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6.1 PHYSICAL INFRASTRUCTURE DEVELOPMENT

For any technology to succeed, there is necessity of supporting infrastructure. Infrastructure like transport, power, communication etc. are facilitative set up essential for progress. Although diverse in their service, they play a fundamental role in development and hence can be thought as capital of society. Installing infrastructure does not produce anything or directly contribute in the development process, but promote activities in it[1]. Underdeveloped countries generally have shortage of resources and there is need to have an effective system to utilize them in optimum way. Important role of infrastructure facilities can be given as follows:

Facilitate Functioning of economy: The infrastructure facilities are the wheels of an economy. Transport, for example, moves men and material from one place to another for production, as also for consumption. It is obvious that, more the infrastructure, better the chances of production and investment.

Promotes development: As infrastructures increase, the capital of the society increases and hence it becomes self-dependent in various dimensions/fields introduced and implemented.

Reduces poverty: Infrastructure, which is appropriate for rural economy such as roads, irrigation, power etc., can raise farm and non-farm productivity and employment. If the infrastructure is of good quality and environment friendly, the surrounding environment can also be benefited from it. Examples for this are drinking water and drainage facilities. The physical stamina and health level of local population can be improved.

Non-economic Benefits:

- Social benefits like getting together and social make up of the people from different communities, regions and groups
- Political benefits like political integration of country having heterogeneous groups
- Administration becomes timely and effective
For people oriented development various infrastructures can be developed but they can only realize their full potential if people are involved and motivated. For this information and knowledge are needed to be shared, which is made possible by Information Technology, specifically by systems like Knowledge Based Systems. The service of Internet can be utilized to communicate information regarding development without formal barriers. The group of youngsters is the main user group of such facility and they can be trained to implement, supervise and provide feedback about programme under consideration. Rural universities can establish basic infrastructure like Internet and development information like low input agriculture, commodity prices, alternative crops, market patterns, new techniques, integrated pest management etc. for farmer’s group can be made available on it. Farmers association may contribute in it.

6.2 EDUCATION AS AN INFRASTRUCTURE

6.2.1 Introduction:

Education is a continuous, life long process. The revolution in infrastructure like science and technology has influenced the entire education system. Education technology is one of the effective means of communication, which uses a wide range of instructional media like Radio, TV, Films, Computers etc. The primary goal of a university is to promote knowledge and to disseminate it, and prepare the people to enter in life to assume higher positions in various fields like science, technology, education, business management and entrepreneurship. A university is rightly described as a temple of learning. The frontiers of knowledge in all areas are continuously expanding. We are facing veritably an explosion of knowledge and technology in all fields. In addition, it is observed that every university has not only to keep pace with the fast progress all over the world, but also to make its own contribution.

A university can be considered as a business having many types of problems and situations, among them many are semi-structured and unstructured. To meet the goal positively, we need to increase the efficiency, effectiveness, productivity and timeliness of decision making process involved in various activities related in this business. In problem solving, important methods of computer are very useful and solve it effectively. This application is efficient and appealing because of the role, that computer plays in the problem solving process.
We need to increase the usability of the problem models by providing analysis of solutions, certain methodologies with some criteria etc. Industries have successfully applied computerization for their problems for the above reference. Present advanced field of computer science and IT particularly in terms of developments on inexpensive computing device like PCs and user-friendly software can fulfill some of the above requirements of the business. Some of the activities of a typical university that can be implemented on PC, which falls into category discussed in Box 6.1 (Preliminaries) are summarized in this chapter.

6.2.2 Activities in a University:

Activities in a typical Indian university can be divided into two major categories: Servicing Divisions and Students Oriented Activities. Servicing Divisions include Financial, Accounting & Budgeting Activities, Inventory & Estate Management, Administration, Internal & External communication within unit and abroad, etc. Student Oriented Activities include Admission, Teaching, Examination[11] and other inter-disciplinary Activities like seminars, workshops and convention; extension activities, etc. besides several other activities. The chart of some of the university activities is shown in Figure 6.1 A. An attempt is made to fit few sample activities into possible Computer Based Information Systems (CBIS) in Figure 6.1 B.

