MEASURING COMPETENCIES USING EXPERT SYSTEM: INSTITUTIONAL PERSPECTIVE

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ABSTRACT

Competency Based Management (CBM) has become vital to any firm's strategic position and organizational decision making. The role of Expert System (ES) is to provide a knowledge based information system that is expected to have human attributes in order to replicate human capacity in ethical decision making. In this paper a holistic framework is proposed to review the ES approach that will be practically feasible for organizational settings. It is based on the psychological conceptions of human competence and performance in the workplace. We explain the application of ES that can be used in an institute to systematically assess existing and future competencies required. Using an ES approach to Educational Institute with CBM will be able to more effectively use their limited resources to reap the more benefits from their investments in both people and technology.

Key words : AI; Artificial Intelligence, DSS; Decision Support System, DSS; Decision Support System, ES ; Expert System, Knowledge Base, SCM; Strategic Competency Management.

1.0 INTRODUCTION

Information Technology (IT) has become the important component for the success of any business organization. In today's fast changing business environment the role of IT is changing a lot. Its use has not been restricted to record keeping, processing transactions or viewing the reports and analysis of data but the role has been extended to take decisions and to build strategies for enhancing the business usage from Management Information System (MIS) to the Decision Support System (DSS). The DSS helped the managers to extract the critical information from their huge data in the way they want (Turbain, 1995). With today's dynamic and highly competitive environment, the organizations tend to lose their competitiveness /business, if their employees don't keep pace with the emerging technologies. The transformation from production economy to knowledge economy has provided both the opportunities and challenges. This scenario is true in under developed and developed countries. The organizations require man power with different set of values and competencies which should be productive, creative, responsive and adaptable to fast changing business environment (Stenmark, 2005). So, it becomes impetus to understand the knowledge in the Human Resource (HR) data.

Educational Institute like any other organization are challenged to stay relevant – both in terms of education and research. A review of the Financial Times, The Economist or any magazine that covers Educational Institute leads one to conclude that institutes are under constant assault by industry, journalists and academics alike to justify their existence, relevancy and effectiveness, given the rapid rate of change in today's world.

1.1 Role of decision making in CBM

In any innovative business organization, the Competency Based Management (CBM) has become a very crucial element for effective operation. The CBM helps organization by adapting to quick market changes and rebuilding their strategies and business plans. The CBM has become one of the vital HR tool for managing and developing the skills of employees, recruiting the most appropriate candidate, making effective succession planning and developing the Employee Relationship Management (ERM). CBM involves lots of decision making. By developing Decision Support System (DSS) for CBM, we couple the intellectual resources of human expert along the powers of emerging technologies to improve the decisions making. Decision makers basically

utilize knowledge for taking the decisions. Any Knowledge based DSS not only provides solutions of the unstructured problems quickly but also provides an improved way of communication for the employee satisfaction (Turbain, 1995). CBM is one of the areas which require the domain expert to develop various theories through their acquired knowledge from training, reading and years of experience. These days Artificial Intelligence (AI) tools are applied to the knowledge based DSS. Hence, an Expert System (ES) can be applied to the CBM. It has shown quite promising results to many problem areas such as information systems, information science, business strategies and organization science (Jackson, 2000). Its unique characteristics to simulate human reasoning over the representation of human knowledge and coming to solutions / advice through heuristics methods has attracted the lot of attention for the research work. As the business environment is uncertain and the unpredictable the organizations are turning to AI and ES to develop a knowledge management systems that can provide the basis for future sustainability and competence. (Young, 1999) discusses about the use of neural network in the Financial Management System (FMS). (Tingly, 1999) proposes AI to insurance organizations to offer multiple channels for the rapid response for the customers. There are many such knowledge management implementations using AI and ES that rely upon the mean making and sense making capabilities of AI and ES technologies and humans using them.

