CHAPTER - 2

Knowledge Management in Universities

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Chapter – 2

Knowledge Management in Universities

“Of course there's a lot of knowledge in universities: the freshmen bring a little in; the seniors don't take much away, so knowledge sort of accumulates.”

-Abbott Lawrence Lowell
Former President of Harvard University

“Knowledge is power”
Sir Francis Bacon 1561 -1626,
English philosopher, statesman, essayist and scientist

2.1 Introduction
The Universities are not only the teaching organizations but also a platform that creates knowledge and support the communities. The business of Universities is all about knowledge and operations on knowledge. Over the centuries, they have developed a knowledge culture around this business. The rapidly expanding use of technology in teaching and learning, and the transformed economic basis upon which Universities are instituted, have caused Universities to transform the ways in which knowledge is produced, stored, disseminated, and authorised. The use of Internet technologies in particular impacts on academic knowledge in fundamental ways, breaking traditional knowledge linkages, creating new Knowledge Management practices and creating new teaching and learning cultures. A strategic approach to Knowledge Management in Universities – a shift in focus from means to ends – allows purposeful and integrated approaches. The degree to which these changes are implemented by strategic reasoning is proposed as an indicator of success.

The world is changing fast and the world of Higher Education is changing more faster. In this new world, the Universities will have to deal with entirely new challenges of stakeholder demands. With the increase in competitive culture, the Universities are implementing strategies to improve the quality of
students, research and provide the best possible service to the society. The role of Knowledge Management has become vital to improve the efficiency and effectiveness in the working of the University. The Universities now are interested in creating knowledge, transferring knowledge to the stakeholders, develop knowledge workers in various disciplines, and provide community services effectively.

The Universities all over the globe have the deficit of knowledge experts, researchers, supporting tools and infrastructure, especially, in the countries like India where apart from the parameters discussed above, finance is also a major crunch.

In order to sustain in the competition, the Universities are trying to implement new strategies in order to enhance the quality of students and research. We feel, Knowledge Management is the best tool which can improve the position of the Universities all over the world in general and Universities in India, in particular. Information and Communications Technology (ICT) can play a lead role in managing the Knowledge in different areas of the Universities that include Teaching-Learning, Administration and service to the society. ICT can now become the enabler for improving the performance of various areas of Knowledge Management which include knowledge creation, storing, transferring and reusing.

2.2 The University : As a System

The University as a system is divided into two parts namely, Teaching-Learning and Administrative. If we take the literal meaning of University, it means a place of higher learning and research which confers degrees in variety of disciplines. As we have taken Sardar Patel University as a model for our study, we put forward constitution and features of this University in brief.
The Vice-Chancellor is the Head of the University who looks into both the Academic and Administrative affairs. The main governing body is the Syndicate and the Senate (the functions and constitution of which are available on the University website www.spuvvn.edu). The University has 25 Postgraduate Departments, 11 faculties which include Arts, Science, Pharmacy, Medical, Engineering, Commerce, Homeopathy, Law, Home Science, Management, Pharmaceutical Sciences. The Departments are responsible for teaching-learning and research in the University. It has Administrative Sections which support activities related to admissions of students to various departments, finance, establishment, examinations conducting, etc. The University has 87 affiliated colleges located in the jurisdiction of 8 Kms. The University data can be converted to information and subsequently to knowledge if it is organized in a proper form. But this knowledge is either untapped or not properly stored so that it can be disseminated to right person at right time. This is the area where we would like to contribute the research outcomes to the University right from the knowledge gathering, organizing, storing, disseminating and generating new knowledge.

The aim of our research is to provide various models, frameworks and at some instances implementable solutions to manage knowledge in the University. These solutions will be through information and communication technology. In this chapter we have described areas in which Knowledge Management is required in the University and the outcome of the research shows the clear distinction in the state of the University before and after the solution provided. In the following chapters, we have described different areas where management of knowledge is necessary in the University. Some specific areas which are untouched are explained. A model is proposed on the basis of which different frameworks are derived and discussed.
2.3 Proposed Model of Knowledge Management in University: A Three Tier Approach

Knowledge Management Systems generally consists of two components:

i) Knowledge  ii) Process

Knowledge Management Systems can be categorised as:

i) Content management tools: Tools that offer abilities to integrate, classify, and codify knowledge from various sources.

ii) Knowledge sharing tools: Tools that support sharing knowledge between people or other agents.

iii) Knowledge search and retrieval systems: Systems that enable search and retrieval and have some knowledge discovery abilities.

iv) General KMS: Systems that propose an overall solution for a University’s Knowledge Management needs.

