Knowledge Management Maturity Model: An Engineering Approach

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ABSTRACT:

Knowledge Management Maturity Model is a structured approach for implementing knowledge management. It can also be considered as *engineering* of knowledge management Many practitioners and researchers have developed knowledge management maturity models, which have many strengths and inadequacies. This paper attempts to develop a new model combining the strengths and eliminating the inadequacies of the existing models, with flexibility, adaptability and practical usability as the core objectives. The concept of *Key Maturity Indicator* is introduced which makes the model more flexible.

Keywords: *Knowledge management, Maturity model, Key maturity indicator*

1. Introduction

Knowledge Management (KM) is an interdisciplinary field covering various areas like Information and Communication Technology, Information Science, Systems Science and Engineering, Knowledge Engineering, Collaborative Engineering, Human Resource Management, Organizational Development, Change Management, Performance Management etc. Knowledge Management is a conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that will improve organizational performance(APQC,2000). The most fundamental processes in Knowledge Management are knowledge creation, knowledge sharing and knowledge utilization. From a systems perspective knowledge management can be considered as a system with the subsystems of People, Process, Technology and Knowledge. Consistent with the terminologies used in the literature, the sub systems are referred as Key Areas(KA).

Data, information and knowledge form a continuum. According to Davenport and Prusak (1998), when experience and insight are added to information, it becomes knowledge. Knowledge is classified into explicit knowledge and tacit knowledge. According to Nonaka "explicit knowledge is the knowledge that is easily expressed, captured stored and reused. In contrast, tacit knowledge is highly personal. It is hard to formalize and therefore difficult to communicate to others" (Nonaka, 1991). However the term 'explicit knowledge' is used where the knowledge is already available explicitly in the form of documents , audio and video recordings etc in electronic or non-electronic form and the term 'tacit knowledge' where the knowledge still resides in the minds of people in the form of experience, feelings, opinions, intuition etc. It is possible to convert certain percentage of the tacit knowledge into explicit by suitable knowledge elicitation methods.

A maturity model provides a guiding road map. This paper reviews the literature on Knowledge Management Maturity(KMM) models and proposes a new model which combines the strengths of the existing models and eliminates their inadequacies. The inadequacy only indicates that the feature is not explicitly mentioned in the referred literature. The paper is organized as follows. The first section reviews maturity models in general and KMM models in particular. The second section describes the new KMM model. The third section details the unique features of the new model . The fourth section dwells on the conclusion and the future work

2. Knowledge Management Maturity Model - An Engineering Approach

Maturity models describe the development of an entity over time. The entity can be anything of interest. It can be a human being, an organization, a technology, a product, a process etc. Maturity model gives a path to improvement. Maturity Model can also be used as a basis for comparison (Klimko, 2001). Maturity models are driven by the necessity to have a clear cut road map for any organization that is embarking on knowledge management implementation. It provides the clear vision with a description of the path ahead. Knowledge Management Maturity Model(KMMM) can be considered as an application of structured approach to knowledge management implementation. In other words development of a KMMM is nothing but *engineering* of KM. IEEE Standard 610.12 define 'software engineering' as the application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software- that is the application of *engineering* to software(IEEE, 1990). In consistent with this definition we can define Knowledge Management Maturity Model as the "application of systematic, disciplined, quantifiable approach- that is an *engineering* approach to development, implementation and successive progression to attain maturity in knowledge management". Maturity model can also provide a common understanding of the terminologies involved in knowledge management implementation to various stakeholders. Maturity models have the following properties(Klimko,2001,Weerdmeester et al., 2003).

- The development of a single entity is simplified and described with a limited number of maturity levels(usually four to six).
- Levels are characterized by certain requirements which the entity has to achieve on that level.
- Levels are sequentially ordered, from an initial level to a final level of perfection.
- During development, the entity progresses forward from one level to the next. No levels can be skipped.

Maturity models are basically application of life cycle approach. The entity develops through the levels , until the highest level, which is the level of perfection.

A well known maturity model is Maslow's hierarchy of human needs(Maslow 1943). Maslow postulates that there are five levels in human needs. The human needs start with physiological needs and progresses to safety needs, needs of love and belonging, esteem needs and finally to self actualization needs.

Another very popular maturity model is Capability Maturity Model (CMM) and its latest version Capability Maturity Model Integration (CMMI) developed by Software Engineering Institute of Carnegie Mellon University for process improvement. CMMI supports both a staged representation and a continuous representation. In the staged representation the model has five levels. The lowest level is called "Initial", which is characterized by ad hoc and chaotic processes and progresses through "Managed", "Defined", "Quantitatively Managed" to the final level of "Optimizing", which is characterized by continual improvement of process performance through continual and innovative process and technological improvements(Chrissis et.al, 2007).