We feel that institutes like any other organization have their own challenges. Developing an effective way for managing competence can enable an institute to build stronger links between stake holders while providing timely input into the decision making process. Academic institutes all over the world follow the common pattern to measure the competencies of their employees. The basic human resource component in educational institute is faculties, supporting staffs, team heads, and training and development staffs. They also have a well defined competence metrics in terms of their jobs and their requirements. They too have the competency assessments tools which are applied periodically to assess their competencies. For their existence in the competitive environment there should be customer orientation and the plan for continuous improvements and up gradations.

The purpose and objectives of the paper is

To outline a future direction for the Educational Institute through emerging applications of ES for the Competency Management.
To ensure thee efficiency in the quality of students through the strategic management and development of the competencies of the Faculty, Staff, Resources and etc.
to extend the holistic framework developed with ES like other business organization in the Educational Institute to help the heads in their advising capacity to take decisions in building strategies for the effective business plan.

The main motivation to this paper is there is very few available systems which combine the decision making process with ES to enable the competence management, by formulating the strategies required for any innovative organization. This area has got relatively very little attention but has shown a wide scope. We feel that organizations are facing a huge talent crunch i.e. there is a gap between what they have and what the market requires. They are unable to utilize the tacit and explicit knowledge of their employees. So we feel that the educational institute should take substantial efforts in implementing the technical education which can help the students by not only developing them with all necessary skills and habits but also willingness for life long learning.

With the implementation of the CBM approach in educational institute with the ES approach one can visualize capturing those aspects of decision making which can help to bring strategic reforms in the Education. It will help us to use the knowledge of the domain experts in the form of rules and logics in our system to develop the future plan of action.

This paper presents the conceptual framework in the adoption of the CBM approach through ES application in Educational Institute. The paper is organized as follows: Section II presents the related and other published work in the field. Section III highlights the processes for the CBM. Section IV presents the role of ES to CBM and its SWOT analysis .Section V addresses the educational institute process. An academic conceptual framework is proposed .Section VI frames the requirements for development of ES .It also covers some of the result patterns to develop strategies for the competence management

.Section VII presents the expected benefits .Section VIII concludes the whole paper.

2.0 RELATED WORK

Many Competence Systems are designed nowadays and they are often used as HR tools which help to manage the data repositories. Let us review what work has been done and what new requirements are being proposed by different people in this field. (Lidgren, 2002) develops the range of Competence Systems and also studies the various barriers of accepting these competence systems in knowledge based organizations. (Stenmark, 2002) discusses the usage of Intranet as a tool in knowledge management for the Competence System. (Walter R, 2003) identifies the necessity of innovative unified strategies for the management of the organizational competence. (Schmeidinger, 2005) examines competence based Business development (CbBD) that can help organizations in the effective identification, measurement, combination and integration of organizational competences, which are in the form of human competencies, tools and materials. (Draganidis, 2006) explores an ontology based application that can be used for the competence management. (Keenan, 2005) points a DSS to match the skills of the prospective employees with the needs of the employer. (Huang, 2004) proposes a DSS in Human resource selection which utilizes the Fuzzy Neural Network in evaluating the managerial talent. (Guignard, 1999) explains a usage of powerful and easy to you Internet enabled Expert System for the Knowledge Management. (Malhotra, 2001) looks at the possibilities of AI and Expert Systems technologies for the issues like dynamic radical discontinuous change impacting organizational performance and human sense making process so that their implementation can replace the domain expert for more effective knowledge management.

By observing the above related work we feel that there are very systems that has the capacity to integrate the decision making process with human reasoning and thinking. The ES implementation in this area shows wide scope.

The goal of this paper is to develop a framework with ES that helps the academic deans in their advising capacity to take decisions in building strategies for the Competence Management.

3.0 COMPETENCY BASED MANAGEMENT

Competence can be defined as combination of the intelligence, education, experience, ethics and interest. Competencies are unique resources which is knowledge based and can lead to direct competitive advantage. Competencies are intangible assets which cannot be copied by any competitor.