For our study, we have considered University Knowledge Management System (KMS). Hence, the description mentioned here relates to a University. The tacit knowledge resides into the minds of the teachers, researchers and administrators and explicit knowledge is available in physical files, documents in the hard format or soft format, various manuals, reports and so on. The main function of the Knowledge Management System is to gather this knowledge and organize it in a specific form and make it accessible to the users. The existence of tacit and explicit knowledge has to be handled differently. The organizational knowledge which is owned by the individual employees of the University, group of employees (heterogeneous or homogeneous) or University as a whole (patents, best practices, specialization, extension activities, awards and so on) has also to be tapped by KMS. The flow of knowledge from one person to another solely depends on the context and experience of the user expecting to acquire knowledge. It is very difficult for a Knowledge Management System to anticipate the types of requests that will be received from the users; hence the knowledge base has to be ready with the best possible
knowledge stored. Secondly, due to difficulty in determining the knowledge required by the users, the processes associated with it have to be highly dynamic. It is a very complicated task to capture knowledge without understanding the users’ point of view of accessing and using the knowledge.

As a part of our study, we propose a Three Tier Reference model for Knowledge Management for any University in general and Sardar Patel University in particular\textsuperscript{[10]}. The model identifies and incorporates all the elements and processes of Knowledge Management System that are necessary for any University. These processes will help to move the knowledge from the place where it exists to a place where it is accessible by the user. We take an example to explain one such process: to help the student identify a Research Guide depending on his topic of interest and Guide’s willingness to accept him as his student. The model will show the path to develop, assess and operate Knowledge Management System in the University. The model will also be helpful in providing a base to develop ICT based Knowledge Management System.

We have named these tiers as \textbf{KM T1, KM T2} and \textbf{KM T3}. The \textbf{KM T1}: contains knowledge about the “University’s Aspects” i.e. deals with pertinent information about the University, functions, roles, vision, mission, goals and the relationships between them. The second tier: \textbf{KM T2} contains the all processes required to control the elements of \textbf{KM T1}. The third tier: \textbf{KM T3} provides the resources to the elements of the second tier. The purpose and function of each tier is discussed in the following sections.

\textbf{2.3.1 Tier 1: KM T1}

The first tier KMT1 consists of various “University Aspects” that relate to the functions of the University i.e. teaching-learning, administration, extension activities and also its mission, vision and goals. We abbreviate the University Aspect as UA. Each UA is associated with some knowledge which may be
tangible or intangible, for example, personal experience, talents, providing knowledge to the student about the courses offered by the University is intangible but helping the enrolled student to find and provide scholarship is tangible i.e. any data, documents etc., provided to support knowledge is tangible. In this tier, every UA should have knowledge templates that would facilitate the user who may be internal or external. The knowledge objects around UA abbreviated as K-objects may keep updating, for example the rules for admission this year may not exist for the next year; the expert on a particular subject may retire or leave the organization. That means the K-objects should be dynamic in nature.

Figure 2.1, shows the model of Tier 1: KMT1. As discussed above UA consists of University Aspects which includes everything related to the University. Each University Aspect has some purpose and the outcome produced depends on process which requires resources available to carry out the processes. The aspect is abide by some rules and laws. We elaborate this by giving an example: let us consider Admission Process as one of the UA. The purpose of this UA is to give complete knowledge on Admission Procedure for a particular course in the University. The outcome i.e. the detailed procedure will depend on the process involved which will be fetched from the resources like brochure, manuals, and guidelines available in various forms in the University. This
knowledge will be shared with students or other knowledge seekers. That means in this case students are the main source to present their requirements and it is necessary to have knowledge on fulfilling and managing those requirements. The activities that are required to address this UA include providing centralized and easy access to the knowledge submitted, to reuse information rather than creating again, keeping the manuals and reference material ready, and having some mechanism to answer the queries generated by the user. The K-objects associated with this UA include the experience of staff in terms of procedures, manuals of procedure i.e. brochure, tacit knowledge of the staff, etc.