In this paper literature survey of fifteen KMM models has been carried out, identified their strengths and inadequacies, and a new model which combines the strengths and eliminates the inadequacies of the existing models is proposed. These maturity models were identified based on literature survey through academic journals, web sites of various organizations and references used in some of the models. The fifteen models were selected based on the adequacy of the information provided in the published literature. The characteristics of the fifteen KMM models reviewed, along with their strengths and inadequacies are summarized in the table 1. In the table column 2 lists the model names followed by the authors. The models are named with the name of the first author, wherever available. Column 3 lists the key areas identified in the model. The models which did not identify any key areas is represented as 'Generic'. Column 4 lists the number of levels of the models followed by the names of the levels. Column 5 lists the characteristics of the maturity levels in progression from the lowest level to the highest level. Column 6 and 7 list the strengths and inadequacies identified by the authors. The inadequacy does not necessarily mean that the feature is not present in the model, but only indicates that the feature is not explicitly mentioned in the referred literature.

Table.1. Characteristics of Knowledge Management Maturity Models

Sl. No.	Model Name and Author	Key Areas	No of Levels and Names	Characteristics of Levels	Strengths	Inadequacies
1	KMMM (Kochikar) Kochikar (2000)	People, Process, Technology.	5 Default, Reactive, Aware, Convinced, Sharing.	Fragmented knowledge, Need based knowledge sharing; Organization-wide knowledge sharing systems with visible link between KM processes and results; Self-sustaining KM movement; Institutionalization of knowledge sharing culture.	Detailed description of behavioral characteristics and identification of parameters at each level. An objective assessment methodology	No validation. Knowledge is n a KA. No classificati of parameters level 5 No Extended organizational maturity.
2	KMMM (Hubert) Hubert and Lemons (2010)	Generic	5 Initiate, Develop, Standardize, Optimize, Innovate.	Informal and inconsistent KM processes; Establishment of a KM strategy that is tightly linked to the business strategy; Refining the KM processes into standard replicable methodologies; Expansion of KM strategy through out the organization; Continuous improvement, Institutionalization and breakthrough innovation.	KM strategy that is linked to business strategy and driven by return on investment. Individual, departmental and organizational performance assessment aligned with the KM strategy.	No Key Areas. No Assessm methodology. No validation. No Extend organizational maturity.
3	KMCA (Kulkarni) Kulkarni and Freeze (2004)	Knowledge	6 Difficult, Possible, Encouraged, Enabled, Managed, Continuously Improved.	Discouragement for knowledge sharing; Selective knowledge sharing ; Recognition and reward for knowledge sharing; KM enabling of normal workflow; Monitoring and measuring of knowledge sharing; Systematic measurement and improvement of knowledge sharing.	Detailed assessment methodology. Validation of the model	Only 'knowledge' Key Area. No Extend organizational maturity.
4	KMMM (Klimko) Klimko (2001)	Generic	5 Initial, Knowledge Discoverer, Knowledge Creator, Knowledge Manager, Knowledge Renewer	Lack of specific attention for KM activities; Recognition of the importance of existing knowledge; Identification and creation of new knowledge required for future activities; Institutionalization of KM function with dedicated KM unit; Documented and measurable KM processes; Knowledge sharing with other organizations and exploiting common ways of knowledge creation.	Advanced and Innovative knowledge. Documented and measurable KM processes. Extended organizational maturity.	No Key Areas No validation. No Assessment methodology
5	Knowledge Journey KPMG (2000)	People, Process, Content, Technology.	5 Knowledge Chaotic, Knowledge Aware, Knowledge Focused, Knowledge Managed, Knowledge Centric	Lack of visible relationship between KM and achievement of organizational goals; Implementation of KM pilot projects; Organization-wide usage of KM tools and realization of business benefits of KM; Implementation of integrated framework for KM tools and procedures; Adoption of KM procedures and tools as integral part of	Identification of characteristics in terms Key areas like people, process, technology and content.	Partially normative mo since freedom given to select requirements reach a matur level. No validation. No assessment methodology

