Chapter – 2

Theoretical Foundations
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THEORETICAL FOUNDATIONS

This chapter describes the concepts in the discipline of knowledge management and it reviews the literature regarding curriculum and curriculum development process. This was required as this research is interdisciplinary involving study of knowledge management as well as curriculum development. In this chapter the concepts of knowledge management in order to lay the foundation to apply them to develop KM framework will be explored. This chapter also reviews how knowledge management is applied in other disciplines and processes as well as education.

2.1 KNOWLEDGE MANAGEMENT CONCEPTS AND EVOLUTION

This section presents a review in the discipline of knowledge management. It covers a number of related concepts, history, life cycle, associated tools and techniques, benefits of knowledge management.

Data, Information and Knowledge Concepts
Thomas H. Davenport et al (2005) have defined data as “a set of discrete, objective facts about events”. When some context is added to the data, it becomes meaningful and called information. Thus data is raw in appearance and information is processed data. The processing can be in a simple form like presenting data in a proper format or complex form like scientific or engineering computations with high precision. Data are in the form of objective facts without any context or judgment. It may be in the form of raw text, numbers, images or sounds. For an organization, it may be in the form of structured records of transactions. Data becomes information when it is contextualised, categorised, analysed or summarized. Therefore information is data having relevance and purpose.
Knowledge is adding intelligence to information, converting it into actionable information (Ajay Kumar et al, 2004). Information develops into knowledge when it is used for taking actions like making comparisons, assess consequences, set up connections and engage in a dialogue. Knowledge is information that is supported with experience, judgment, intuition, and values (Thorn C.A., 2001). Information helps in understanding relationships between the pieces of data. But realization of pattern in data and information is knowledge. When these patterns are identified, there is a high level of predictability and reliability to determine how these patterns will change or evolve over time (Filemon A., 2008).

For example, listing of figures like 62, 76, 55 is representing some data, it does not reveal any meaning. But if the context is added to this data that these are percentage of marks scored by a student in subjects Science, Mathematics, English by presenting it in following form,

<table>
<thead>
<tr>
<th>Name of Subject</th>
<th>Percentage of marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>62</td>
</tr>
<tr>
<td>Mathematics</td>
<td>76</td>
</tr>
<tr>
<td>English</td>
<td>55</td>
</tr>
</tbody>
</table>

**Table 2.1 Example of Information Representation from Data**

Then it makes it understandable, which is information. This information can be used to advise the student to improve English or to conclude that the student is good in mathematics and can select this subject for higher studies or career, which is knowledge.

**Knowledge**

As stated in Webster's Dictionary, knowledge is "the fact or condition of knowing something with familiarity gained through experience or association".
A frequently used definition of knowledge is "the ideas or understandings which an entity possesses that are used to take effective action to achieve the entity's goal(s). This knowledge is specific to the entity which created it."

Elias M. Awad et al (2010) have defined Knowledge as “Human understanding of a specialized field of interest that has been acquired through study and experience”. He further comments “it may also be an accumulation of facts, procedural rules or heuristics”. He defines these elements as: “Fact is a statement of some element of truth about a subject matter or a domain. A procedural rule is a rule that describes a sequence of relations relative to the main. A heuristic is a rule of thumb based on years of experience”.

Definition of knowledge given by Thomas Davenport and Laurence Prusak (2005) is “Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied 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.”

Jillinda J. Kidwell et al (2001) have commented that “when information is combined with experience and judgment, it becomes knowledge”. This knowledge can then be applied for decision making.

Knowledge enables people to act and hence can be thought of as a potential but not actuality.

The present researcher has defined knowledge by summarising above definitions as follows:

Knowledge is the contextual information and values combined with insights developed through experiences so that it can be applied in further decision making and actions, to make them more effective because of the expertise getting used.
Knowledge Management

Knowledge management developed as a discipline after publishing of work of some researchers in 1970s. It started with the concept of a “knowledge company” introduced in the literature (Filemon, 2008). The awareness and implementation of knowledge management increased to a considerable extent in 1990s, particularly after mid 1990s. Grant K (2011) states that it was the result of some pioneering efforts in late 1980s and early 1990s that the concept of Knowledge Management emerged as a recognized discipline by the mid to late 1990s. He has analysed the results of search for the term "knowledge management" and other terms related to knowledge management on the ProQuest online database. The terms were searched in publications like academic journals, popular magazines, business publications and newspaper articles from 1990 to 2009. The analysis of literature on knowledge management reveals that it was a significant “latency” period for KM from the late 1980s to 1994. Afterwards, a rapid growth period was identified from 1995 to 2001 when knowledge management was practiced in major organizations. After this it settled with no decline till today.

Definitions of knowledge management:

In the early days, Knowledge management was defined by Nonaka and Takeuchi as “the process of applying a systematic approach to the capture, structuring, management, and dissemination of knowledge throughout an organization to work faster, reuse best practices, and reduce costly rework from project to project”.

Elias M. Awad et al (2010) have defined Knowledge Management as “a process of capturing and making use of a firm’s collective expertise anywhere in the business – on paper, document, database (called explicit knowledge) or in people’s heads (called tacit knowledge). KM in an organization is facilitated by the coordination among the three important elements people, processes and technologies (particularly information technology)”.

Prusak (1997) has defined knowledge management as “any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organizations”.

Theoretical Foundations

Knowledge Management

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Theoretical Foundations
According to Wikipedia, “KM comprises a range of strategies and practices used in an organization to identify, create, represent, distribute, and enable adoption of insights and experiences. Such insights and experiences comprise knowledge, either embodied in individuals or embedded in organizational processes or practice”.

Amrit Tiwana (2001) defines Knowledge Management as “the process of managing organizational knowledge for creating business value and sustaining competitive advantage through the creation, communication and application of knowledge gained from interactions, to maximize business growth and value”.