2.3.2 Tier 2: KM T2

The UA normally remain the same but the K-objects i.e. the knowledge related to it keep changing. For this the University has to decide the knowledge manipulating processes that may influence the changes in K-objects. Von Krogh [The Von Krogh Model of Organizational Epistemology (1995)] has stated that there are knowledge enabling processes that positively influence the K-objects. K-objects exist in different states e.g. in the beginning the state is of identification of K-object, this state exists when necessity arises to have some knowledge on specific UA. After that K-object passes through various states like creation/acquiring, synthesize, discover, preserve, and mobilize. Let us take an example in terms of one of the UA i.e. UGC announced Academic Performance Indicator for promotion of teachers. Due to this, teachers need knowledge to fill the form. For this the University needs to generate knowledge, refine the knowledge and finally store the knowledge for dissemination to the users. The knowledge disseminated using different presentation forms should be evaluated. These knowledge manipulating processes include knowledge discovery, knowledge creation, knowledge explanation, knowledge storing, knowledge propagation, knowledge staging and, knowledge assessment. The knowledge discovery process consists of the activities that are required to develop new K-objects or update the existing K-
objects. For example, it includes the process of identifying the knowledge holder(s) of the required knowledge, the form in which knowledge exists, the process of converting the knowledge and the sources of knowledge. The knowledge creation process includes all the procedures that require generating new knowledge like obtaining knowledge from various sources, discovering the hidden knowledge, integrating knowledge by interacting with UA. Refinements in the existing explicit knowledge are a part of knowledge explanation like testing, streamlining, and maintaining.

After this process the knowledge storing activities commence and the procedure of storage differs as per the type of the knowledge. For example if it is an explicit knowledge like document of procedure of admission in the University, it requires codifying, organizing and storing in one of the formats and storage device. The knowledge thus stored after passing through various phases needs to be propagated or disseminated which should be presented to the aspiring user of the knowledge. The knowledge dissemination may take place through documents, databases, training and so on. Now it is the users’ responsibility to identify that the knowledge accessed by him is correct or not. The drivers of the processes discussed above are the vision of the employees of the University, clear understanding of the steps required to generate knowledge, know-how on converting goals into actions, setting the standard guiding procedures of conversation among the internal sources and external sources, forming Knowledge Management groups and knowledge maps, inculcation of sharing culture among the employees, creating right contexts and making the knowledge public.

The components of this tier signify the means to realize knowledge purposes by using organizational resources which may be human resources, ICT based systems, etc.
2.3.3 Tier 3: KM T3

The third tier includes the information and communication technology which provides tools that support the activities related to Knowledge Management in the University. The tools should provide ways to convert tacit knowledge to explicit knowledge which include the ways to gather the tacit knowledge like designing appropriate forms, arranging discussion forums, defining templates of acquiring knowledge. The tools also should support the organization and storage of explicit knowledge existing.

In our study we have presented different forms that will help acquire knowledge from the experts of their fields such as teaching or administrative. We have shown the way in which these forms can be stored and applied different techniques to provide knowledge to the users. Keeping this reference model in view, we would describe how this model can help in managing knowledge in the Universities.

Figure 2.2 shows the role of KM T1, KM T2, KM T3 in the proposed model by giving an example. A new UA - Choice Based Credit System was launched in the year 2010. The knowledge objects associated for this UA include, the guidelines laid down by the Gujarat Government and the knowledge gained by the committee members (tacit knowledge) by discussions, seminars, workshops and study of the guidelines. This knowledge was not available to all the concerned stake holders. This knowledge is posted in the Knowledge Base. Some knowledge about this UA and the content in the Knowledge Base exists with in the University also. The knowledge object for this UA passes through various stages and finally is stored in the knowledge base. Various tools are needed to access the knowledge at the right time. The knowledge provided for this UA would differ from user to user. For example a teacher will require knowledge for the eligibility criteria for promotion, the rules for filling the form and the soft copy of various forms required under the career advancement scheme.
The Establishment Section requires knowledge about rules for framing of various committees like committee to assess the information filled in by the candidate, interview committee, etc. and the committees in turn require knowledge to assess/interview/select the candidate.

Figure 2.2 : The Three Tier Model
In this study, we have taken specific areas where ICT can help in managing the knowledge in the University. Each step that leads to final deployment of rules in the knowledge base is also discussed and finally, the outcome of the study is outlined. In order to extract knowledge various techniques like data mining, searching, etc. are suggested applied at various instances.

2.4 Knowledge Generation in the University: An Example

Knowledge generation from the existing models of the University Administration is a rarely explored application of data mining. A large amount of data is being added throughout the years. We propose to extract, create and present the knowledge in different forms to the stakeholders. Different models are used to extract information and to create knowledge e.g., The areas that are concentrated for this purpose include: trends of the selection of a course by students of the University as per exposure and market demand, result analysis, and admission analysis among several others. We explore the possibilities to improve decision-making and policy making in University Administration. This attempt forms a broad framework for futuristic knowledge based model of the University, which would help in improving the Quality of Services in a University and in attaining the status of “Centre of Excellence”.