				organizational and individual processes.		
6	KMMM (Natarajan) Natarajan (2005)	Business Process Readiness, Technology, Infrastructure, Human Behaviour, Leadership.	4 K-stages	Lack of specific KM; Establishment of information sharing mechanism; Establishment of systematic KM processes; Institutionalization of KM as an integral part of business activity;	Validation of the model	Specific software indus sector. Maturity st requirements not in terms Key Areas
7	KPQM (Paulzen) Paulzen and Perc(2002)	Organization, People, Technology.	5 Initial, Aware, Established, Quantitatively Managed, Optimizing.	Unplanned knowledge processes; Implementation of the first structure to ensure a higher process quality; Systematic structure and definition of knowledge processes; Enhancement of the process management through tracking the performance measures; Establishment of structures for continuous improvement.	Integration of KM processes in to business process.	Excessive concentration process, with v minimum concentration people, technology a knowledge.
8	5iKM3 (Mohanty) Mohanty and Chand (2005)	People, Process, Technology.	5 Initial, Intent Initiative, Intelligent, Innovative.	Lack of formal processes for effective usage of organizational knowledge; realization of the potential in harnessing organizational knowledge for business benefits; knowledge enabled business processes and realization of its business impacts; matured collaboration and collective organizational intelligence; utilization of organizational knowledge for consistent and continuous process optimization and business advantage	Integration of KM processes to business process and business benefits An assessment model that includes a proposed solution.	No parameters Key Areas. No validation
9	K3M Wisdom Source (2004)	Generic.	8 Standardized Infrastructure For Knowledge Sharing, Top-Down Quality Assured Information Flow, Top-Down Retention Measurement, Organizational Learning, Organizational Knowledge Base, Process-Driven Knowledge Sharing, Continual Process Improvement.	Capturing and delivering of knowledge in repeatable steps; Identification of executive block of knowledge that is critical to lead the organization as a cohesive unit; Measurement of team understanding of executive knowledge; Culture of knowledge sharing and organizational learning; Culture of continuous improvement and innovation; Result focused process frame work; Culture of knowledge creation; Continuous process development .	Good concentration on process improvement.	No Key Area l people, technology a knowledge. No validation No assessm methodology. Number of stag are too high

		People & Competencies, Collaboration & Culture, Leadership & Support, Knowledge Structures & Knowledge Forms, Technology & Infrastructure, Processes, Roles & Organization.		day to day work processes with necessary technical systems and KM roles; Measurement of KM efficiency; Organizational ability to adapt to any new KM requirements.	methodology	No validation No illustration c the assessment model.
12	Strategic KMMM (Kruger) Kruger and Snyman (2007)	Generic	5 Initial, Repeated, Defined, Managed, Optimizing	Lack of awareness on the importance of knowledge as a strategic resource and ineffective management of Information and Communication Technology)ICT; Recognition of the importance of KM function and evolution of ICT systems into data and information systems; Formulation organization-wide KM policy and implementation of ICT systems to support management decisions and knowledge work; Encouragement of KM activities and effective ICT and knowledge infrastructure; Strategies for institutionalization of KM practices; Extension of ICT and KM to the extended value chain of the organization.	KM policy and strategy. Extended organizational maturity	Lack concentration Key Areas ot than technology No validation. No assessm methodology
13	KM3 (Gallagher) Gallagher and Hazlett	Knowledge Infrastructure, Knowledge Culture, Knowledge Technology.	4 K-Aware, K-Managed, K-Enabled, K-Optimized	From lack of awareness of knowledge management in the first stage to a complete and focused knowledge strategy that is tightly coupled to business strategy and ultimately results in improved business performance in the final stage.	Knowledge strategy that is tightly coupled to the business strategy and business performance An objective assessment methodology.	The embryo form of the moc without details illustration.
14	G-KMMM (Pee) Pee and Kankanhalli (2009)	People, Process, Technology.	5 Initial; Aware; Defined; Managed; Optimizing.	Lack of intention to formally manage knowledge; The intention to formally manage the knowledge; Basic infrastructure to support KM activities; Well established KM initiatives; Automatic integration of KM into organizational process and continuous improvement;	Integration KM process into organizational process. Validation of the model	Knowledge K Area is considered.
15	KMMM (Boyles) Boyles et al (2009)	Human Resource, Training, Documentation, Technology, Tacit Knowledge,	5	Each Key Area progresses from ‘not utilized’ , ‘to a little extent’, ‘to some extent’, ‘to a great extent’ and ‘ to a very great extent’.	Detailed assessment criteria were listed.	The model is validated

- It should combine the strengths of the existing models and eliminate their inadequacies

The new model is proposed with the following premises:

- Since the main objective of KM is to improve organizational performance, higher level of KM maturity implies higher level of organizational performance and thus a higher Return On Investment (ROI)
- The Key Areas in KM are People, Process, Technology, Knowledge and ROI

Each Key Area is identified with certain number of parameters called Key Parameters(KP). Each parameter is identified with certain values called Key Values(KV). Key Parameters identified for different Key Areas and the Key Values are listed below.

