6.1 Conclusion

The Indian Higher Education System, at present, is facing many challenges arising out of globalization and liberalization. The global institutions of the twenty-first century are already evolving, who are gradually moving towards becoming virtual organizations powered by Information Communications Technology and Management Information System. A shift in outlook can also be noticed where education has now become a marketable service rather than a social service. Moreover, the use of Information Technology in the field of education is eliminating the concept of jurisdiction of a university, and creating IT enabled facilities such as distributed classrooms. These situations create competition for colleges and universities, particularly accelerated with the opening up of education sector to global competition, and will be resulting into a threat to the existence and survival of weaker institutions.

Another aspect that draw significant attention is the fact that many weak institutions, particularly in rural, semi-rural and in under-developed areas are facing resource constraints that include shortage of manpower and faculty besides infrastructure. The XIth Plan has advocated the formation of cluster-colleges and universities as a remedy to the problem. IT based appliances & applications and IT-enabled services through networked environment are expected to be deployed by these clusters for optimum
utilization of resources, and provide better ‘just-in-time’ service to its end-users to fight global competition.

The design of a ‘Logical Model of Management Information System’ for cluster-interlinked educational institutions (as shown in Figures 5.2 and 5.3) is the ultimate outcome of the research. Such a model may be considered helpful in easy access and exchange of valuable information and data amongst the colleges and institutions, thus helping the institutions and the colleges in the cluster to operate economically in wider areas and with better technological and operational effectiveness. Such an attempt of a logical design of a M I S, keeping in view the organizational and management system of the institutions in West Bengal, support the present and the future day needs for a user-friendly Uniform Mechanized Office Maintenance System to run successfully in offices of a cluster of educational institutions of higher education for operational efficiency and economy in scale, and may thus be considered as a step towards the development of an ‘ERP for Indian Educational Sector’. The present research work can therefore be considered as a time relevant initiative in developing an IT-enabled better administrative technique for educational institutions of higher studies in India and particularly that in West Bengal.

The MIS Model as generated through this research work is compliant with the essential features that an information system should contain. It is designed to generate end-results through integration of procedures and data-files on the basis of one-time entry of data into distributed files setup and providing automatic relation of data among sub systems and automatic cross referencing among files, and accessible from a centralized control point through Systems Administrator. The database is designed to cover information on personnel, academic, students, facilities, financial and
auxiliary activities, which are re-organized in four modules such as staff administration, student management, finance and general services and also library management as a part of the students’ module.

An information system suitable for cluster-institutions should have certain essential characteristics: standardization, accessibility, e-flexibility, e-maintainability and security. An IT-enabled information system is different from the traditional modes of information processing. The system should be so designed that a user can obtain just-in-time information. Identification of the critical information points, i.e. where certain management processes are carried out, calls for assessment of the management structure of the institution. Any element in the system should carry the same definition for all areas. Codes to identify activities must be standardized for all uses. Computer programmes should be capable of modification when there are changes in the policy and its resultant regulations. There should be only one source of updating any particular item of information. Updating should be handled in batch runs at the computer. On-line updating should be a carefully controlled process. Adequate back-up procedures must exist to recapture information lost through error. Confidentiality of data must also be provided for.

The MIS Model as drafted through the present research work is expected to provide such an information system that contain the required provisions to generate documents on personnel data, related to the up-to-date biographical record, current activities, publications, salary budget, payroll and benefits etc. Database may cover academic information relates to the past, present and forecasted programmes in academic, research and public service which include data relating to course offerings, degree programmes and research projects, information on faculty time distributed
among teaching, research, and committee works. Student data may relate to admissions, academic records, extra-curricular and follow up records, scholarship, financial aid, accounts due, medical records, housing and counseling data. A comprehensive data base of students can provide information on student achievement before and after graduation and can serve as a key variable in the evaluation of the institution's educational programme. Individual programmes can be evaluated from data on grades achieved by students changing to and from various curricula. Infrastructure data may relate to land, buildings, classroom and laboratory space, equipment, special laboratories and maintenance. This would help to determine optimum utilization of facilities by activity, to assign rooms for classes, to maintain inventories and also to find joint uses for some resources. Financial data may relate to fund utilization & accounting, payroll information, income, expenditures and student financial assistance. Auxiliary enterprise data may relate to hostel management, extra-curricular and sporting activities. In short, the information system derivable through the MIS Model is expected to furnish appropriate organized, detailed information that support the traditional reporting requirements, suitable for historical use as well as for planning and budgeting purposes.

6.2 Recommendations

6.2.1 Developmental Strategy

Two generic strategies can be thought of, for the institutions that compete for growth and survival:

- a value added strategy for the traditional elite institutions which uses IT as the tools and techniques to manage the administration and deliver highly flexible but innovative state-of-art educational services;
• a cost-based strategy which focuses on using IT to develop, manage and deliver quality programs anywhere, anytime for a restricted range of educational and related services to a mass market.