Jayanthi Ranjan et al (2007) state that “Knowledge management is concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the organization’s objectives”.

Jillinda J. Kidwell et al (2001) have stated that “knowledge management is the process of transforming information and intellectual assets into enduring value”. They have further commented that in corporate sector KM is considered key to achieve competitive advantage.

Sarmistha Dutta (2009) defined knowledge management as “the skill and act of dealing with situation by putting together information, understanding, and skills gained by individuals through education and experience in an organizational context”.

Mohammed Al S et al have stated that according to Snowden D, “knowledge management refers to the developing body of methods, tools, techniques and values through which organisations can acquire, develop, measure, distribute and provide a return on their intellectual assets”.

Andrew L S Goh (2005) defines KM as “a systematic leveraging of data, information, skills, expertise, and various forms of assets and capital to improve organizational innovation, responsiveness, productivity and competence”.
Alavi and Tiwana (2003), identified that there are four processes associated with knowledge management—“knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application”.

Thus, considering the most common part and other aspects from the various definitions studied, the present researcher considers the definition of knowledge management as follows:

Knowledge management is the process of acquiring, retaining, sharing and applying knowledge to enhance organization’s performance, innovation and competitive advantage.

Power of KM lies in the three aspects—information management, human capital management and quality management (Prusak L, 2001). In Information management, different types of information having different values are treated or processed differently. KM focuses on providing proper information (content) in context and facilitates knowledge use and knowledge availability. KM helps in quality management by improving organisational processes through organization’s collective knowledge. KM involves connecting groups, communities and networks of people resulting into human capital ideas, innovations to increase productivity.

**Types of Knowledge**

Knowledge is usually classified into two broad categories: explicit and tacit. Explicit knowledge is documented information and can be expressed in formal language like rules, best practices, formulae, equations, etc. Tacit knowledge is know-how and learning acquired in human mind in the form of insights, perceptions, experiences, skills, competencies, relationships, ideas, beliefs and values etc. (Kidwell et al, 2001).

Georg von Krogh et al (2013) have described the contributions of Professor Ikujiro Nonaka in context with knowledge management by mentioning 35 references of Nonaka’s work. They have mentioned that Nonaka distinguished knowledge into explicit and tacit dimensions as “Explicit knowledge can be captured in symbols, codes, statements, figures, drawing, heuristics, criteria and so forth, whereas tacit
knowledge is tied to the body, senses, movement, physical experiences, mental practice, intuition etc. Tacit knowledge is difficult to express to others”.

Elias M. Awad et al (2010), comment that “Tacit knowledge is knowledge embedded in human mind through experience and jobs which includes intuitions, values and beliefs acquired from years of experience”. Tacit knowledge is difficult to share and codify. There are methods and tools for tapping tacit knowledge. Explicit knowledge can be codified and digitized in books, documents, reports, white papers, spreadsheets, databases etc. Explicit knowledge is easy to retrieve and transmit than tacit knowledge.

As stated by Dr Vicki Compton (2004), tacit knowledge is embedded in the subconscious and is developed through practice and can only be evidenced in practice. Tacit knowledge is defined exclusively as ‘Know How’ and ‘Know That’ being its explicit counterpart or tacit knowledge can be both procedural (Know How) and conceptual (Know That).

Ikujiro Nonaka (2007) has related individual’s knowledge and organizational knowledge with an example as “A middle manager’s intuitive sense of market trends becomes the catalyst for an important new product concept. A shop-floor worker draws on years of experience to come up with a new process innovation. In each case, an individual’s personal knowledge is transformed into organizational knowledge. Making personal knowledge available to others is the central and continuous activity of the knowledge creating company.” These are the examples of tacit knowledge.
Employees of “Earnst & Young” have maintained a repository of ‘best practices’ in which worldwide employees of this organization contribute to share and document this explicit knowledge. “Accenture” have maintained information which is extracted from concerned persons and is made independent of its developer. This information (explicit knowledge) is shared and reused in similar contexts.

Feedback of customers collected about particular products is an example of explicit knowledge. But analyzing those feedbacks to get insights about customer expectations or preferences is an example of tacit knowledge which can be used to improve the product or target particular types of customers. ‘Nokia’ company uses KM practices to study market trends and customer requirements. This knowledge is then put into action in product development. Thus Nokia delivers a new mobile communication product in around 25 days of period (Jillinda Kidwell et al, 2001).

Elizabeth A.Smith (2001) narrates another example of KM. “Xerox” designed a system called ‘social tactical system’ which connects their 25,000 field service representatives with internet and shares a common documentation method. Technicians write their experiences about how to diagnose and repair machines. When a representative contributes a tip, his name and reference goes in the system.
Service representatives access, contribute and renew these tips and maintain this tacit knowledge base. This results in saving on both parts and labour.

In the same way, Zane Swanson et al (2011) have proposed a KM framework for managing Enterprise Resource Planning (ERP) curriculum. In this system it is proposed that after performing a class assessment, any lessons learned should be added into the repository of case teaching notes along with any adjustments made to the corresponding assessment measure. Lessons learned, in this case is the example of tacit knowledge.

Similarly, for curriculum development, the explicit knowledge like information on new topics drawn from new technologies introduced, current research and professional developments can be continuously upgraded and shared so that it is available and beneficial to all concerned with that discipline. Collaborative groups of teachers, academicians, professionals can be formed across the departments, institutions, universities crossing the boundaries of states and countries so that knowledge is shared globally also.