3.1. KeyParameters

Key Parameters (People)

The parameters for People KA are Awareness, Participation, Reward and Recognition Scheme:

Awareness:This parameter indicates the level of understanding and acceptance of employees the practical meaning of KM as applicable to them.
Participation: This parameter indicates the level of participation of employees in formal KM activities.
Reward and Recognition Scheme: This parameter indicates the effectiveness of reward and recognition schemes to motivate employees for voluntary participation in formal KM activities.

KM roles, Communities of Practice, Mentoring and Succession Planning:

KM roles: This parameter indicates the effectiveness of KM roles which can be full time or part time.
Communities of Practice: This parameter indicates the effectiveness of knowledge sharing communities.
Mentoring and Succession Planning: This parameter indicates the effectiveness of mentoring and succession planning.

Key Parameters (Process)

The parameters for Process KA are KM Policy, KM Strategy, KM Processes, Process Integration:

KM Policy: This parameter indicates the effectiveness of KM Policy which is a statement of intent of what one wants to achieve with KM.
KM Strategy: This parameter indicates the effectiveness of KM Strategy which is a statement of how one wants to achieve KM.
KM Processes: The KM processes considered are knowledge identification, knowledge creation, knowledge acquisition, knowledge preservation, knowledge quality, knowledge sharing, knowledge utilization, KM ROI measurement. The parameter indicates the over all effectiveness of KM processes.
Process Integration: Process integration refers to the integration of KM processes with normal work processes. The parameter indicates the level of integration and its effectiveness

Key Parameters (Technology)

The parameters for Technology KA are Network, Data and Information management, Explicit Knowledge Management, Tacit Knowledge Management, , Artificial Intelligence(AI) and Knowledge Engineering(KE) techniques, Technology Integration:

Network : Network refers to organization-wide connectivity of computer systems and other related resources. The parameter indicates the effectiveness of the network.
Data and Information Management: The parameter indicates the effectiveness of organization-wide data and information system.
Explicit Knowledge Management: The parameter indicates the effectiveness of technology for content management.
Tacit Knowledge Management: The parameter indicates the effectiveness of technology for collaboration
AI and KE Techniques: The parameter indicates the effectiveness of AI and KE for knowledge elicitation, knowledge representation, knowledge retrieval, inference etc.
Technology Integration: Technology integration refers to the integration of various systems of the organization like Data Management Systems, Information Management Systems, Content Management Systems, Collaboration Systems, AI and KE Systems etc. The parameter indicates the level of integration and its effectiveness

Key Parameters (Knowledge)

The parameters for Knowledge KA are Knowledge Classification, Knowledge Capability Areas, Knowledge Organization:

Knowledge Classification: Knowledge classification refers to the classification of knowledge into core, advanced and innovative(Zack, 1999, Gottschalk. 2002). The parameter indicates the combined effectiveness of core , advanced and innovative knowledge.
Knowledge Capability Areas: The parameter includes the knowledge capability areas identified by Kulkarni and Freeze(Kulkarni and Freeze, 2004) viz data, knowledge documents, lessons learned, expertise and knowledge in the form of Frequently Asked Questions (FAQ). Also it includes unapproved and un solicited knowledge in the form of blogs, wikis etc. The combined effectiveness is indicated by the parameter.
Knowledge Organization: Knowledge organization refers to the organization of the knowledge based on knowledge map, meta knowledge, taxonomy etc. and its combined effectiveness is indicated by the parameter.

Key Parameters (ROI)

This paper uses Employee Satisfaction as the only parameter for ROI. The parameter indicates the level of satisfaction on KM activities.

3.2. Key Values

The 'Key Values' identified for the Key Parameters are 'Nil', 'Low', 'Medium', 'High' and 0 – 100. The value 'Nil' indicates that the parameter is either not applicable, or not assessed or does not exist. The values 'Low', 'Medium' and 'High' indicates that the parameter is assessed qualitatively. The value 0-100 indicates that the parameter is assessed quantitatively and it is expressed in percentage.

