A T A	*Data* is a set of discrete, objective facts about an event.	Sequences of numbers, letters, pictures, etc. presented without a context is known as *data*.	*Raw Data* is a collection of numbers, characters and is a relative term; whereas *data* are values of qualitative or quantitative variables, belonging to a set of items.
I N F O R M A T I O N	Data becomes *information* when it is presented as a *message* that makes a difference to the receiver of the message. In other words, data becomes information when some *meaning* is added to it. Methods for adding meaning can be *contextualizing, categorizing, calculation, correction, condensation*.	Organized data, tables, sales statistics, a well presented talk when presented in context is *information*.	*Information*, in its most restricted technical sense, is a sequence of symbols that can be interpreted as a message. *Information* can be recorded as signs, or transmitted as signals. *Information* is any kind of event that affects the state of a dynamic system. Conceptually, *information* is the message (utterance or expression) being conveyed.
K N O W L E D G E	*Knowledge* is a fluid mix of framed experience, values, contextual information, and expert insights that provides a framework for evaluating and incorporating new experiences and information. It originates and is embedded in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms."	Organized information together with understanding of what it means is termed as *knowledge*.	*Knowledge* is a familiarity with someone or something, which can include facts, information, descriptions, or skills acquired through experience or education. It can refer to the theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject); it can be more or less formal or systematic.

III. TYPES OF KNOWLEDGE

Knowledge as described by experts is of three types:

A. *Explicit knowledge:* Knowledge expressed as words or numbers. This type of knowledge is codified and well defined. It is the knowledge that can be communicated in formal language.

B. *Tacit knowledge:* Knowledge expressed as insights, intuitions and hunches. This type of knowledge is highly personal and hard to formalize. It is very personal because it depends on an individual's actions, commitment and involvement and it is hard to formally communicate.

C. *Self-transcending knowledge:* The ability to sense the presence of potential, to see what does not yet exist. It can also be described as tacit knowledge prior to its embodiment.

The first two [12] are commonly acknowledged, while the third was presented by Scharmer [13].

These three types of knowledge can further be classified according to whether the explicit, tacit or self-transcending knowledge can be described as:

A. *Declarative knowledge:* Facts, know-what comprehension

B. *Explanatory knowledge:* Rationalization, know-why knowledge

C. *Procedural knowledge:* Instructions, know-how understanding
D. *General/Organizational knowledge:* Knowledge that is easily transferred and possessed by large numbers of people.
E. *Specific/Individual knowledge:* Knowledge that is difficult to transfer and thus is possessed by very few people [14].

IV. KNOWLEDGE MANAGEMENT

What is knowledge management? As an introductory step it is useful to distinguish between raw information and knowledge [15]. Raw information may be widely available to a number of agencies, but only some organisations will be able to convert the information into relevant knowledge and to use this knowledge to achieve their aims. The processes by which they do this are known as KM strategies [16]. Knowledge Management is a multidisciplinary paradigm, which uses technology to support the acquisition, generation, codification and transfer of knowledge in the context of specific organizational processes [17]. Small organizations focus on knowledge acquisition; with few people and limited dispersal of knowledge, they face relatively few obstacles sharing or reusing knowledge. Large organizations, in contrast, have difficulty finding and reusing knowledge. Even determining whether the knowledge exists within the organization can be difficult [18].

Knowledge management has become a major management trend and is considered as a way of reconceptualising the management of organisations and a major 'programme' promoted by management consultants [19]. While the management aspect of knowledge management seems to be understood to some extent, there is no common concept and understanding of knowledge and of knowledge development as basis for it [20]. Firestone and McElroy [21] stated that "KM results in better quality solutions, by enhancing knowledge processing within an organisation".

Hanssen *et al.* [22] refer to two main strategies for knowledge management:

A. *Codification* – to systematize and store information that constitutes the knowledge of the company, and to make this available to the people in the company.
B. *Personalization* – to support the flow of information in a company by having a centralised store of information about knowledge sources, like a ''yellow pages" of who knows what in a company [23].