Tacit knowledge has to be continuously enhanced through communication to others and then re-circulated back into explicit information for later use. (Sudhir Warier, 2004)

Knowledge Management Life Cycle

Elias M. Awad et al (2010) have defined four phases in knowledge management life cycle and presented as four process view of knowledge management. They are capturing, organizing, refining and transferring of knowledge. The knowledge capturing phase involves gathering of knowledge through digital files, audio files, e-mails etc. After this capturing or knowledge creation, the captured data or information has to be organized in such a way that it can be retrieved to create useful knowledge. This organizing may involve indexing, cataloging, filtering, codifying etc. of the information. After organizing, the information should be refined by applying techniques like data mining, contextualizing, compacting etc. After storing the refined knowledge, in the last transfer phase, knowledge should be disseminated i.e. made available to the concerned users.
Sudhir Warier (2004) has represented the knowledge life cycle as Fig. 2.2

![Image: Knowledge Life Cycle (Source: Sudhir Warier, 2004)]

**Fig. 2.2: Knowledge Life Cycle (Source: Sudhir Warier, 2004)**

Knowledge has a definite lifetime and may become obsolete with passage of time. Organizational strategies or ‘best practices’ which were successful at a particular point of time and context, may become ineffective at another point of time and context. Hence knowledge must be continuously updated and maintained. Since KM is an ongoing process and is not a destination, by following this knowledge life cycle, an organization can leverage its most important asset - the Intellectual Capital. (Sudhir Warier, 2004).

**Nonaka’s model of knowledge creation and transformation**

As described by Elias M. Awad et al (2010), knowledge creation and its use becomes effective through its transfer and conversion through technology. Nonaka’s model describes converting knowledge between tacit and explicit as follows:

- Tacit to tacit (Socialization) – knowledge sharing through meetings, presentations, discussions, sharing of experiences etc. Support of IT in the form of groupware tools, will enable knowledge sharing between geographically dispersed people also.
• Tacit to explicit (Externalization) - after tacit knowledge is captured, for storing, it is converted into explicit.
• Explicit to explicit (Combination) – summarizing, analyzing, commenting on reports, records, feedbacks etc.
• Explicit to tacit (Internalization) – Knowledge reuse, application, new ideas, constructive action etc.

Knowledge creation becomes more effective if it spirals through this cycle.

**Knowledge Creation/ Capture/ Acquisition:**
Knowledge creation is concerned with development of new organizational knowledge in the firm and/or correction of existing knowledge. Sources of knowledge and knowledge to be extracted from those sources should be identified first. Thus knowledge discovery is the first stage which involves developing new knowledge (tacit or explicit) from data or information or from previous knowledge. Knowledge Discovery is also used to extract the valuable knowledge from database, documentation and the experts (Louay et al, 2009).

Capturing explicit knowledge is easy and follows the cycle: capturing, organizing and refining the information so that it is easier to locate, to facilitate learning and problem-solving. Capturing tacit knowledge is difficult which requires identifying expertise of individuals, capturing their experience and making them available to all who need them. The acquisition of knowledge from individuals or groups is transformation of expertise from a source of knowledge to a warehouse of knowledge including electronic data bases and individuals’ memories, intranet, documents, etc. (Sebastian C et al, 2010).

Adel Hamdan Mohammad et al (2012) have stated following steps for tacit knowledge acquisition: Identify knowledge experts, problem domain and problem model. Acquire knowledge related to approach to the solution and content of the domain. Identify the intelligent (tacit) knowledge- customize it, remove irrelevant knowledge, acquire the heuristics and reasoning rules involved. Categorize the acquired knowledge.
(Tools used for capturing and representing tacit knowledge are discussed in chapter 4)

Knowledge Organization / Storage

The knowledge needs to be verified for its usefulness and validity and then stored into repositories. This knowledge need to be organized in order to ensure easy retrieval and sharing for users. This requires description of documents, their contents, purposes and features. These descriptions should be organized so that these documents and their parts are accessible to the users requiring them. The methods involved to facilitate this are abstracting, indexing, classifying, cataloging, records management and creation of databases for information retrieval (Sudhir Warrior, 2004). Organization of on-line resources is more challenging. Construction of the repositories involves complicated storage structures and their maintenance. Thus this is the step covering more technical aspects of information technology perspective.

Knowledge Transfer/ Dissemination, Application

This is the most important step in the sense that if the knowledge is shared and applied, then only it results into efficient problem solving, innovation, reduced costs, competitive advantage etc. The knowledge should not remain idle in the repositories or with employees. It must be disseminated and applied wherever useful. Transfer of tacit knowledge is more difficult than the explicit. According to Mohammad Sh. Et al (2013), the medium used to transfer tacit knowledge depends on level of tacitness of the knowledge. For example, a high degree tacit knowledge like “the study of the behaviour of employees” needs some observation mechanism. The most suitable medium to transfer this type of knowledge is video conferencing. In contrast with this, to transfer tacit knowledge with low degree of tacitness such as communicating best practices, the proper medium can be voice mail or written mail.

Knowledge Management Systems

Maryam Alavi et al (2001) have stated that knowledge management systems are type of information systems that manage organizational knowledge i.e. they are IT-based systems developed to facilitate the organizational processes of knowledge creation, organization, transfer and application.
According to Maier R. (2005), Knowledge management systems can be defined as “information and communication technology based systems developed to support the management of knowledge assets in the organization”. This support is achieved by making the processes of capturing, storing, organizing, disseminating, searching and retrieving knowledge easy through the system. A knowledge management system is the system developed to help knowledge users in identifying, sharing, getting and using knowledge they need. A KM system can be considered as a technological part of a KM initiative to increase productivity of knowledge work of a person through organizational instruments.

Basic components of a knowledge management system are

- **Repositories**: Repositories hold explicated formal and informal knowledge.
- **Collaborative platforms**: Collaborative platforms support distributed work, include expert locators and informal communications channels.
- **Networks**: These are the means of communication and conversation. They may include hard networks like intranet, extranet, internet and soft networks like shared spaces, forums, groupware supports.
- **Culture**: Cultural enablers to encourage sharing and use of the above.