The new KMM model has six maturity levels(level 0 to level 5). The maturity levels are named as 'Default', 'Initial', 'Qualitative Development', 'Quantitative Development', 'Maturity' and 'Extended-Organizational Maturity'. The new KMM model identifies different maturity levels by a specific combination of Key Maturity Indicators(KMI). Each KMI is identified by a specific combination of KA, KP and KV. For an organization to be in a specific maturity level all the KMIs pertaining to that level and all preceding levels need to be satisfied. No levels can be skipped. If an organization satisfies all the KMIs pertaining to one level say level 1 and at least one KMI pertaining to the next level for each KA, then organization can be considered to be in a level 1+. Similarly if the organization satisfies at least 50% of the KMIs pertaining to level 2 for each KA, then that organization can be considered to be in a level of 1++. Also if the organization satisfies all KMIs of level 1 and satisfies at least one KMI or at least 50 % of the KMIs of level 2 in one or more specific KAs alone, the organization is considered to be in level 1 in the over all maturity and 1+ or 1++ in the specific KAs alone. The Maturity Levels and Key Maturity Indicators are listed below.

3.3 Maturity Levels

The maturity level, their general characteristics and characteristics in terms of Key Areas are described below.

Level 0: Default

Level 0 is the basic level. By default all organizations will be at a minimum of level 0. It is characterized by the absence of any formal KM activity. The organization recognizes and rewards only individual expertise and capabilities. Organization is in a level of 'unconscious incompetence' in KM
People: Awareness of KM may not exist . People work in isolation and compete with each other. The thinking is "we do not know anything about KM"
Process: The only KM processes are mandatory reports, formal training and informal socialization.
Technology : Generally individual productivity tools are being used.
Knowledge : Only routine knowledge required for survival is created and shared through training and informal socialization.
ROI: This Key Area is not applicable at this level, since formal KM is not existing.

Level – 1 : Initial:

It is characterized by the intention of the management to start formal knowledge management activity. Though organization does not have the clarity on how to proceed, it initiates KM activities. Organization generally works as silos and the knowledge sharing takes place only within the silos. Though islands of excellence exists, pool of excellence is lacking. Organization is in a level of 'conscious incompetence' in KM

People : A low level of awareness of formal Knowledge Management and the need for Knowledge Management exists among the employees.
Participation in KM activities is low. Only part-time KM roles exist. Mentoring and succession planning is prevalent in an adhoc way. Thee
thinking is " we need KM , but it is too difficult and time consuming"

Process: A documented KM policy and KM strategy exists. Organization-wide procedure for documenting and selective sharing of routine and procedural knowledge exists. Procedure for formal knowledge sharing sessions exist.

Technology: Organization wide network exists. Isolated/networked systems for data, information and explicit knowledge like publication,
progress report, project reports etc., exist. Also technology infrastructure for tacit knowledge sharing exists in a primitive level.

Knowledge: The quantity of routine and procedural knowledge shared have improved.

ROI: Since formal KM activities are only initiated ROI may be negligible.

Level 2 : Qualitative Development

This stage is characterized by qualitative assessment of KM activities and its impact on the performance of individuals, department and organization. Based on the qualitative assessment the performance of KM activities and its impact on the performance is good.

People: Organization wide awareness and participation of KM activities is monitored qualitatively and is good. Dedicated full time KM roles were created in addition to part time roles with clear mandate and review mechanism. A committee of senior management reviews the progress and takes appropriate corrective actions. Reward and recognition schemes are introduced. Knowledge sharing communities are encouraged. Mentoring and succession planning is practiced with appropriate knowledge transfer. The thinking is "we are doing KM"

Process: The effectiveness of KM policy and KM strategy is improved in a qualitative way. Formal processes for knowledge identification, creation, acquisition, approval, quality rating, preservation, sharing, utilization and impact assessment on performance of individuals, department and organization exists. All the formal processes are documented, the effectiveness is measured qualitatively and corrective mechanisms are incorporated. The effectiveness of the formal processes is good

Technology:A user friendly knowledge portal with necessary content management and collaboration technologies, and necessary security features is operational. Integration of organizational data and information system with knowledge portal is being explored. Knowledge engineering techniques are being explored for knowledge acquisition, knowledge representation, knowledge retrieval and inference. The portal is so configured in such a way that employees can do the information/knowledge oriented work from the portal itself. All the necessary links to other internal and external websites and utilities are provided. The effectiveness of the portal monitored qualitatively and is good.