Figure 6.1 A : Activities in University
6.3 TECHNOLOGY FOR EDUCATIONAL INFRASTRUCTURE

Present advanced field of Computer Science and IT, in terms of developments on comparatively less expensive computing device like PC and user friendly software can fulfill some of the requirements of the university business by improving the quality of decision making. The following Box 6.1 represents the Computer Based Information Systems Preliminaries in the environment.

6.3.1: Transaction Processing System (TPS): TPS focuses on data transactions (viz. Routine activities like payroll, inventory, record-keeping etc.) for low level management and operational staff. Transactions are collected and processed in a batch to manipulate master information with the help of predefined standard procedures. For each application a corresponding database can be maintained.
### 6.3.2: Management Information System (MIS):
MIS focuses on information for middle to high level management to increase efficiency in structured representation of information. The examples may be production control, sales forecasting etc. This information produced represents the structured routine problems using conventional Operations Research (OR) tools and methods. The database can be interactively accessed to produce structured information.

### 6.3.3: Decision Support System (DSS):
DSS supports decisions for semi-structured problems to produce information to support a specific decision for top level management and to increase the effectiveness of the decision and actions taken by them. Example can be building a new branch, introducing a new course, etc. For middle level control, it helps semi-structured decision making in evaluation and project scheduling type of activities. If operational level face problems of semi-structured environment like scheduling, DSS again helps there too. Similarly, full or partial DSS help can be taken for unstructured decisions like (buying software), (negotiation & recruitment) and (R & D planning) in operational, middle and strategic level of management respectively. For DSS, the impact is on decision, in which there is sufficient structure for computer and analytical aids to be of value but where managers' judgment is essential\[2\]. The examples of such systems are crop-pattern planning, tax-planning system etc. Also, Grouped Decision Support System (GDSS) is used when more than one decision-makers are working together as a group. Within the financial constraints, purchasing books for a department of a university under some critical success factors can be an example of such GDSS.
6.3.4: Expert Systems (ES): Expert System, which is basically a decision making and/or problem solving system, uses inferential logic for unstructured problems. Instead of traditional database, it has a knowledge base consisting of facts, rules and heuristics. Such systems are used for applications like diagnosis, strategic planning, internal control and planning as well as maintenance strategies for narrow domain. MYSIN, PROSPECTS, HRUDAY are some of the examples of such systems[12]. The knowledge base is symbolically manipulated by non-algorithmic way of processing, to produce advises, explanations and self-learning. The real impact of an ES lies in the ability to harness and make full use of the scarce resources: the talent and experience of key members of the domain experts.

6.3.5: Executive Information System (EIS): This system provides information to the senior executives for decision making process, environmental scanning and focussing on control strategies for external, online, corporate database. These systems provide extremely user-friendly interface for the executives in their own decision making styles for timely and effective tracking and control. It also provides drill down capabilities. The example of such EIS can be an immediate transfer of a branch manager in a company.

6.3.6: Executive Support System (ESS): This system supports executives particularly for their planning, analysis, communications in addition to their information need. EIS helps to understand the past and present position of the environment, but it does very little to visualize the future. ESS contributes little more in the same direction. In real life all EIS and ESS are developed and implemented on experimental base, to learn their development process and its usage[3]. In general, both ESS and EIS should have access to public database, aggregate financial information, critical non-accounting data; such as customer satisfaction or staffing levels and external data; such as economic indicators and competitive or marketplace information[5].

Box 6.1: Computer Based Information Systems Preliminaries
The evolutionary path of the Computer Based Information System is summarized in Figure 6.2.

Figure 6.2: CBIS Tree
6.4 PROPOSED EXECUTIVE EXPERT SYSTEM (EES) FOR THE ENVIRONMENT

6.4.1 Introduction:

The proposed EES is a combination of an Executive Information System and an Expert System. University executives can use this approach for decision making and/or problem solving tool to take timely and effective decisions. The hybridized model for EES is described as in Figure 6.3. Here the traditional database, model management system with few forecasting models and expert system are combined under one shelf[9].