Knowledge Management Systems require the technology or IT tools in the tasks like database and database management; communication and messaging; browsing and retrieval. Turban et al (2005) have listed components of a knowledge management system include technologies like communication, collaboration, storage and retrieval with supporting technologies like knowledge discovery in databases like searching and extracting information, data and document mining etc., XML (for portals), artificial intelligence and intelligent agents.

Turban et al (2005) also state that implementation of the knowledge management system needs technology tools that support knowledge management. They include collaborative computing tools like groupware, knowledge servers consisting of repositories, enterprise knowledge portals, document or content management systems, search engines etc.
Some existing knowledge management systems or proposed frameworks for knowledge management systems in various disciplines are discussed in section 2.3.

**Knowledge Portals**

Knowledge portal is a place where users of the knowledge management system interact with the system as an entry point. Then users can use the facilities and knowledge provided by the system in order to accomplish their task. Portals help make individual’s time more efficient by providing focused information to facilitate better decision making. A Web portal, includes several hardware and software components to serve user’s requests by retrieving and delivering the necessary information through a Web browser. The components include servers like database server, application server, web server. It can use various information technology tools to locate or extract required information requested by the user.

As mentioned by Marjan et al (2010), “portal is a gateway to online network accessible resources through the Intranet, extranet or Internet”. Based on nature of contents and the target users, portals are classified into four types:

- **Information Portals:** Their purpose is to provide required information to users.
- **Collaboration Portals:** They provide facilities to connect users in order to collaborate in activities and facilitate team work.
- **Expertise Portals:** These portals support users’ communication to share their experiences, special interests and services.
- **Knowledge Portals:** The combination of all the above mentioned services is provided to users through knowledge portals.

**Knowledge Repository/ Knowledge bases**

Knowledge bases are the tools for storing and managing knowledge. This knowledge may represent processes, applied for processing ideas and provide reasoning. Knowledge may be embedded in textual information which needs to be decoded, to apply and evaluate.
As stated in Wikipedia, “a knowledge repository is a computerized system that systematically captures, organizes and categorizes an organization's knowledge”. The repository can be searched because of efficient storage and searching techniques and data can be quickly retrieved.

**Taxonomy**

Taxonomy is a tool which provides structure to information or knowledge. It facilitates retrieval of focused information so that only relevant information and knowledge is presented to the user. Eric Woods (2004) has the view that “taxonomies are a fundamental part of modern information architectures. Taxonomy can help improve the efficiency of application integration, website design and knowledge management initiatives. It also assists with the improvement of information quality; it provides easier navigation and will facilitate better information sharing. Taxonomies are seen as a tool or set of tools that will assist with the structuring of information and provide a vital solution for organisations in their quest to find relevant information in the shortest possible time in a consistent manner”. He further lists the benefits of developing taxonomy as easier navigation, more efficient search, improved quality, improved information sharing, better user experience, support for interoperability and integration.

**Benefits of Knowledge Management**

Klaus North et al (2004) have listed and evaluated benefits and barriers regarding knowledge management through survey in business organizations. Benefits are categorised as operational and strategic benefits as follows:

**Operational benefits**

It improves intradepartmental and interdepartmental communication, resulting into increased level of co-operation, better quality and speed of decision making, improved processes. It also results into rising potential of the organization to accept change, better financial performance and improved customer satisfaction. It helps in increasing motivational level of the employees and innovation, cost reduction, saving time, Efficient IT-systems, Reduction of working places and “time to market”.
Strategic benefits
It gives long-term competitive advantage, improved bargaining power and investor relations reduced product development cycle and innovative products, improved market value, etc.

In this inter-disciplinary research, along with the theoretical background of KM, it was essential to understand the detailed requirements of curriculum development process to give quality curriculum. In order to propose a knowledge management system for curriculum development, it was necessary to study the curriculum development process and components of a good curriculum. This was done through literature survey and studying some model curricula. Nature of curriculum and curriculum development processes proposed by various researchers is reported in the next section.

2.2 CURRICULUM AND CURRICULUM DEVELOPMENT PROCESS

This section reviews the literature on curriculum and curriculum development process including history right from 1949, various models and processes introduced for curriculum development process, nature of curriculum- its components and other related concepts.

2.2.1 Curriculum
This section contains various views and models of curriculum. It also presents the study of some existing good curricula and model curricula from various institutions.

Definitions of curriculum
As listed in Analytic Quality Glossary (web: Quality Research International, 2012), core definition of Curriculum is “the embodiment of a programme of learning and includes philosophy, content, approach and assessment”. This glossary also gives explanatory context of curriculum as “A curriculum may be set down as a formal
document but it is argued that this is only a part of the full curriculum, which also includes non-formal elements in the learning process”.

The analytical review given in the glossary mentions definitions given by different researchers as:

NTNC defined curriculum as (web: Quality Research International, 2012):
“A program of courses to be taken in pursuit of a degree or other objective”.

Wojtczak defines curriculum as (web: Quality Research International, 2012):
“An educational plan that spells out which goals and objectives should be achieved, which topics should be covered and which methods are to be used for learning, teaching and evaluation”.

Coles argues that (web: Quality Research International, 2012):
A curriculum is more than a list of topics to be covered (syllabus). A curriculum is a policy statement about a piece of education, and indicates the ways in which that policy is to be realised through a programme of action. As a working definition of a curriculum it is the sum of all the activities, experiences and learning opportunities for which an institution (such as the Society) or a teacher (such as a faculty member) takes responsibility — either deliberately or by default. He further comments that the curriculum that actually happens — that is what is realised in practice — includes informal contact between teachers and learners as well as between the learners themselves, termed ‘the hidden curriculum’. So in fact it is useful to think of there being three faces to a curriculum: the curriculum on paper; the curriculum in action; and the curriculum that participants actually learn.