Competence Based Management (CBM) involves the capturing, evaluating, mapping, assessing and updating the competencies of any organization according to their business plans (Walter, 2003). Competence Management is the way in which organizations manage the competencies of the corporation, the groups and the individuals. It has the primary objective to define, and continuously maintain competencies, according to the objectives of the corporation (Berio, 2005). The CBM focuses on the core competencies required by the organization as a whole rather than the competencies of the individual employees.

Competence Management System can be developed by the breaking of the various activities involved in organization into various sub-activities. The first step is to identify the various competencies to perform the various responsibilities associated with each job role. The next major step involved in the CBM process is the mapping of competencies. It involves the identification of the competencies required to perform a given job. The competencies can be in terms of technical, managerial, behavioral, and conceptual and the attitude required in performing a task (Russell and Norvig, 1995). Then the assessment of competencies is required to find the level of competence possessed by individual. The competence is valuable to the organization only if it can be used in the enterprise and can be updated with the change in the environment. The continuous evaluation of the competence is required for their relevance to enterprise requirements. The various phases of the Competence Management (CM) involve these variations. CBM involves the connection of the organization competence system to the task system and finally connecting the task system to the demand system of the market. To accomplish each of the connection, lot of expertise and time is required.

The various steps are involved in the gap analysis process (See fig 1). The first step is to formulate the business plans of any organization. The second step is to find the available competencies and resources. The third step is to find the required competencies is to find the various competencies and the resources required. The next step is to find the difference between these two sets (existing and required competencies) and helps to find the competencies that have to be gathered through trainings and developments. Thus, this gap analysis clears about the requirement that has to be fulfilled in order to accomplish the business vision of any organization.
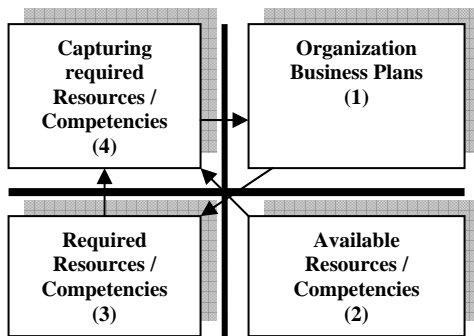

Fig1: Gap Analysis for the Competence Management

Offering technical education has become big challenge to any educational institute. As the students produced must be up to certain levels of quality and should be readily absorbed by the corporate world. So the educational institutes are also striving very hard and looking for a process which can also provide them with some tools that can help to achieve their goals and missions.

So, with the competitive and the complexity in the working environment, one must feel a need to develop a tool to perform tasks efficiently and promptly. One of such emerging technology is the application of the ES in the CBM to enhance the decision process. The knowledge based DSS with ES will offer the capabilities of the human expert to formulate the strategies that are required for the CBM.

4.0 ROLE OF ES TO CBM.

As the educational institutes have to work on the dynamic environment, they have to respond to the variations in the organization trends. Applying ES to such conditions is quite

promising as it provides the knowledge in permanent form. In ES, knowledge base is separated from the processing mechanism. ES can easily deal with the qualitative data. It provides a capturing, magnifying and distributing access to judgment and knowledge. It helps to manipulate large database. ES has the capability to replicate and provide the human expertise. The ES has three distinct modules of information (i) Rules, (ii) Facts, and (iii) Control Strategy (Mark, 1995). This intelligent system can be used for the complex procedure involved in CBM. ES can act as a fast problem solver as compared to humans. Their output is consistent. They can be easily replicated as needed. Its use can free up the human experts to do some other tasks. It can be easily expanded in future by adding more rules as the organization gains experience in using them and some changes in the policies. The ES can also be integrated with the neural network in order to train it some new rules/conditions that were not present at the time of building the ES.

There are very few activities which are performed using ES such as natural resource management. Its use is also seen in the production industry for the planning of the assembly line. It has also shown its implementation in the medicines for the diagnosis of the various diseases and provides suggestions for the cure of those diseases. Nowadays, the organizations are utilizing the powers of ES in the Employee Relationship Management (ERM). Its power can be utilized in the competence management of the organization and firms.