Since the exposure of Information Technology to the human beings, knowledge has been playing a significant role in the lives of mankind. It is a tendency of a human being to create knowledge from available data, information or knowledge. Universities have vital contributions in knowledge development in terms of academics, economics, social, entrepreneurial, linguistic, commercial progresses, etc. Effective administration of a University is a complex and trustworthy process and it contributes to attain the status of “Centre of Excellence” in administration. A huge quantum of data is registered to University every year. The aim of this study is to create knowledge by appropriate data mining techniques. This knowledge should be disseminated and shared among the stakeholders. The stakeholders of the system include
administrators, faculty and students. To give the clear understanding of how the process model will help in creation of knowledge, in this study the Admission Process is selected at Sardar Patel University as a case. This will help to develop a broad framework for knowledge-based model of University, which in turn helps to improve Quality of Services at the University.

As an example, we have taken admission process that is a vital UA of any University. We have divided entire admission process into three phases: (i) Pre-admission process, (ii) On-Admission Process, and (iii) Post-admission process. We have tried to create individual K-objects and then co-relate the knowledge from above phases of admission process.

2.4.1 University Administration

Although we have considered Sardar Patel University administration for the process model, yet a generic University Administration in India can be visualized as under:

The entire University administration is divided into different sections. Each section has different hierarchy of the staff and is assigned different functions and tasks. These sections include Examination Section, Academic Section, Establishment Section, Account Section, etc. The data that comes to these sections is converted into information and the required knowledge is delivered to the stakeholders at a given point of time. The problem arises when a user wants some information, which can be arrived at only after integrating the information from various sections. This is the point where the possibility of wrong delivery of knowledge or delay in providing knowledge may increase. The reason is improper entities and attributes, no linkages and lack of integration. Even a perfect MIS system may not be suitable to provide desired information.
There are several methods by which we can provide knowledge to the stakeholders at the right time. For this we have chosen data mining techniques to deliver the knowledge. Before going into details of the process of knowledge generation and dissemination, we describe few terms related to data mining in the following paragraphs.

2.4.2 Data Mining

Data Mining is a multidisciplinary field that draws work from database technology, machine learning, statistics, pattern recognition, information retrieval, neural networks, knowledge based systems, artificial intelligence, high performance computing and data visualization\(^6\). Data mining has emerged as an important field due to increased amount of data that has to be converted to useful information and knowledge. Data Mining can be viewed as the natural evaluation of Information Technology. The database systems also have shown a significant change from data collection, database creation, data management and data analysis.

There are situations where the data has grown enormously and the decision making has become difficult due to piling of unwanted data. These are the conditions where we are rich in data but poor in information.

“Data mining refers to extracting or mining knowledge from large amounts of data”\(^30\).

“Data mining is the process of discovering interesting knowledge from large amount of data stored either in databases, data warehouses or other information repositories\(^30\).

Data Mining can also be defined as an analytic process designed to explore large amount of data to find consistent patterns and organized relationships.
between variables and validate the findings by applying detected patterns to new subset of data.

Many authors have referred data mining as one of the processes of Knowledge Discovery in Databases. Knowledge Discovery consists following steps:

(i) Data cleaning
(ii) Data integration
(iii) Data selection
(iv) Data transformation
(v) Data Mining
(vi) Pattern evaluation
(vii) Knowledge presentation

The Data captured for processing is cleaned i.e. inconsistent data is removed. In the next step, the data from the multiple sources is combined and then the data relevant to analysis task are retrieved from the database. The data is then transformed into various forms appropriate for mining. Data mining methods are applied to extract data patterns which are then analysed and patterns representing knowledge based on interestingness measures are identified. This knowledge is then represented using various knowledge representation techniques.

2.4.3 Data Warehouse

A data warehouse is subject oriented, integrated, time variant, and non-volatile collection of data in support of management’s decision making process[50]. Data Warehouses focus on modelling and analysis of data for decision making. Data Warehouse provides a simple and concise view around particular subject issues by excluding data that are not useful in the decision support process[30]. Data Warehouses are constructed by integrating multiple heterogeneous sources such as relational databases, flat files, and on-line transaction records. Data are
stored to provide information from a historical perspective. A data warehouse is a separate physical store from the application data found in operational environment. Data Warehouse consists of consistent data store that serves as a physical implementation of a decision support data model and stores the information on which an enterprise needs to make strategic decisions.