Smith M. K. (2000) quotes that John Kerr defines curriculum as, “All the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside the school”. This means that learning is planned and guided. It should be specified in advance what we are planning to achieve and how we are to go about it. The definition also refers to schooling i.e. this term has emerged in relation with other schooling ideas like subject and lesson. Many people still consider syllabus as a curriculum. Unlike syllabus, a curriculum generally includes the relative
importance of its topics and how they will be delivered and assessed. A syllabus usually follows the traditional textbook approach of an “order of contents”.

Daniel Tanner (1980), has defined curriculum as “The planned and guided learning experiences and intended learning outcomes, formulated through the systematic reconstruction of knowledge and experiences, under the auspices of the school, for the learners’ continuous and willful growth in personal social competence.”

This author’s view about definition of curriculum

From all these definitions it appears that a curriculum is more than a ‘syllabus’, which refers to ‘contents’ of teaching, a teacher should deliver. Curriculum has to specify in addition to these ‘contents’, the methods of teaching, learning and evaluating the learning outcomes and resources required. Objectives should be specified along with teaching strategies and methods of assessment to check whether the concerned skills are achieved.

Models of Curriculum

Smith M. K. (2000) describes four views or approaches to curriculum (fig. 2.3):

1) Curriculum as transmission – This approach views curriculum as a body of knowledge to be transmitted i.e. syllabus/contents to be delivered to students.

2) Curriculum as product – This approach attempts to achieve certain outcomes with respect to students. Objectives are set and planned to achieve, then implemented followed by the outcomes (products) measured.

3) Curriculum as process – In this approach, process through which learning is achieved is continually evaluated to see the outcomes.

4) Curriculum as praxis (practical application of theory or skills)- In this approach, actions are not only informed but committed. Curriculum is delivered through an active process which integrates planning, acting and evaluating.
Depending on the nature of curriculum they are represented by various models by different researchers and academicians.

Ronald Barnett et al (2001) proposed a model of curriculum that constitutes three domains: knowledge, action, and self. They explain it as “The knowledge component is comprised of discipline-specific subject matter; the action component includes the necessary skills of the discipline; and the self component includes identifying oneself with the competencies of the discipline”.

Pasi Sahlberg (2005) has classified curriculum in the form of models as follows:

**Curriculum as content or product**
In this model, curriculum is represented as detailed description of contents that will be delivered. Predetermined objectives lead to selection of content and choice of teaching methods depending on qualities of teachers and students.

e.g. if a curriculum for ‘Database Management Systems (DBMS)’ is prepared using this model, it will have more emphasis on concepts and issues related to databases, different types or models of DBMS rather than hands on experience on a DBMS like oracle or SQL server.
Curriculum as experience
This model assumes that methods through which goals of the curriculum are achieved are more important than the content of the curriculum. This model emphasizes experiences than transfer of information and it is more difficult for evaluation and assessment of student.

e.g. if a curriculum for ‘DBMS’ is prepared using this model, it will have more emphasis on hands on experience on a DBMS like oracle or SQL server rather than study of different types or models of DBMS, their evolution etc.

Curriculum as framework
It is not a fixed-content curriculum. It only sets objectives and broad guidelines for curriculum planning. It leaves decision making and curriculum planning authority to local education authorities. This model is suitable where decentralization is needed to raise the quality of education. It requires highly qualified and committed personnel for implementation.

e.g. if a DBMS curriculum is designed as framework, it will have objectives as students should know features of different types of database models, should be able to work on a DBMS like oracle through queries, procedures, reports etc. Teacher will decide queries of which level or categories should be covered.

Outcomes-based curriculum
In this model, teaching is planned based on description of intended learning outcomes. Thus it may consist of minute details of skill-set and knowledge the student is intended to achieve.

e.g. if DBMS curriculum is framed as outcomes-based curriculum, it should give detailed list of types of SQL queries, functions, programs that student should be able to do or detailed list of DBMS concepts student be able to apply practically.
Standards based curriculum

This model sets the criteria what students should know and should be able to do. It sets the standards for teaching and learning which are subject specific, detailed descriptions of expected learning outcomes in different phases.

e.g. At different phases i.e. semesters/trimesters in the programme what the students will achieve with respect to different subjects.

Some model curricula and related guidelines were studied to identify components of good curriculum. Fred C. Lunenburg (2011) has stated three essential components of curriculum as “Objectives, Content, and Learning Experiences”. Taba’s model (Smith, M. K., 2000) consists of two more components added to this as follows: “(i) objectives, (ii) contents, (iii) learning experiences, (iv) teaching strategies, and (v) evaluative measures”.

Hawes (1979) proposed a student-centered model. In this model, in addition to the core components like “objectives, content, pedagogy, and evaluation”, the model gives importance to aspects like “physical situation, teacher behavior, pupil behavior, etc”.

Study of some model curricula of different institutions was undergone by this researcher in order to find out practical nature and components of good curriculum. This included ACM reports- ACM model Curricula, ACM/AIEEE curricula for Information Technology discipline, Model curriculum for MBA by UGC (web: University Grants Commission), Model Curriculum For Undergraduate Programme B.E./Tech. in Electrical Engineering proposed by AICTE (2001), ISACA Model Curriculum for IS Audit and Control.

Components of curriculum in model Curricula (for course/subject) given by some educational bodies are given below:
• AICTE (for Undergraduate Engineering) - Objectives, desired entry behavior, teaching method, key concepts, suggested text books and references.

• UGC for MBA - Objectives, Course contents, Suggested readings

• ACM 2010 (Information Systems) guidelines – Catalog description, Learning objectives, Topics, Discussion

• ISACA Model Curriculum for IS Audit and Control- Domain, topic, hours, subtopic

The University of Manchester website lists the components of curriculum as: Aims, Intended learning outcomes, Syllabus, Learning and teaching methods and Assessment.