The educational institutes operation in the changing trends in the organizations and their requirements demands the continuous monitoring and strategically analyzing. The use of ES in institutes can provide solutions to the conditions that exist such as student development, faculty development, infrastructure development etc.

We have done the SWOT analysis for explaining the implementation of ES system for the managing the competencies for the educational institute (See Fig 2)

STRENGTHS	WEAKNESS
‣ Replicate Human Reasoning ‣ Easily Affordable ‣ Easily Expandable ‣ Fast Problem Solver ‣ Entrepreneurship Benefits	‣ Domain expertise is usually at their limits ‣ Prove costly ‣ Lack of technical knowledge and expertise. ‣ Lack of awareness
THREATS	OPPORTUNITIES
‣ Qualitative data has to studied with respect to quantitative approach ‣ Adaptability Threats ‣ Cost effectiveness ‣ Resistance to change	‣ Applied to various areas such as Medicines, Insurance, Banks ‣ can be extended to HRIS in entrepreneurs ‣ helps to develop decisions

Fig 2: SWOT analysis of the ES based CBM system

5.0 CONCEPTUAL FRAME WORK:

As already mentioned the objective of this paper is to build a tool using ES that could manage the strategies required by the decision makers for the competence management in the organization.

After reviewing the relevant literature about the competence system, it is prudent that competence depends upon many factors such as changing requirements in the organization, employee development plans, succession planning and emerging trends in the area etc and hence it becomes very important to take all these factors in account for developing the ES. In an institute domain, there are many diverse yet interesting databases ranging from students, faculties, courses, administration, and registrar to training

and developments. One may wish to know in addition to the various information such as how many students are well placed with different organization, how much increase is there in the placement ratio, how many students appeared and passed, how many bagged the university ranks etc., what are trends with in the organization to achieve the goals, what strategies have to be formulated and how. The given frame work develops the process which addresses these types of issues and aids in contributing the increase in the quality of education delivery.