Knowledge:In addition to routine knowledge, advanced knowledge required for performance improvement and future activities is created/ acquired and shared. Tacit knowledge is elicited and shared across the organization, in addition to sharing in communities. Knowledge is organized with Knowledge Map, Meta –Knowledge structure and taxonomy. Knowledge in the form of Lessons Learned, Frequently Asked Questions (FAQ), Experise, Data etc. are documented, preserved and shared. Unapproved and unsolicited knowledge also is being shared. The quality of knowledge and its organization is measured qualitatively and is good.

ROI: Since formal KM activities are improved qualitatively the ROI should be good.

Level 3 – Quantitative Development

This stage is characterized by quantitative assessment of KM activities and its impact on the organizational performance. The organization is able to quantitatively link the KM activities and the organizational effectiveness in terms of various performance indicators. The effectiveness of the measured parameters reaches more than 50% of the targeted value. Organization reaches the level of 'conscious competence' in KM

People: Awareness and acceptance of KM activities is improved significantly. More than 50% of the employees are active participants in KM activities. Knowledge sharing communities exist irrespective of departmental boundaries and more than 50% of the employees are members in one or more knowledge sharing communities. People have started recognizing that knowledge management is a part of the normal work. Dedicated KM roles, reward & recognition scheme and mentoring and succession planning continues with quantitatively measurable ROI. The thinking is "we are doing KM very well"

Process: The effectiveness of KM policy and KM strategy is improved and is more than 50% of the targeted value. Organization wide KM processes get integrated with normal work processes with quantitative measurements and corrective mechanisms. More than 50% of the normal work processes have integrated KM processes

Technology: Integration of organizational data and information system with knowledge portal is successful in locating the relevant knowledge. Isolated applications using Knowledge Engineering techniques used for knowledge acquisition, knowledge representation, knowledge retrieval and inference like natural language processing, speech recognition, ontology, knowledge discovery through data mining / text mining, case based reasoning, rule based reasoning etc are successful and is being integrated with the knowledge portal. The portal is configured in such a way that more than 50% of the employees can do the information/knowledge oriented work from the portal itself. The effectiveness of the knowledge portal is measured quantitatively and is more than 50%.

Knowledge: In addition to routine and advanced knowledge, innovative knowledge required for innovations and leadership positions is created/ acquired and shared. The quality of knowledge in Knowledge Capability Areas and its organization is measured quantitatively in addition to qualitative measurements. The over all quality of the knowledge shared is more than 50% of the targeted value

ROI: More than 50% of the targeted value.

Level 4 – Maturity:

Knowledge management has become an integral part of every activity and got embedded into the organizational culture. The level is characterized by continual improvement and institutionalization of the knowledge management practices. The effectiveness of the measured parameters reaches more than 90%. Organization reaches the level of "unconscious competence" in KM.

People: Everyone recognizes knowledge management as an integral part of their work. They are able to see the visible link which is backed by qualitative and quantitative measurements between KM activities and performance and growth of individuals, department and organization. People have become insensitive to organizational hierarchies and affiliations as far as Knowledge Management activities are concerned. Collaborative activities and knowledge sharing communities are widespread throughout the organization. The effectiveness of KM roles has reached a level where dedicated senior level KM roles like Chief Knowledge officer may get replaced with part-time roles, though lower level roles for technology enhancement/maintenance may continue. The effectiveness of reward & recognition scheme and mentoring and succession planning have reached a level where exclusive schemes may get vanished and may become a part of the normal work culture. Continual improvement in effectiveness of various parameters, performance, growth and ROI is monitored and is moiré than 90%. The thinking is "we have achieved in making KM a way of our life"

Process: The effectiveness of KM policy, KM strategy, KM processes and process integration is continually improved and is moiré than 90%.of the targeted value. Process integration have reached a level, where KM processes have become an integral part of every organizational activity including organizational performance measurements

Technology: The data and information system of the organization get seamlessly integrated with the knowledge management portal. Knowledge Engineering techniques used for knowledge acquisition, knowledge representation, knowledge retrieval and inference like natural language processing, speech recognition, ontology, knowledge discovery through data mining / text mining, case based reasoning, rule based reasoning etc are matured and get seamlessly integrated with the knowledge management portal. The portal is configured in such a way that all the employees can do all the information/knowledge oriented work from the portal itself. All the employees have made the KM portal as their preferred home page. The security, reliability, availability, user friendliness and effectiveness of the of the KM portal is continually improved and is more than 90%

Knowledge: The quality and quantity of knowledge shared is continually improved and is more than 90% of the targeted value. The knowledge necessary to carry out the current and future activities of the organization is guaranteed as an integrated package of explicit and tacit knowledge.