Judy McKimm (2007) has suggested elements of curriculum in clinical education as: Aims and learning outcomes, content, teaching and learning methods, assessment, learning resources.

From this study about definition and models of curriculum, components of model curricula, components of a good curriculum were identified as

• Goals and objectives
• Contents
• Teaching Learning Methodologies
• Resources
• Learning Outcomes
• Ways of evaluating learning outcomes (Assessment / Evaluation methods)

Goals usually describe educational intention of the programme/course/institution as general statements.

Objectives are more specific statements reflecting the intended outcomes. Objectives guide to develop and implement the curriculum. Objectives give basic guidelines for selection of contents, teaching-learning methodologies and assessment methods.
Contents refer to the subject matter related to the particular course/subject that the student need to know in order to fulfill the objectives for the course. This can be referred to as ‘syllabus’. While selecting contents, there should be proper balance in breadth and depth of the topics related to the particular learning/discipline.

Learning and teaching methods are the means by which students will learn the contents. They describe the teaching that students will experience (lectures, practicals, fieldwork etc.). The learning methods may include individual study, group learning (e.g. group projects and activities), online learning etc.

Learning outcomes describe what a student will be able do or possess the characteristics on successful completion of a course or topic. Essential Learning outcomes describe the knowledge, skills and attitudes students will achieve by completing the study of course. General Curriculum Outcomes describe what students should to know and be able to do after completion of that course. (The Department of Education, 2006)

Assessment measures the extent of students' achievement of the intended outcomes. Different types of assessment methods can be used to assess different kinds of skills, knowledge and attitude of the students. The traditional evaluation methods include descriptive, short or multiple choice questions. But different evaluation methods can be used to enhance critical thinking skills and other competencies needed in the professional market. These may include case study analysis, students’ portfolio, self- assessments, open book test, group projects, presentations, prototyping, technology- based evaluation, etc.

### 2.2.2 Curriculum Development as a Process

Pasi Sahlberg (2005) quotes “Even in the education systems where pupils do relatively well in the inter-national comparisons, curriculum development is a common and often a central feature of overall education sector improvement”

Smith, M. K. (2000) lists steps in curriculum development as stated in Taba’s model as follows:
Step 1: Diagnosis of need
Step 2: Formulation of objectives
Step 3: Selection of content
Step 4: Organization of content
Step 5: Selection of learning experiences
Step 6: Organization of learning experiences
Step 7: Determination of what to evaluate and the ways and means of doing it.

Olivia et al give "Six step approach to curriculum development" as:
Step 1: Problem Identification
Step 2: Needs Assessment of Learners
Step 3: Identification of Goals and Objectives (which are specific and measurable along with effective learning methods)
Step 4: Identification of Educational Strategies (which will accomplish the objectives with respect to both content and method)
Step 5: Implementation i.e. Identification of sufficient resources, support, and others to successfully implement the curriculum
Step 6: Evaluation and Feedback describing the plan to evaluate the effectiveness of the curriculum and providing information about continuous quality improvement

Australian Curriculum Assessment and Reporting Authority (web: ACARA, 2012) lists the four phases for curriculum development process as:
1) Curriculum shaping
2) Curriculum writing
3) Preparation for Implementation
4) Curriculum monitoring, evaluation and review

The process is outlined as follows:
“Advice is sought at key points from teachers, professional associations, curriculum experts and from the broader educational community. The curriculum documents are benchmarked against some existing curriculum. Project managers and project officers manage the curriculum development process, including establishing consultative networks, managing consultation and the work of curriculum writers. Board
appointed Curriculum Advisory Panels will provide advice to the writing teams on the quality of the material. The Board and its Curriculum Committee will review and approve curriculum documents at key stages of development”.

It is also mentioned that the curriculum will include contents to be delivered, student achievement standards along with work samples and reporting process.

On the website of Flinders University, South Australia, major phases in curriculum development with their outcomes are documented. The phases listed are: “Scoping and positioning, Definition, Detailed design, Planning review and confirmation, Implementation, Ongoing review”.

**Models of Curriculum Development**

For the curriculum development process, various models are proposed by different researchers. Some of these models are developed for particular disciplines like communication skills, health sciences, agriculture, information systems etc.

Steps for curriculum development mentioned in Wheeler’s Cyclical model are: “initial situation analysis, identification of aims and objectives, contents selection and organization, selection and organization of learning activities, and the assessment/evaluation process”.

P. Taylor (1997) quotes about Hierarchical Model (Fig.2.4) that it is commonly used model for curriculum development. This is because many institutions that are involved in curriculum development have their organizational structure as hierarchical and expert-centered. He proposed another non-hierarchical model as ‘Participatory curriculum development model’ (Fig.2.5) where approach is more flexible, accommodating the demands, needs and expectations of stakeholders.
Christopher W. Storey (2007) refers to two models: one by Brown (1995) and one by Richards (2001) and combined them (Fig. 2.6). Brown described curriculum development as “a series of activities that contribute to the growth of consensus among staff, faculty, administration and students”. He further explains that this “series of curriculum activities will provide a framework that helps teachers to accomplish...
whatever combination of teaching activities is most suitable … that is, a framework that helps students learn as efficiently and effectively as possible in a given situation”.

Fig. 2.6: Model by Brown (2005)

Richards describes curriculum development as “the range of planning and implementation processes involved in developing or renewing a curriculum”. He defines the processes as focusing on “needs analysis, situational analysis, planning learning outcomes, course organization, selecting and preparing teaching materials, providing for effective teaching and evaluation” (Fig.2.7).

Fig. 2.7: Representation of Richards’ model (2001) by Christopher (2007)
Jerry D. Estenson (1999) has introduced a model to set course objectives for developing curriculum in ‘Business Communication’ course (Fig.2.8). He used a collaborative process and identified competencies to be developed and assessed among the students of this course.