2.4.4 Towards Process Model

We explain the Knowledge Management in the University Administration by giving different examples. The first example is of Admission process of the University. The information of the existing and past students, existing and past faculty lies in the University in the form of various databases of heterogeneous nature. They may be stored electronically (databases, spreadsheets, word-files, etc.) or on paper as manual files\[^{32}\].

In order to create knowledge from the existing information, we recommend the use of ICT, which will organize existing information and create new knowledge using the following model. The information of staff and faculties is scattered in different files. These files in turn will be cleaned, transformed and integrated and ultimately loaded to data warehouse that will be used for applying data mining techniques. The Association Rule Mining technique is used in the primitive stage to arrive at some interesting patterns. At a later stage other techniques like Cluster Analysis, Outlier Analysis, and Evolution Analysis etc. would be used to generate effective knowledge.

2.4.5 The University Management Software for Sardar Patel University

A Web based software was developed under the guidance of the researcher by a group of students using the Linux as the platform and Java as the development tool. The detailed description of the software is presented in the following chapters. But we would describe one of the modules of the software i.e. the admission module which helps the Academic Section to enter the data of the students aspiring for the Post Graduate courses of Sardar Patel
University and provides necessary reports. The forms were appropriately changed to include all the possible information of the students so that any knowledge can be generated using the database of students. Some of the screen shots of the system is shown in Annexure – I.

For database related processing we have used MySQL, for business logic J2EE (Java 2 Enterprise Edition) and for reporting Jasper Report and JFree Charts over Linux Operation System with JBoss Application Server. The System is accessible over intranet of University.

The database thus created for last five years is used for analysis and creating knowledge for facilitating the administration for various purposes.

2.4.6 Creating a Data Warehouse

Admission process utilizes various files (including admission notification, eligibility criteria for different courses, and other circulars), and databases (including Academic Section Database, Bifurcation Details, etc.). After integrating these data they are processed in order to achieve higher normal form. These data are integrated, cleaned and transformed to create data warehouse as depicted in Figure 2.3.

![Figure 2.3 : Creation of Data Warehouse](image)
2.4.7 Association Analysis

Association rule mining finds interesting association or correlation relationships among a large set of data items. If we are able to find interesting association relationships from large amount of data, it may be helpful in decision-making, strategic management and that in turn helps to improve services to stakeholders. For example, consider a group of students studying in B.Sc. (Physics) and Grade equal to ‘A’ who are likely to opt for M. Sc. (Nuclear Physics). This correlation can be shown by the formula of association mining as under:

\[
\text{Student (X, “B.Sc. (Physics)”)} \land \text{Aggregate Percentage (X, “A”) } \\
\Rightarrow \text{Opt For (X, “M. Sc. (Nuclear Physics)”)}
\]

As we process more information, we find some interesting and useful patterns that help the University to create new knowledge. This knowledge will be stored in knowledge base for future use like comparison among various forms of knowledge and to generate new knowledge. For the above example, we can find trend of selection of course for Post Graduate degree by students who are studying at B.Sc. (Physics). And we can have prediction about how many candidates would be interested to apply for particular course. By external source of knowledge we can find trend, factors influencing this trend like better job opportunities, interest in research or other factors.

By matching external knowledge and internal knowledge, we can address certain issues such as:

- Should we increase intake?
- How many more faculty members needed?
- What infrastructure facilities will be needed?
- What could be the financial requirement?
- What actually industry demands and are we providing this to students?
- Should syllabus of the course be revised, etc.?
This shows case of how association analysis helps to create knowledge and how this knowledge can help in decision-making and strategic management.

**Tanagra**

Tanagra is a free data mining software tool for academic and research purpose. Several methods of data mining are proposed in the tool which includes exploratory data analysis, statistical learning, machine learning and database area. The main purpose of Tanagra is to provide easy to use data mining software and it also allows the researchers to add their own data mining methods.

![Figure 2.4: Data Mining using Tanagra](image)

**Analysis of Data using Tanagra 1.4.44**

We arrived at the conclusion stated above by taking the data set of the years 2005 to 2008 of Admission Master Database. This data was analysed using Tanagra 1.4.44. The same pattern was discovered for the year 2009 also. Hence, now the University can take the decision depending upon the knowledge discovered.
It is found that knowledge thus generated can also create new knowledge by processing. This is depicted in Figure 2.5.

![Figure 2.5: Knowledge Creation](image)

**2.4.8 Knowledge Dissemination**

According to the attributes of knowledge it would be disseminated to stakeholders. The stakeholders of the University include UGC; AICTE; Department of Education, Government of Gujarat; Vice-Chancellor, Registrar, Syndicate Members, Employees, Students & their parents, society, and other interested bodies (including governmental & non-governmental organizations). At the strategic level, graphical representation of knowledge would be a better option to view the entire system with broad perspective and at the operational level various tabular formats give clarity. Applicability of knowledge in University ranges from local to global level. Categorization of knowledge according to attributes helps to identify which knowledge helps in operation management and which in the strategic management?