ROI: More than 90% of the targeted value

Level 5 – Extended - Organizational Maturity:

Level 5 is characterized by achieving maturity with respect to partnering organizations like, suppliers, customers and other alliance organizations and seamless integration with these organizations. Essentially, organizational boundaries with respect to knowledge management

breaks down and the partnering organizations together as a single entity reach the KMIs of level 4 maturity. However to achieve level 5 maturity, the extended organization may have to assess the current level and gradually progress from that level, however low it is.

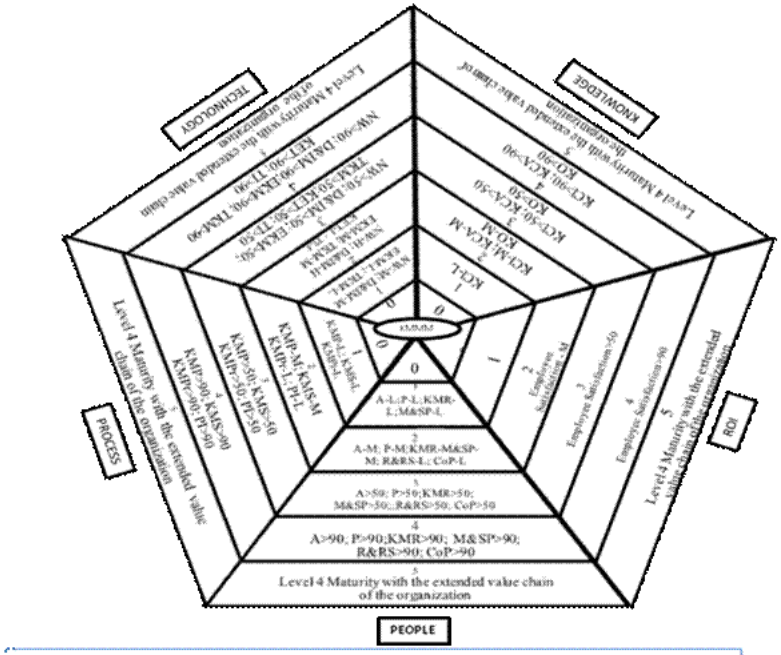
3.3. Key Maturity Indicators

The Key Maturity Indicators for various levels of maturity levels are summarized in Table 2 and they are pictorially represented in Figure 1.

Table 2. Maturity Levels And Key Maturity Indicators

Level	People	Process	Technology	Knowledge	ROI
0 Default	_	_	_	Only routine _	
1 Initial	▪ Awareness- Low ▪ Participation -Low ▪ KM roles –Low ▪ Mentoring and Succession Planning-Low ▪ Communities of Practice-Nil ▪ Reward and Recognition Scheme- Nil	▪ KM Policy-Low ▪ KM Strategy-Low ▪ KM Processes-Low ▪ Process Integration-Nil	▪ Network-Medium ▪ Data and Information management-Medium ▪ Explicit Knowledge Management-Low ▪ Tacit Knowledge Management-Low ▪ KE techniques-Nil ▪ Technology Integration- Nil	▪ Knowledge Classification-Low ▪ Knowledge Capability Areas-Nil ▪ Knowledge Organization-Nil	▪ Employee Satisfaction-Nil
2 Qualitative Development	▪ Awareness-Medium ▪ Participation -Medium ▪ KM roles -Medium ▪ Mentoring and Succession Planning-Medium ▪ Communities of Practice-Low ▪ Reward and Recognition Scheme- Low	▪ KM Policy-Medium ▪ KM Strategy-Medium ▪ KM Processes-Medium ▪ Process Integration-Low	▪ Network-High ▪ Data and Information management-High ▪ Explicit Knowledge Management-Medium ▪ Tacit Knowledge Management-Medium ▪ KE Techniques-Low ▪ Technology Integration-Low	▪ Knowledge Classification-Medium ▪ Knowledge Capability Areas-Medium ▪ Knowledge Organization-Medium	▪ Employee Satisfaction-Medium
3 Quantitative Development	▪ Awareness->50 ▪ Participation ->50 ▪ KM roles ->50 ▪ Mentoring and Succession Planning->50 ▪ Communities of Practice->50 ▪ Reward and Recognition Scheme- >50	▪ KM Policy->50 ▪ KM Strategy->50 ▪ KM Processes->50 ▪ Process Integration->50	▪ Network->50 ▪ Data and Information management->50 ▪ Explicit Knowledge Management->50 ▪ Tacit Knowledge Management->50 ▪ KE techniques->50 ▪ Technology Integration->50	▪ Knowledge Classification->50 ▪ Knowledge Capability Areas->50 ▪ Knowledge Organization->50	▪ Employee Satisfaction->50%
4 Maturity	▪ Awareness->90 ▪ Participation ->90 ▪ KM roles ->90 ▪ Mentoring and Succession Planning->90 ▪ Communities of Practice->90 ▪ Reward and Recognition Scheme- >90	▪ KM Policy->90 ▪ KM Strategy->90 ▪ KM Processes->90 ▪ Process Integration->90	▪ Network->90 ▪ Data and Information management->90 ▪ Explicit Knowledge Management->90 ▪ Tacit Knowledge Management->90 ▪ KE techniques->90 ▪ Technology Integration->90	▪ Knowledge Classification->90 ▪ Knowledge Capability Areas->90 ▪ Knowledge Organization->90	▪ Employee Satisfaction->90%