Accordingly, objectives of the course established were: development of competencies/skills for “Cross Cultural Communication, Writing Mechanics, Interpersonal Communication, Oral Presentations, Writing Style, Managerial Skills and Technology”. Methods for assessment or evidences of achievement of these objectives were also listed and can be summarized as: Achievement of ‘Cross-Cultural Communication’ can be tested from behavior of students in a multi-cultural team, case study analysis, test scores in theory exams. Writing mechanics and writing styles can be judged from portfolios written by students, their e-mails, research projects, diagnostic tests. Interpersonal skills may be tested from interaction with faculty and in class team meetings, scores in group projects etc. Evidence of learning public speaking can be Participation in discussions in class and presentations. Assessment of Managerial Skills can be done on the basis of quality of research.
projects and team exercises etc. Expertise in technology can be reflected through use of computer graphics, e-mails, quality of word processing assignments etc.

This shows that the methods to assess or measure achievement of learning outcomes must be clearly mentioned in the curriculum.

The main features of the above models for curriculum development are summarized below:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year</th>
<th>Name of model/ Author</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1949</td>
<td>Ralph Tyler’s Model (linear)</td>
<td>Guidelines in descriptive form</td>
</tr>
<tr>
<td>2</td>
<td>1962</td>
<td>Hilda Taba’s Model (interactive)</td>
<td>Emphasis on instructional strategies</td>
</tr>
<tr>
<td>3</td>
<td>1967</td>
<td>Wheeler’s cyclical model</td>
<td>Many similarities with linear and interactive models</td>
</tr>
<tr>
<td>4</td>
<td>1995</td>
<td>Model by Brown</td>
<td>Evaluation after every step and flexibility or reverting back to previous step for modifications</td>
</tr>
<tr>
<td>5</td>
<td>1998</td>
<td>Hierarchical Model (cited by P Taylor)</td>
<td>Less flexibility due to levels in hierarchy of participants but suitable for organizations with hierarchical nature</td>
</tr>
<tr>
<td>6</td>
<td>1999</td>
<td>Model by Jerry D. Estenson</td>
<td>Meant for development of course objectives and their evaluation. Gives insights in how to design methods to evaluate achievement of learning outcomes</td>
</tr>
<tr>
<td>7</td>
<td>2001</td>
<td>Richard’s Model</td>
<td>Interaction between elements at all stages though steps are sequenced.</td>
</tr>
<tr>
<td>8</td>
<td>2003</td>
<td>Participatory Curriculum Development Model by P Taylor</td>
<td>Introduced to overcome drawbacks of Hierarchical Model, more communication among participants</td>
</tr>
<tr>
<td>9</td>
<td>2007</td>
<td>Process by Christopher W. Storey</td>
<td>Combination of model by Brown and Richard</td>
</tr>
</tbody>
</table>

Table 2.2: Summary of the Models of Curriculum Development
These models were useful in exploring various features of curriculum development process with different contexts or purposes. Approach for curriculum development can vary depending on the requirements, constraints, institutional policies etc.

The next section deals with the study of application of KM in various processes to get insights to apply KM for curriculum development process.

2.3 APPLICATIONS OF KNOWLEDGE MANAGEMENT

In order to see the applicability of knowledge management in curriculum development, use of knowledge management in other disciplines like business organizations, healthcare services, software development process, new product development process, e-business, customer relationship management, disaster relief, banking sector, education etc. was studied. Following are some of the frameworks introduced for various processes.

Shuib Basri et al (2011) have explored knowledge management practices in software development process within software development companies. They have argued that “Software process is not standardized for software projects. The process must be frequently updated and improved to cope with any environment changes. Such environment required KM for supporting software process definition and activities”. Practices related to Communication, Documentation, Learning and sharing, KM process and commitment are suggested. Communication among team members, management and staff, regular feedback from stakeholders about the project, documentation of the experiences, lessons learned from previous projects, documentation of the staff knowledge, KM strategy for managing organizational knowledge including Formal trainings, commitment to knowledge sharing and transfer etc. are some of the KM practices discussed.

Marzanah A. Jabar et al (2010) have presented a framework to support management of knowledge and competencies in project management. They have suggested concept maps as a tool for capturing tacit knowledge of experts. They have used five types of concept maps in the knowledge repository having structure as: 1) Knowledge asset-
Mohammed Alshahrani et al (2009) have built KM framework for project management in construction industry in four phases. In first phase, project related basic information, experiences and lessons learned are captured. In the second phase this captured knowledge is transferred to a multidimensional database. In the third phase this knowledge is distributed in six categories based on characteristics. In the fourth phase the KM system’s performance is measured. The knowledge gained from earlier projects is applied in planning next projects. Out of these phases, the second phase - capturing and transferring knowledge, is represented in fig. 2.9.

![Fig. 2.9: Framework for Second Phase of KM system regarding bidding process in project management in construction industry](image)

Tata Motors Commercial Vehicle Business Unit (2011) uses KM framework for manufacturing operations (Fig. 2.10). Impact on all stakeholders is measured.
Nuha Abdullah Hassan et al (2011) have proposed a KM system for the disaster relief work in Malaysia (Fig. 2.11). Reasons for need of this system is mentioned as to identify information necessary in relief, use it effectively, use technological tools to ease systematic data collection and communication. Drawback of the existing system (without KM) is mentioned as in spite of categorized information, since it is in the form of original text documents, it is not feasible to analyse and reuse in a time-critical environment.
Fig. 2.11: Framework for KM system for the support of Humanitarian Assistance/ Disaster Relief in Malaysia
(Source: Nuha Abdullah Hassan et al, 2011)

It is claimed that this proposed KM system having knowledge base of updated information about disasters will provide situation awareness. It will result into faster and effective decision making to react immediately and reduce the damage by retrieving up-to-date knowledge relevant to the disaster. The knowledge about past experience in disaster relief, maintained in the knowledge base, will assist in decision making about disaster relief operation.