**2.4.9 Knowledge Possibilities**

Knowledge generation has vast possibilities in various contexts for the model. From strategic level to operational level and from global to local applicability we can have different perspectives of knowledge. In the system, knowledge flows in both ways-from top to bottom and vice-versa. We can have different
bifurcation that may be overall, department wise, course wise, subject wise for admitted students which may be further bifurcated according gender, income, caste, previous result, major subject, etc. All the above classifications can be represented in tabular and graphical format individually or in a combined manner. This will gradually create a knowledge base and also further comparison and aggregation from knowledge base will help to find out other possibilities for creating new knowledge. This extracted knowledge has organization-wide applications for University. Some of these we have discussed in the above case study. The main facets of application of knowledge in decision making and strategic management for University Administration include:

(a) Academic Section
   (i) Intake in courses
   (ii) Fee structure
   (iii) Syllabus
   (iv) University & Industries
(b) Examination Section
   (i) Result Analysis
   (ii) Result vs. Placements
   (iii) Result vs. Admission
   (iv) Overall result
(c) Establishment Section
   (i) Recruitment
   (ii) Promotion vs. efficiency
   (iii) Salary & Wages
   (iv) Perks
(d) Account Section
   (i) Budget
   (ii) Accounting & Auditing
The above applications are a few out of the list of possible applications. Gradually, the knowledge base increases, the application will get broader in various facets of Administration.

2.4.10 Proposed Architecture for Knowledge Discovery Management System for a University (KDMSU)

The above model that we have described has many drawbacks which are listed below:

- The model can be operated by a person who has the knowledge of the Computers, data mining techniques and the ICT tools used by us
- The model may not give correct results if wrong data mining techniques are selected
- The result may be affected if any of the steps are missed
- Data Mining Systems cannot dig out the required knowledge from the given database unless some guidance is given to it.

We propose to develop model on knowledge based management system that will help to find out the best suited methods for educational data sets. Hence, in the architecture (Figure 2.6), different subsystems are shown that will help in knowledge discovery from the given data set. The traditional data mining techniques Association analysis, Clustering and Classification are used in educational domain. But there are certain areas in educational domain which require in depth analysis of data. Here the user is expected to understand the portion of the database he is interested in, the kinds of knowledge to be mined, background of the knowledge useful in guiding the discovery process, interestingness measures of pattern evaluation and how the knowledge should be visualized\[30\]. These data mining primitives help the user to communicate with data mining systems to examine the results of the knowledge discovery from all the angles.
Hence we propose an architecture that would help a user to discover knowledge using appropriate data mining technique.

Figure 2.6 : Architecture for Knowledge Discovery

2.4.10.1 Working of the KDMSU:

The Database Management System which exists in the University is used as a component of KDMSU for storage of data, data retrieval and other related operations. The data may come from various sources like administration database, educational software, online courseware, etc. The Data Preprocessing System provides tools to help in preparing data (by removing noise, finding missing data, finding duplicate data and so on) for data mining techniques. As the data to be presented to the Data Mining System should be clean, most of the time is consumed in cleaning the data (almost 70-80% of Data Mining System). This tool should have the features like accessing data from different file formats, filtering of unwanted data, merging of data sets, data visualization, removal of duplicate data. This tool can be developed using any programming language or one can use the available tools for Data Preprocessing like WEKA, Tanagra, Sumlink, etc. By analyzing the Data Sets, the Data Mining System should be able to select an appropriate method to provide a suitable model or help in extracting patterns of data. The Outcome Envisioning System provides
visualization of the results in the form of models, patterns. This system also helps in interpreting and evaluating the knowledge which is generated and helps in generating the new knowledge. This knowledge will be stored in the knowledge base which in turn can be accessed by the user using the interface provided to the user. The user interface may be a portal. The user interface should provide help to the user to put forward user’s query to the system relevant to domains in different forms e.g. Suppose the user wants to know the trend of course selection in last five years. The data related to Admission Database will be retrieved along with the student information. The user is interested only in the relationship between students and course selection, hence these attributes will be selected for mining. After selecting the attributes, type of data mining method such as characterization, classification, clustering, association rule mining or evaluation analysis is considered. In the above example, the administrator or the user is interested in the trend of selection of courses. Association Rule mining can be selected looking at the requirement and the available data sets. Users should have the knowledge about domain to be mined. This knowledge will help in guiding the knowledge discovery process and for evaluating the patterns found. Interestingness measures are then used to separate uninteresting patterns from knowledge discovered, help the mining process, evaluate discovered pattern. The rules whose support and confidence are below the defined thresholds are considered as uninteresting. Then these discovered patterns are displayed.