![Figure 6.3: Hybrid Approach: EES](image)
6.4.2 Examples of such EES:

Many socio-economic applications regarding the training & enhancing the technical skills at remote level, preparing programmes for adult education and awareness for special group people etc. can be candidates for the proposed EES. At university level some uses of the system can be quoted as follows:

(i) University Examination Result Decision Making System: The university executives are supposed to take decision, which is affected by many uncertain and fuzzy parameters like present situations, current policy of the university, past record of the students, level of gracing of marks and several direct & indirect factors. Also, the executive has to think on the future impact of the decision. For this problem, the EES approach leads to an effective and timely solution to prepare a final result, while considering of some/all factors with different weights making mal practicing minimum; and

(ii) Grant Management System: A committee of executives jointly considers the usage and distribution of the grants & funds given to the various universities in the country by any funding agency like University Grants Commission(UGC) level. The amount of money and other facilities given to a university is determined by the UGC executives team, which requires knowledge about the present scenario of the university network, its work and efficiency of each university and proposed plans of the university to use the loans and grants. For this matter, it is desired to evaluate the plan against the present government policy, past few years' record of the university and present financial condition of the university with some forecasting. To satisfy information need of executives and to solve problems intelligently, it is needed to have an EES system. The following Figure 6.4 describes the situation graphically.
(iii) To determine Students Education Policy at different level. The education policies either at department level or at university level play a wide role in the career of the students. When students come out from the institution, it may happen that the market demand is changed. To overcome these situations, the education policy should consider future market needs and demands of manpower and technology. This forces us in introducing a forecast model and knowledge about the course contents, technology, its real life use and facility available at the unit. The forecast model and knowledge base of an EES may serve efficiently for determining education policy.
Also for the certain applications, with the characteristics of an ES, we may achieve some of the following characteristics of an EIS approach for smooth operations:

- Through Multimedia: the ability to combine graphical, tabular and textual material[5].

- Through Communication Network: the ability to send information along with any comments from one executive to another and combination of information.

- Through DBMS & Model Management System: the ability to monitor and highlight critical success factors for an individual user's responsibilities.

Also many of the activities in the university business have repetitive nature for certain part of the task and hence efficient communication and/or automation definitely increases the output. In addition, inheritance and/or polymorphism can be observed in many of the activities and observation of performance can be done with respect to time. Beside inheritance and polymorphism, encapsulation is suggested for certain activities and so it is suggested to have an object oriented approach while automating the activities in such large business. The Faculty Information System could be the example of such activity. Thus, an object oriented approach for some of the activities are suggested. We can also combine such design under one common library and this library can be used as a Global Object Design Library for future use. Figure 6.5 represents the relationship of CBIS in the environment.

On the other hand while seeing in depth, there may be little difficulty in forming knowledge base and forecasting model. For many situations it is difficult to collect knowledge without a problem to get solution, as most of the intelligence is stored in subconscious mind of expert. The Knowledge Engineer plays a key role in extracting knowledge form experts and hence the creation of knowledge base partially depends on the communication skills of the engineer. Also, he has to compile several experts' knowledge, which may conflict from one another. Uncertainty, inconsistency and incompleteness of the information can create problems not only during acquisition of the knowledge, but in the forecasting model also.
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Figure 6.5.A: Relationship with Other CBIS

Figure 6.5.B: Relationship of Entities in the Area
6.4.3 Multimedia Databases in Students Information System: An Example:

As an illustration, we consider the seven inter-related data stores in different media to store textual, animation and graphical information for students, courses and faculty members of an institute. According to the application, set of rules can be formed to access these databases and hence achieving little more, intelligent support for executives. This example of multimedia database followed by few rules, which might help in course selection for faculty members (to teach) and students according to their interest. Table 6.1 gives the example of multimedia databases.