The success of any educational institute can be judged by analyzing the acceptance of its students in the enterprise and the work done to enhance the research and developments. The proposed business process will improve the overall development of the students as per the industries requirements. By developing a learning culture in the educational institute, they can also provide great inputs for the research and developments. In fig 2, one can visualize the effect of the implementation of CBM in any educational institute. This business process helps to develop the raw students admitted through the entrance exams after counseling to the different educational institute .The goals and objectives of the institutes are set by keeping the requirement of the enterprise. The whole process can be seen as a cycle where each activity affects the other activity such as placements & bagging university ranks in any educational institutes will effect its admissions, the requirements from the industries effects the competence requirements in the faculties.
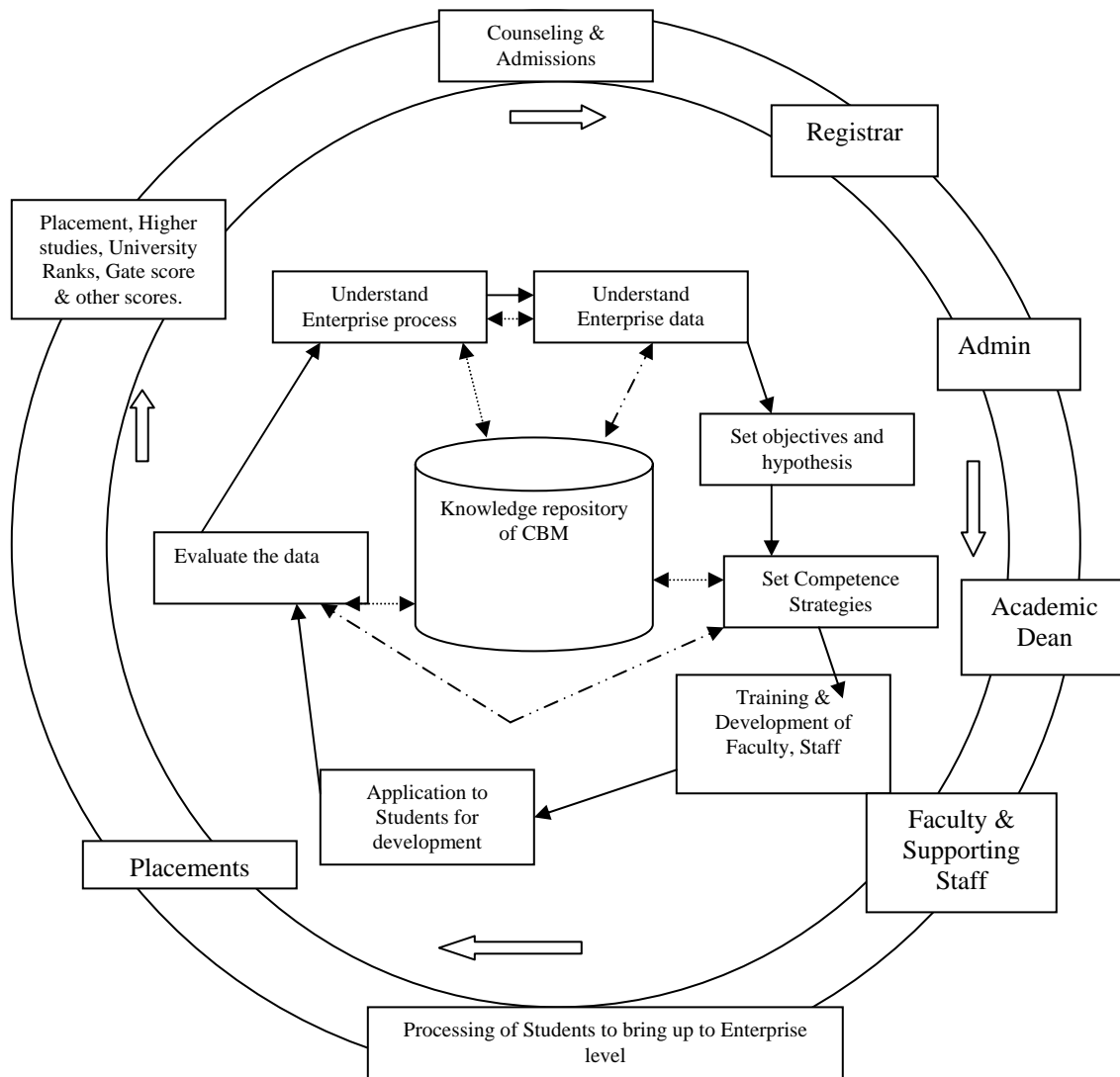
Fig 3 Business Process in Educational Institute with CBM approach

6.0 DEVELOPING THE EXPERT SYSTEM

An ES is an information system that follows human lines of reasoning expressed in rules to arrive at a conclusion from known facts (Mallach, 2002). Any ES consists of knowledge base, which contains the problem solving expertise of the system. The domain expert and the knowledge engineer contribute to the development of the knowledge base of an ES. The inference engine is a program that applies the problem solving knowledge base to known facts. User Interface requests information from the user and sends output to the user.

6.1 Documentation of the As-Is Process:

The documents of the current As-Is Process will be prepared by the interviews with the domain experts and the curriculum developer. The specific reasoning /action behind the decision to particular problem will be extracted and will be framed in the form of procedures.

**6.2 Categorization of the Core Activities**:

Based on the documentation acquired the core activities that are required for the competence management such as profiling, mapping, evaluating, assessing, gap analysis etc. will be identified and the various sub activities will be formulated.

6.3 Develop Knowledge Base Rules

A set of rules/facts will be developed which conclude the appropriate steps to be inserted in to the core activities. These rules determine the steps that have to be taken for the accomplishments of the various subtasks. This step involves transferring of the human expertise in to computer system.