2.4.10.2 An Algorithm for Selection of appropriate Data Mining Technique for Knowledge Discovery

1. User gives the requirement of extracting knowledge to the system, e.g. wants to know the pass out students of a particular subject in the last ten years who are/were employed in the industries.

2. The query thus generated by the user is analyzed and if the knowledge for this query already exists, it is provided to the user and step 5 is executed.
3. The user interface helps the user to use the first subsystem i.e. Data Preprocessing System which is used for fetching the information from the Alumni Table. The required functions to clean the data are applied.

4. The cleaned data is then presented to the subsystem named as Data Mining Subsystem where knowledge discovery using the most suited Data Mining Technique which is selected by the intelligent subsystem used to select the method.

5. The Knowledge thus discovered in the form of patterns /models are presented using ‘Outcome Envisioning System’

6. The user is provided the required knowledge.

2.5 An ICT based Framework for Managing Knowledge of University Personnel

We present the Knowledge Management component in relevance to understand the management of personnel in the form of administrator, faculty members and staff members and suggest model to access knowledge about an individual for improving the system. The knowledge about the students will help in understanding their strengths, weaknesses and their whereabouts. This will help in developing a knowledge base of talented human resource in various sectors of economy. The knowledge provided to the stakeholders will be relative to their positions, e.g. a student seeking a course in the University will be interested to know about the qualifications and expertise of the faculty, an employer would be interested in knowing the above parameters apart from others like his/her behavior with colleagues, sincerity and others. These traits will be gathered from the other persons involved with that individuals like guide, peers, students, parents and other stakeholders. This study deals with the designing the appropriate forms for accessing the information from an individual/other related persons to designing the database and using the appropriate Information and Communications Technology (ICT) tools to make the suggested model workable.
In this study we have followed Nonaka & Takeuchi’s model which suggests that knowledge creation process is dynamic in nature suggested methods to manage such a process effectively. There is a spiral of knowledge involved in their model, where the explicit and tacit knowledge interact with each other in a continuous process which leads to creation of new knowledge. There are different areas in an University where the knowledge has to be captured, stored, modified and make it available for sharing and regeneration (Figure 2.7). Faculty and staff are the knowledge assets for the University.

Figure 2.7 : Conceptual Model of KM in a University

They possess knowledge about courses, rules, administration, etc. We have taken a specific area as a part of our study i.e. managing the knowledge of University Personnel and provide knowledge to the stakeholders. Let us take an example of a student who wants to pursue research in a University. The student should have the knowledge about the faculty who can guide him. Such a knowledge about faculty will be useful to others also which is shown in the
Figure 2.8. The related forms to add the required information about teachers is shown in Annexure – II.

Figure 2.8: Diagram Showing Utility of Knowledge of Teachers for the Stakeholders

Similarly, the knowledge about the management, officers and staff will be useful to various stakeholders of the University (Figure 2.9).

Figure 2.9: Utility of Knowledge of Management/Staff to the Stakeholders

2.5.1 Proposed Model

2.5.1.1 Knowledge Acquisition & Storage

Knowledge acquisition is the key component of any Knowledge Management System. The quality of system constructed will broadly depend on the type of data acquired. It is very much essential to understand the areas where the knowledge exists. There may be different forms for acquiring the knowledge. Development of a well defined framework for knowledge acquisition will help to acquire consistent knowledge for the University in general and personnel in particular. Knowledge acquisition is the most difficult and expensive task in any Knowledge Management system.
System. The data come from various sources like field observations, questionnaires, forms and measurements collected from controlled experiments [44]. The process starts after defining various forms that will be filled by the individual, his/her peers, bosses, management, students. The forms for the individual will include the basic information like name, address, qualification, achievements in the form paper publications, seminars attended, and so on. This information will help in sharing the knowledge about the individual with the respective stakeholder. In order to have holistic knowledge about the individual teacher, we need to consider inputs from peers, boss and students. The knowledge may include his behavior, expertise in terms of teaching, intellectual level and other traits which the individual may not be able to describe for himself. The information thus gathered will be processed using appropriate techniques, be entered into the database. We have used MySQL database as backend for entering various forms. There will be some information regarding the teacher that will be available in the form of documents and not entered into the database mentioned above. Document Management System is used to manage the published papers. This information can be kept as link to those documents in the database. The same is true for links of the books published online. The following diagram (Figure 2.10) shows the process of data acquisition and storage:

![Diagram](image)

**Figure 2.10 : Knowledge Acquisition and Storage**
Processing includes analysis of the data entered for individual actors like students, peers and higher ups.