Amrit Tiwana (2001) has given a guide to use of KM for Customer Relationship Management (CRM) in e-business. Integrating KM and CRM would give business the depth of customer information, analysis and help truly understand customer needs. KM will help to recognize and act on market gaps and opportunities as they emerge.
The use of knowledge about customer purchases in adaptive real time cross-selling is stated by Tiwana as: being able to integrate past purchases, the system can reorder items that were most frequently purchased along with given item, and offer them first. In addition, some special bundle deals can be offered on such purchases in web business. Thus web provides a highly suitable environment for cross-sell offers and can be made more effective by integrating aggregated knowledge gained from past buyers. KM can also help for intelligent personalization of customer information based on registration information, by integrating customer knowledge with customer interaction processes.

As stated by Chris Hooven (web: OSF Global Services, 2014), CRM and KM together can help an organization in better customer support and improving the overall efficiencies. By integrating CRM and KM, the organization can better address customer issues through the support of tested solutions maintained as knowledge store. The concerned people can access customer data and technical information to find solutions or resources which will help resolve customer issues faster. A combined approach to KM and CRM helps to analyse customers’ buying patterns and identifying problems through customer inquiries. It also reduces response time to customer inquiries because of availability of necessary information, and increases customer satisfaction.

KM can help in banking sector to give benefits like reduced loss of intellectual capital, reduced costs by obtaining information, increased communication, knowledge sharing, productivity and innovations, reduced training needs, efficient decision making, achieve competitive edge, knowledge based growth and work culture, creation of corporate memory etc. In a bank, to increase customer satisfaction, calls for three types of knowledge- i) knowledge of customers’ business, ii) knowledge of customers’ needs, iii) knowledge of bank’s various products, services, systems, procedures and applications to deliver efficient products and services (Dr. N. Nagarajan, Editor, 2003).

Jayanthi Ranjan et al (2007), have given conceptual framework of knowledge resources in Business Schools showing stakeholders and requirements of management institutions (Fig. 2.12). This was particularly useful to the present researcher in
identifying sources, users and application of knowledge. They have justified implementation of KM in Management Education with the following reasons and benefits: Management institutes possess a modern information infrastructure. Sharing of knowledge takes place among faculty, students, staff associated with course, programs, placements and administration. Usually, in the academic environment people don’t hesitate to publish knowledge. KM will help in documentation management and increase the extent of information and knowledge sharing to meet external and internal demands. The institutes thus will gain competitive advantage to achieve good ratings by newspapers and business magazines. They have also given nature of data, information and knowledge in the form of know-what, know-how and know-why, associated with processing knowledge in business schools. This helped the present researcher to think about data, information and knowledge required for curriculum development process.

Fig. 2.12: Conceptual framework of knowledge Resources in Business Schools
(Source: Jayanthi Ranjan et al, 2007)
Rusli Abdullah et al (2005) have proposed a framework for KM system implementation for higher learning institution with emphasis on collaboration (Fig. 2.13). They have also given technical perspective of a KM system as given below. This was particularly helpful to identify technologies supporting knowledge management functions.

![Fig. 2.13: Technical perspective of a KM system](Source: Rusli Abdullah et al, 2005)

Sanjay Agarwal, et al (2008) have emphasized the need for revising curriculum at regular intervals. They have presented KM framework for improving Curriculum Development Process in Technical Education (Fig. 2.14) based on guidelines given by Jillinda J. Kidwell et al (2001).
Sarmistha Dutta (2009) has proposed a model of Library Knowledge Management System for curriculum development (Fig. 2.15). She has suggested that syllabi or course curricula can be put up in an open archive or portal. Willing teachers of related subject fields and outside experts on the subject should act as resource persons for contributing criticism, comments, suggestions, modifications, or change of orientation for the syllabus of that subject. Senior students or outgoing students can be asked to give feedback and suggestion. A knowledge manager should also store / display / input new developments occurring in the field as and when necessary.
Fig. 2.15: Framework for a Library KM System (Sarmistha Dutta, 2009)

In the KM framework proposed by Zane Swanson et al (2011) for ERP curriculum consisting of ERP cases based on objectives, assessment requirements etc. They have emphasized on case design for ERP, using a flowcharting tool supported by a database. There are two components of this framework, Component I for overall design and Component II for detailed design of the curriculum. Component I is flowcharting the curriculum using competency mapping which uses Microsoft Visio as a tool. The flowchart is used to map ERP practice cases to program courses. Component II addresses mapping and library functions. It expands on information in the flowchart from component I by searching and mapping the contents in the
The database maintains the mapping relationships and ERP cases available for use along with information of faculty, students and case experiences. The cases are actually implemented by students using an ERP system. Students are assessed as stated in the accreditation standards, hence cases are selected from the knowledge base depending on skills required to be assessed. Accreditation standards from different accrediting bodies are also maintained in the repositories. The Entity-relationship diagram shown for the KM database for this curriculum design contains entities like Program, Class, Objectives, Assessment Criteria, ERP case, Case Knowledge, Faculty, System Administrator and suitable relationships among these entities. An objective may be defined by some other objective or may be aligned with some other objective. Objectives are assigned to classes. A class case covers some class objective. There is mapping between classes and ERP cases.

In similar way, in a KM system for curriculum development, a library of objectives, learning outcomes, assessment types can have mapping with associated contents or topics in a particular domain or subject. Broad topics can be mapped with detailed topics to help selection of contents in the curriculum.

After studying the applications of KM in various disciplines and having the detailed study of curriculum and curriculum development process as above, the present researcher could propose a framework for knowledge management system for curriculum development. The next chapter deals with the proposed curriculum development process and the proposed KM framework with its validation.