6.4   Inference/Prediction: A   component inference engine will be developed regarding the problem solving technique. It will consist of the procedures which be providing the capability of thinking/reasoning from the relevant information in the form of knowledge base (Mark, 1995).
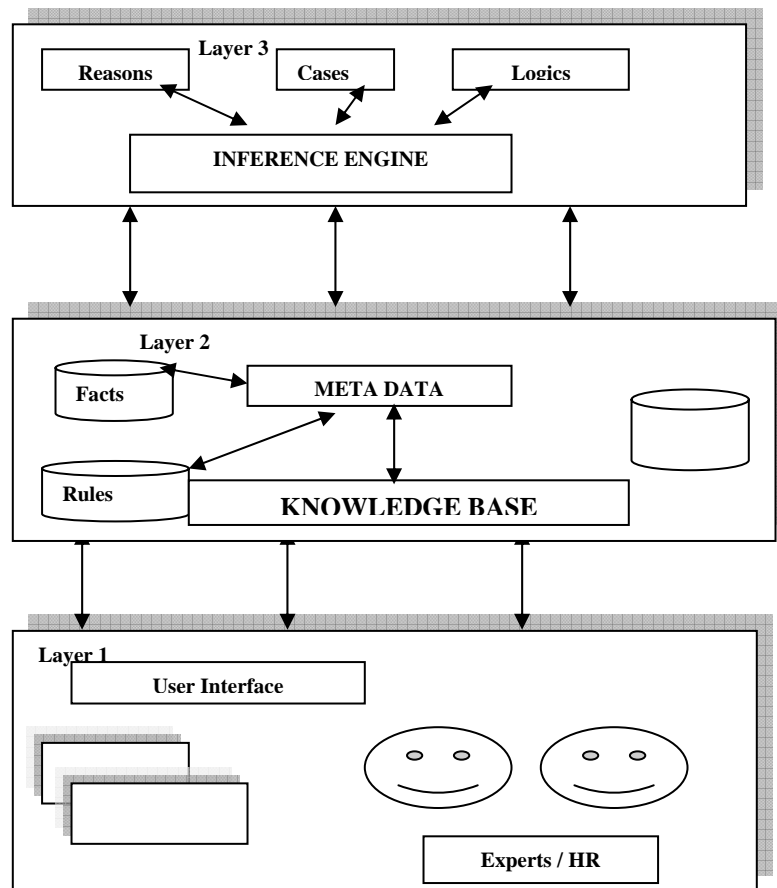
System architecture of the proposed conceptual framework is shown in fig 4. It describes the three layered architecture. The first layer consists of the user interface to interact with the system. The expected users can be the HR department; the Project Managers to handle their team activities and progress, and the employees working in organization. It provides the facility to enter the data into the database. It can help to view the search results satisfying the given criteria by the managers. The second layer consists of the knowledge base developed about the problem area after interviewing the various domain experts and the databases are designed to store the required data. The third layer consists of the inference engine which helps to build the rules, logics by utilizing the experiences and the theories formulated by the domain experts by using various modeling techniques. Hence, it can be utilized to view the overview of the total competence set available at particular time. It can provide us with the comparative analysis of the competencies of the different employee in the organization.
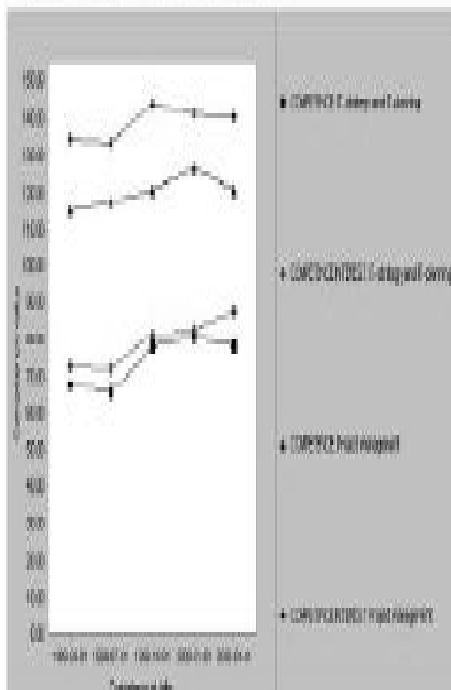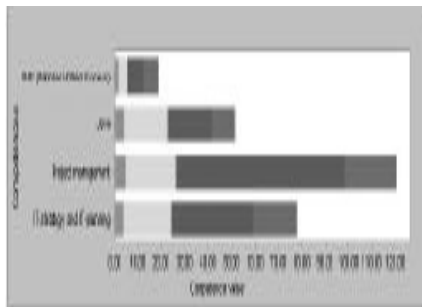
Fig 5: Shows the Competence Variation