Earl [24] has further classified work in knowledge management into schools. The schools are broadly categorized as *''technocratic", ''economic"* and *''behavioural"*. The technocratic schools are:
A. the systems school, which focuses on technology for knowledge sharing, using knowledge repositories;
B. the cartographic school, which focuses on knowledge maps and creating knowledge directories; and
C. the engineering school, which focuses on processes and knowledge flows in organizations [23].

V. GENERATIONS OF KNOWLEDGE MANAGEMENT

The evolution of the knowledge management concept has been categorized into three generations by the knowledge analysts. As per Snowden [25, 26] the first age of knowledge management was the one in which the word knowledge itself was not at first "problematic," and in which the focus was on distributing information to decision makers for timely use in decisions. The second age replaced the information technology focus with one on tacit/explicit knowledge conversion inspired by Nonaka's SECI model. The third age is the one in which knowledge is viewed paradoxically as a thing and a flow; context, narrative and content management is central to our view of Knowledge Management. Further, he believes that there will be an understanding of organizations as engaged in sense-making through utilization of complex adaptive systems (CAS) phenomena constrained by human acts of free will attempting to order them; and finally, the use of the insights and practices of scientific

management will be restricted to appropriate contexts, while "insights and learnings" from theories of chaos and complexity will supplement them in contexts where these new insights are relevant [27].

The first generation stressed on identification of knowledge and furthermore on its sharing, systematising and controlling process within the organization; the second involved itself in exploitation of knowledge with a touch of innovation, whereas the third is aimed at exploration of new knowledge.

The key knowledge management tools for the first generation have been use of information technology for locating and capturing knowledge and skills. To collect and codify the existing knowledge was their main goal. The major tools for the second generation have been a combination of information technology with emphasis on social interaction and communication. The third or the current generation is looking for self-renewing organizations and the tools and technologies used as evolving day-by-day for efficient management of knowledge. The most successful organisations are shifting from strategies based on prediction to strategies based on anticipation of surprises [28]. They are shifting from management based on compliance to management based on self-control and self-organisation. They are also shifting from utilisation of already known knowledge to the creation of new knowledge, from pure 'technology' KM applications to also include 'process' applications [29].

VI. EMERGING TRENDS AND TECHNOLOGIES

The way, knowledge management of an organization, is handled, has undergone significant changes. New techniques, new demands, new kind of data, and the plethora of data is forcing organizations to reformulate their strategies to achieve an interactive, distributed and collaborative environment. Many new trends and technologies has emerged which are discussed as below:

A. *Enterprise 2.0*

Enterprise 2.0: This trend is about empowering employees; providing them an open platform to express opinions and share expertise. Corporate counterpart to Web 2.0, Enterprise 2.0 builds on management to pass some control on to the network; they empower the knowledge workers to work and act autonomous. Based on loosening the control, Enterprise 2.0 will allow information to flow more directly from originator to recipient, and therefore enables faster knowledge sharing and innovation [30].

In May 2006, Andrew McAfee quoted Enterprise 2.0 as *"Enterprise 2.0 is the use of emergent social software platforms within companies, or between companies and their partners or customers"*. This is not altogether a new concept. It is the result of realization, evolution and maturation of the ways of collaboration and participation for effective knowledge management. The objective of Enterprise 2.0 is to produce a more intelligent, efficient and productive workforce within an organization, such that one can communicate easily and freely within company's inter (team members) and intra (other employees of the organization) group environment, as well as with the external environment (with vendors, clients, customers).

The main Enterprise 2.0 features can be summarized as follows [31]:

- The technology facilitates the application of Web 2.0 into the enterprise.
- The technology enables people to collaborate and/or for online communities and provides for a higher level of collaboration.
- It is a new set of technologies, models and methods used to develop and deliver business software.
- The technology offers a new way for knowledge management within the organization. Large corporations use idea management systems to solicit ideas from their customers and employees. Idea generation in some cases fuels the product pipeline.
- The technology enables business agility by putting together the ability to deliver various software services in the organization.
- It facilitates transparency by making information available to all who need it and for development of content-centric systems. Information is readily

available and with suitable search engines, the users can locate the information they need.