The data provided by the individual is on facts but the data provided by others may be biased. Hence a survey is carried out, where data is gathered from a sufficient number of people e.g. 50 students to rate a teacher. This we can call as the tacit knowledge which is in the minds of the people e.g. the teacher might have written that his expertise is on subject ‘X’ but as per the view of his past students, he might be a better teacher in the subject ‘Y’. These observations are based on the experiences of the students. Another example is related to the knowledge that is required by the Vice-Chancellor regarding the teachers who are academically excellent, administratively powerful and cooperative. This query consists of three portions where the academic excellence can be extracted from the information provided by the teacher himself. The other two parameters are based on the experience of co-workers and higher ups. In order to carry out this type of an extensive study of the domain which is knowledge of the teacher that is to be disseminated, is required. Hence the proposed model helps in acquiring knowledge which is near expected level of accuracy.

2.5.1.2 Knowledge Dissemination and Creation of New Knowledge

We call the knowledge stored about a teacher as KNOWLEDGE CAPSULE for the object TEACHER. These Knowledge capsules will constitute a knowledge base. A Knowledge Management System is embedded with the University Knowledge Portal for disseminating knowledge about University personnel (Figure 2.11). A special feedback system is also developed which helps in improving knowledge about the teachers. Finally, the new knowledge thus created will be analyzed and some more knowledge will be provided to the stakeholders like “the teachers who are frequently invited for expert lectures”, “profile of the teachers more accessed by the students”, etc. In this study we
have considered only predefined structured queries which can be used independently as well as combination of the queries.

2.6 Knowledge Management for Administrative Awareness in the University

The University faces many hurdles running the administration smoothly due to turnover of the employees who retire or leave the organization unexpectedly. This happens due to inappropriate system of storing the knowledge on administrative procedures. A system is required which helps the employees to input their duties in the form of documents which can in turn be stored in a repository. This repository will then be accessible to each employee who can retrieve the knowledge and use it and innovate. As all the employees are not expected to be computer literate, it is needed that a proper interface is designed which guides the users to provide proper input.
We take an example of the administrative setup at Sardar Patel University. The University is divided into different administrative sections which are already discussed in the first part of the chapter. The work in each section is carried out by different staff members. The forms should be designed which help to acquire the knowledge about administrative procedures, the function of that section and duties of each employee.

The tables given below describe the knowledge that is required as input to the system.

**Table 2.1: Knowledge Acquisition Table for University Sections**

<table>
<thead>
<tr>
<th>Section Name</th>
<th>Section Head</th>
<th>Function of the Section</th>
<th>Duties of the Head</th>
</tr>
</thead>
</table>

**Table 2.2: Knowledge Acquisition Table for Employees**

<table>
<thead>
<tr>
<th>Section Name</th>
<th>Name of Employee</th>
<th>Tasks to be carried out by the employee</th>
<th>Detailed procedure to be followed</th>
<th>Documents like forms, etc. Needed to carry out the respective procedure</th>
</tr>
</thead>
</table>

The system thus developed will help all the employees to commence their work in any sections in the University using available knowledge in the repository.

**2.7 Conclusion**

Ever since their inception, Universities have been occupied with the fundamental elements of what we now call 'Knowledge Management', i.e. the creation, collection, preservation and dissemination of knowledge. In this chapter we discuss the different ways a modern University deals with Knowledge Management. We use some examples taken from the situation that we know best in the University. While stressing the fact that Universities have been involved in Knowledge Management for so many centuries, we are to deal with tremendous challenges which modern Universities are facing. One of these challenges is the way we are coping with what is generally called our
stakeholders. Universities are no longer living in splendid isolation. They have their own place in society, and they have a responsibility to society, which expects something in return for the privileges it has granted Universities. We elaborate on these essential changes. It is just one of the developments which will undoubtedly change the very idea of a University. In the past, Universities have shown themselves to be extremely flexible - may not be in the short run, but definitely over a longer period of time. This is made very clear in this chapter by taking a small tour through history.

It is recommended to all the Universities that they should have ICT based Knowledge Management System to improve efficiency and effectiveness in serving the stakeholders at any point of time.