Fig 6: Snap Shot of Competence at particular time of different Employees

In fig 5 the variations in the competencies level of different employees working in organization with respect to time. In fig 6, the snap shot of the overall competence of the organization can be seen in the histogram graph. The same information can be available in the linear or the pie charts.

The conceptual view of the system architecture (see fig 7) describes the development of the knowledge flow in any educational institute. This also includes the proactive use of the data to assist the administration, team heads, employees (teaching and non teaching) in tracking and assessing the performance. It also helps to develop the knowledge base that can provide the information required for handling the changing requirements of the enterprise to develop competencies and resources accordingly. Hence, it will provide the technique to manage the competencies strategically. The layered approach provides the facility of separating the data gathering and the data manipulation. The first layer describes the data gathering process through different mediums such as employees (faculties, staff team heads), registrar, administration and other competencies gathering tools. The second layer describes the knowledge base. It is developed by the discussion from domain experts and knowledge engineer. The third layer describes the inference engine used to develop the reasoning based on cases and experiences to reach to solutions as suggested by different domain experts. It helps to do evaluation and assessment and provides information required for the trainings and developments of the employees, resources etc.
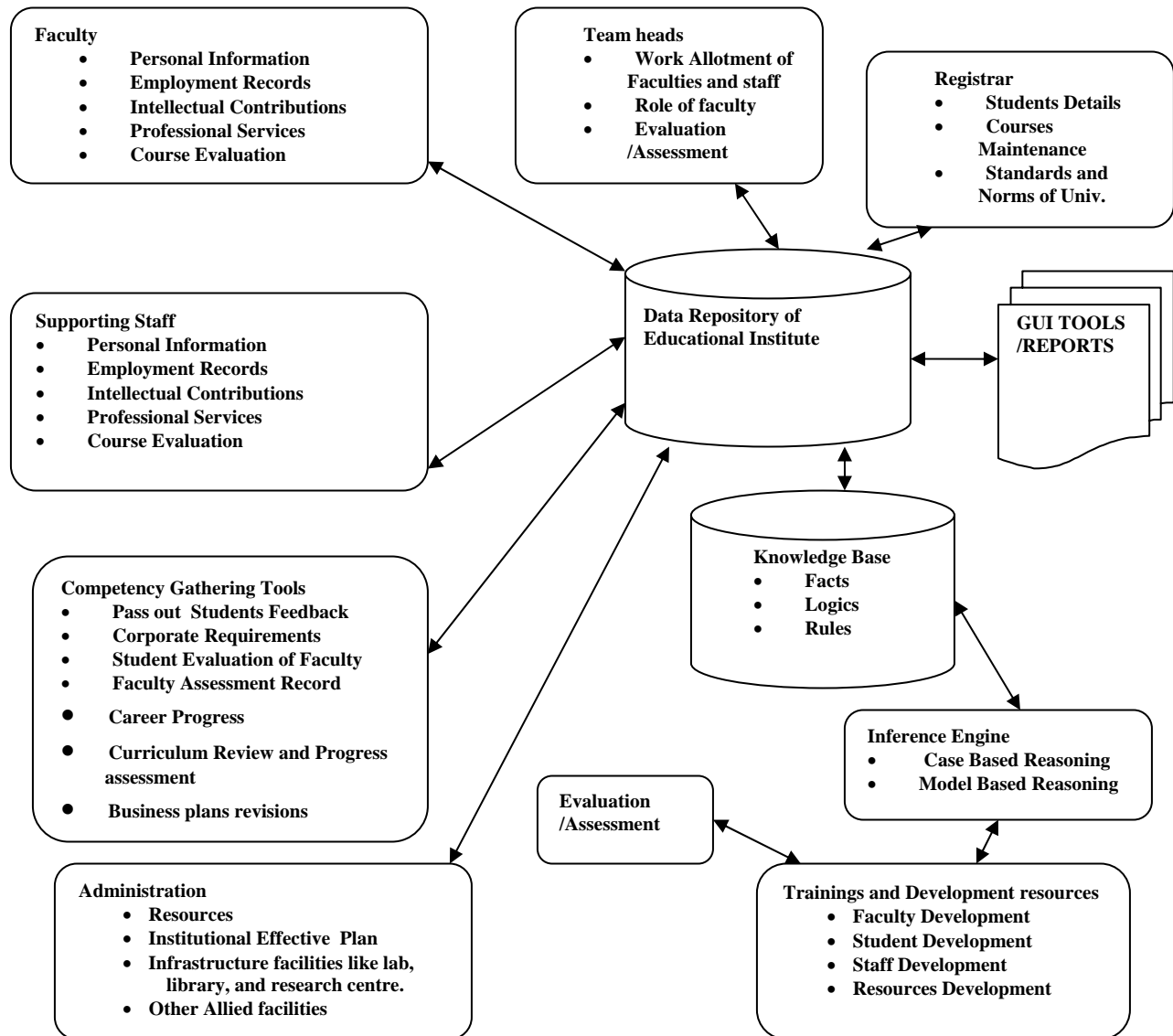
Fig 7: Conceptual View of the System Architecture.