5 Extended-organizational maturity	Same as level 4 with extended value chain of the organization.	Same as level 4 with extended value chain of the organization	Same as level 4 with extended value chain of the organization	Same as level 4 with extended value chain of the organization	Same as level 4 with extended value chain of the organization



Abbreviations:

A – Awareness	P - Participation
KMR – Knowledge Management Roles	M & SP – Mentoring & Succession Planning
R & RS – Reward & Recognition Scheme	CoP – Communities of Practice
KMP – Knowledge Management Policy	KMS – Knowledge Management Strategy
KMPr - Knowledge Management Processes	PI – Process Integration
NW – Network	D & IM – Data and Information Management
EKM – Explicit Knowledge Management	TKM – Tacit Knowledge Management
KET – Knowledge Engineering Techniques	TI – Technology Integration
KCl – Knowledge Classification	KCA – Knowledge Capability Areas
KO – Knowledge Organization	L-Low; M-Medium; H-High

Figure 1: Maturity Levels And Key Maturity Indicators

3.4. Assessment Methodology

The methodology includes assessment of current level of maturity and recommendation to improve the maturity. An objective assessment methodology consisting of verification of records, in depth interview, questionnaire and focus group discussion is proposed. Any organization that is to be assessed has to start with level 1. If an organization is assessed to be in level 1, it can further be assessed for level 1+, 1++, 2 etc. The current maturity level of the organization and the possible solution to improve the maturity has to be arrived at in consultation with various stake holders of the organization.

3.5. Validation

Table 3: Features Of The New Model As Strengths Of Other Models

Sl.No	Features of the new KMMM	Strengths of other models
1	Parameters of maturity level	KMMM(Kochikar)
2	KM strategy	KMMM(Hubert), KM3, Strategic KMMM(Kruger)
3	KM policy	Strategic KMMM(Kruger)
4	KM ROI	KMMM(Hubert)
5	Four key areas(People, Process, Technology and Knowledge)	Knowledge journey
6	Knowledge classification(core, advanced and innovative)	KMMM(Klimko), KMMM(Gottschalk)
7	Documented and measurable KM process	KMMM(Klimko), KMMM(Ehms)
8	Extended organizational maturity	KMMM(Klimko),StrategicKMMM(Kruger)
9	Process integration	KPQM(Paulzen),G-KMMM(Pee), 5iKM3(Mohanty),KMMM(Ehms)
10	Concentration on technology including AI and KE	KMMM(Gottschalk)
11	Objective assessment methodology	KMMM(Kochikar),5iKM3(Mohanty), KMMM(Ehms), KM3
12	Validation (being done)	KMCA(Kulkarni), KMMM(Natarajan), G-KMMM(Pee)

5. Conclusion And Future Work

Formal knowledge management is in the fore front of the business strategy of many organizations. Deriving business benefits from KM depends on many factors. A guiding KMM model is essential for any organization, embarking on formal KM, to bench mark its activities. This paper described a new model combining the strengths of the existing models and eliminating their inadequacies. The model is highly flexible with its unique KMI concept and can be adapted to any organizational environment. The model uses a balanced approach with adequate concentration on various Key Areas viz People, Process, Technology, Knowledge and ROI. The final maturity level considers the target organization along with other partnering organizations as a single entity. Hence the model extends the traditional boundary of the organization, and a step forward in the direction of 'National' and 'Global' knowledge management.

Through an organizational study, the model will be validated and the assessment procedure including the probable solutions to improve the maturity will be demonstrated. The model can be improved by including additional Key Areas and Key Parameters.

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