<table>
<thead>
<tr>
<th>Table 6.1: Multimedia Databases in Students Information System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STUDENT</strong> <em>(STUD-CODE, NAME, BIRTH-DATE, ADDRESS, EDUCATION, IMAGE-CODE, GRAPH-CODE, ...)</em></td>
</tr>
<tr>
<td><strong>STUD-IMAGE</strong> <em>(STUD-CODE, IMAGE-CODE, ID-PHOTO, HAIR-COLOUR, EYE-COLOUR, ...)</em></td>
</tr>
<tr>
<td><strong>STUD-GRAPH</strong> <em>(STUD-CODE, GRAPH-CODE, IQLEVEL, INTEREST, CAREER-GRADE, HOBBIES, ...)</em></td>
</tr>
<tr>
<td><strong>BATCHYY</strong> <em>(STUD-CODE, IMAGE-CODE, GRAPH-CODE, COURSE-CODES(1...Max), RESULT, ...)</em></td>
</tr>
<tr>
<td><strong>COURSESYY</strong> <em>(COURSE-CODE, FACULTY-CODE, TOTAL-NO-OF-STUDENTS,...)</em></td>
</tr>
<tr>
<td><strong>COURSE-BASE</strong> <em>(COURSE-CODE, COURSE-NAME, REFERENCES, ...)</em></td>
</tr>
</tbody>
</table>
6.4.4 Few Rules to Build a Knowledge Base for Course Selection for Student Information System:

(i) IF STUDENT(EDUCATION)='MATHS' AND 
    [STUD-GRAPH(IQLEVEL) > 5 AND STUD-GRAPH(INTEREST)='LOGIC'] 
    FOR STUD-GRAPH(STUD-CODE)=STUDENT(STUD-CODE) 
THEN IF COURSESYY*(TOTAL-NO-OF-STUDENTS) < 25 
    FOR COURSESYY(MATHA001+) THEN 
        SELECT 'MATHA001' 
    ELSE 
        IF COURSESYY(TOTAL-NO-OF-STUDENTS) < 25 
        FOR COURSESYY(MATHA002) THEN 
            SELECT 'MATHA002' 
        ELSE 
            SELECT 'MATHB001' 
        ENDIF 
    ENDIF 
ENDIF 

(ii) IF STUDENT(EDUCATION)='LINGUISTICS' AND 
    [STUD-GRAPH(IQLEVEL) > 5 AND STUD-GRAPH(INTEREST)='LITERATURE'] 
    THEN LIST COURSE-BASE( COURSE-CODE, COURSE-NAME, REFERENCES) 
ENDIF 

(iii) IF BATCHYY(AVERAGE(RESULT)) > 60% AND 
    FOR COURSESYY(COURSE-CODE) = BATCHYY(COURSE-CODE) 
    AND COURSE-CODE IS IN {FACULTY-BASE(AREAS-OF-INTEREST)} 
    THEN LIST COURSE-CODE 
ENDIF 

(Here * shows Corresponding Year In Four Digits, e.g. COURSES1999 for 1999 and + a Course in Mathematics)
In the similar manner, the multimedia information about the people and area under development can be stored and rules can be formed. Such multimedia database would be helpful to the executives in identifying, analyzing and selecting beneficiaries for different schemes at administrative level. The examples are to pass loans for animals and support structures for agriculture and other business, drought prone area development or such special project monitoring etc.

6.5 CONCLUSION

This chapter describes various activities in a typical university environment and the role of Computer Based Information Systems in achieving efficiency, higher productivity and timeliness in the same environment. It also highlights different types of CBISs besides the proposed Executive Expert System for guiding the executives for decision making process in different activities. In a narrow domain of given field, this kind of the system with intelligence, forecast and information support will be very useful to take decision taking and what-if analysis. These decisions can be directly communicated via computer network or through network model of the system. The explanation and reasoning modules of the expert system will serve executives to quench the thirst of the knowledge about the process of decision making and hence this EES can be used to train executives.

Special universities at block/village level can be planned for technical education and the proposed EES can be helpful in various activities for the same. The ability to perform in users own language can be very useful in collecting and understanding user problems and requirements for development purpose.
6.6 REFERENCES