7.0 EXPECTED BENEFITS

The ES developed has a wide scope in the organization. It can be used for various activities for the managing the competence development in the organization. Some of the benefits are given below:

- It will help to integrate the competence development process to the business strategies and will enable the organization to quickly respond to its goals

- It will help to create a culture that rewards success rather than punishes mistakes.
- It will develop the cross functional planning and implementation of information system that links academic instructions and operations.
- It can provide an overview of the total competencies in the organization.
- It will help to take decisions under uncertainty considering complex preferences. It will help the managers to take the decisions /advices by considering all the possibilities required for the competency management in the

organization by tracking the skills of the employee working in the organization, analyzing the gap in the existing and the required competencies.

- It will help to develop the strategies which are required to fill the gap by providing the information for the career development and training.

7.1 Future Work

Integration of the Intelligent Agent with CBM

Intelligent Agents can be developed which can be used to automate certain decision making search & retrievals due to their autonomy, social ability, reactivity and pro activity properties. In CBM, the managers are involved in taking decisions based on the combinations of the judgments and information from their surroundings. The process involves managing the high volume of the data to take the decision timely for the success of the business.

8.0 LESSONS LEARNED

The proposed holistic conceptual framework helps us to find out the challenges faced by the educational institutes in maintaining their existence in the dynamic environment. Like any other business organization are also going for the CBM approach to maintain their quality education. We have studied the various activities which are involved in the competence management process. The powers of expert system have been explored in the process of human decision making.
The ES approach has provided the technique that can be utilized for the competence management of any educational institute or any business organization for the ERM. As a very few work has been done, so this paper can be treated as the n for the future researchers to work.

8.1 Limitations
We have described the conceptual framework for the implementation of CBM approach through expert system. As the CBM applied to the educational institute is discussed in very broad prospect. The typical objectives and cases with the educational institute have not been covered.

9. CONCLUSION

Organizations need to develop a Competence Based Management System in order to maintain

competitive advantage. The ES approach can be utilized to develop the human intellectuals strategically. The Expert System can be used in advising capacity to help Mangers in handling their ethical responsibility in building strategies. In Academic institute the CBM strategies can be implemented by identifying the shortages and needs. It will enable the educational institutes to more effectively use their limited resources to reap the most benefit from their investments in both the people and technology. Thus, we can conclude that such a robust and thriving environment in educational institute will help to quickly respond to their goals and objectives.

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