- The technology adopts an approach that is user-centric and facilitates developing and accessing content.
- It enables the use of social networking platforms either within the organization or between companies. Different blogs can be organized depending on the particular engaged community.
- The technology leverages collaboration to include not only employees but also business partners [32].

Knowledge Management with Enterprise 2.0 can be carried out as follows:

- *Capturing, Collection and Prioritization:* with the help of wikis (can be free/paid/self-hosted)
- *Posting of Messages/Reporting:* with the aid of blogs (There are various types of blogs: *Project Blogs* are authored by multiple authors of the same organization, working on a common project. It is exclusively official and work related. *Personal Blogs* are the most prevalent ones. These are authored singly and mainly meant (though not restricted) for a small group. *A-list Blogs* are authored by media related people and are used as watchlist reports. *Corporate Blogs* are used for marketing or public relations).
- *Intra Organization Communication:* with microblogging (used for Social Networking, Project Management, Knowledge Sharing, Emergency Broadcasting, Analysing and Identifying informal help/support groups)
- *Retaining Updated Form:* with the assistance of RSS (It could be Web-based, Desktop-based, or Mobile-device-based).

B. Semantic Web (Web 3.0)

The semantic web, also known as Web 3.0, is built on the idea that not only humans but also machines can understand information. Enterprises can benefit from semantic web services by defining company-wide meta-data on all forms of knowledge and improve coherence and consistency in classifying content which will lead to more accurate search results.

Semantic Web promises to make Web-accessible data more amenable to machine processing. The Semantic Web is about labelling (annotating) information so that computer systems (and humans) can process it more meaningfully. The semantics underlying such annotations usually come from ontologies, which encapsulate agreement among information creators and users with help from common nomenclature and the use of rich knowledge representation. The latest Semantic Web developments and insights in knowledge management challenge the new era of semantic-based knowledge-management systems. Semantic Web tools and applications contribute significantly to knowledge management's performance, providing a definition for flexible reference mechanisms to knowledge objects and knowledge contributors; integration of knowledge creation and use; integral human involvement in information- and knowledge-management activities; and a definition for and the exploitation of social networks, including social activities and context [33].

C. Ubiquitous Technologies

Ubiquitous Computing is the new player in the game. It encompasses mobile, wireless, pervasive, etc. technologies. It works closely with mobile computing, sensor networking, distributed computing, machine learning, etc. and is still a growing field. With the advent of such a trend, the face of knowledge management is sure to change drastically.

Ubiquitous technology (UT) enables accurate and timely automatic capture of actionable logistics data with little reliance on human intervention. Some of the major areas identified for **immediate benefit** of ubiquitous technologies (RFID, GPRS etc) are:

- Asset Tracking
- Goods Trace ability
- Enhance and streamline business processes
- Seamless Supply Chain Management
- Efficient Remote Monitoring System
- Retail [34].

This is a general trend in business and society. Mobility creates new opportunities for knowledge sharing initiatives to exploit areas which has been out

of reach before. Providing mobile solutions will allow decision making faster and more accurate. The mobile web influences the trends above:

- fast information transfer with visualisation and semantics are required for mobile devices.
- content generation and information discovery happens on-the-go.
- engaging in social networking is done while commuting and travelling.

VII. CONCLUSION

Knowledge management is a rapidly growing field with immense potential. Tracking all the day-to-day activities, development and research works related to knowledge is a herculean task. The field is very vast and is reshaping eventually with time due to the advent of new techniques and technologies Still it will be instrumental to work on some key technologies that seem to be more promising. This paper outlines those trends and technologies which will provide effective solution and advancement to the existing glitches that are being faced today. These technologies are not only individually beneficial but they have also got social benefits as they incorporate social informal conversations and practices.

VIII. ACKNOWLEDGEMENT

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