On review of the IT-enabled management structures of some of the affiliated colleges and university departments in the case study, it is observed that in pursuance to the government policies, the development of centralized infrastructure is taking place to provide some technical services like on-line admission and sharing of strategic educational and infrastructure resources amongst groups of cluster-institutions. As technology becomes more pervasive in all aspects of teaching and administration, both academic and general staff roles are likely to get transformed. The approach to deal with these changing situations in Indian higher education system, particularly that in West Bengal can be a hybrid strategy - a combination of the integrated approach with a central unit managing the integration of teaching-learning and its administration with IT, thereby ensuring optimum utilization of resources and economy in scale; and the distributed approach in the ‘bottom up’ line in rendering educational services and maintaining local information through their local server-clients system. Based on such a strategy, some innovative steps can be envisioned.

(a) Member institutions of the cluster may move towards specialization in certain field of study based on their own strength and make their unit a center of excellence in the selected area. This strategy will help them render best service in the field, thereby help them fight emerging global competition in the educational sector.

(b) The member institutions can offer their specialized result-oriented services to all the students in the cluster against a fee structure, worked out through cost-benefit analysis of their resource sharing. Provisions should be there for the students to move
to different campuses in the cluster to get the best specialized semester lessons – both in on-line and class-room mode.

(c) To support such cluster-based educational initiative, syllabus pattern must be reformed through semester-wise inter-disciplinary study programs, keeping in view the industry needs. Visiting lectures and industrial internships need to be arranged against special pay to the resource persons.

(d) These arrangements need a cluster-centralized MIS to support the accounting works in (i) fees payable by inter-college students against service taken from different campuses (instead of the conventional fees payment practice in their enrolled colleges only); (ii) consolidated students’ attendance record-keeping; (iii) maintenance of visiting resource person’s class-taken schedule and special pay; (iv) inter-institutional contra-clearance of service charges for sharing infrastructure resources amongst each other; and (v) inter-institutional contra-clearance of joint costs of maintaining common infrastructure and inter-institutional extra-curricular programs.

(e) To support a cluster-centralized MIS, a center has to be build and maintained. A team of technical experts under a Systems Manager has to be given charge to look after the accounting and record-keeping works of cluster-based educational programmes, maintaining the system and the central server on day-to-day basis, monitoring the authentication and authorization matrix of the functional modules of all the member-institutions in the cluster, perform the data warehousing and data mining works of the distributed system, and generate routine and non-routine MIS Reports on behalf of all the members in the cluster. The cost of maintaining the centralized infrastructure of the MIS Center has to be shared by all the members on an equitable basis.
The strategy as envisioned may be represented by the help of a diagram as shown in Figure 6.1.

In order to meet the goal of an effective system in the suggested MIS model, the cluster-colleges will need to maintain an integrated information system and practice uniform standard parameters.

The colleges in the cluster should expect data or information to be:

- collected, once only, at the appropriate, earliest time
- held, processed and communicated in electronic form wherever possible
• held and updated centrally in a master source from which users extract relevant items as required
• accurate and relevant
• usable
• secure
• retained and disposed of according to the current college retention schedule

Systems should be maintained and appropriate reports provided to managers and teams by:

• MIS - student records
• Personnel – staffing
• Finance – budgets, financial statements

The network and ICT infrastructure and equipment should be maintained and supported by the Central Computer Services team. A central monitoring center should be established to process all enquiries, applications and enrolments. They will:

• co-ordinate and review developments in systems for the management and dissemination of college information
• advise the Board and Executive on the implications of relevant legislation
• draft and review any necessary policies relating to the management or communication of information.

Key outcomes from such a system development may be:

• continued development of the staff intranet as the primary source of college documents and forms
- continued development of on-line student data collection and processing in full-time admissions, part-time enrolment and progress tutoring
- all curriculum areas will have electronic student tracking systems
- further dynamic software links between key business support systems (Students’ support, Library Management, Finance, Personnel), and between these and their users
- all internal transactions and transfers of data will be carried out by electronic means, and transactions, transfers of data and communication with other organizations will be carried out by electronic means wherever possible.
- development of further electronic database systems each year, according to needs, to make administrative tasks easier and more effective
- all staff will be aware of data and information issues and responsibilities, including legal compliance
- production of a ‘retention schedule’ for records and documents
- establishment of an effective college archive facility, both paper-based and electronic
- promotion of a culture of information sharing.

The Indian higher education system of tomorrow may thus be seen as a collaborative system that incorporate the fruits of the developments in information technology and management information system in the governance of educational institutions based on the education policies of the Government of India. For the implementation of such a model, the strategies in operational management that finds its relevance include (i) feasible cluster formation, (ii) member institutions in the cluster move towards specialization in certain field of study based on their own strength and make their unit
a center of excellence, (iii) the member institutions offer their specialized result-oriented services to all the students in the cluster against a fee structure, worked out through cost-benefit analysis of their resource sharing, (iv) syllabus pattern reformed through semester-wise inter-disciplinary study programs, keeping in view the industry needs, (v) a Central Monitoring Unit to be build up and maintained under the supervision of Cluster Systems Manager to support the cluster-centralized MIS, and the cost of maintaining the centralized infrastructure of the MIS Center to be shared by all the members on an equitable basis.

6.2.2 Formulation of the System’s Security Policy Statement

It is essential to formulate a Systems Security Policy for the individual institution and cluster-institutions. Such a Policy Statement is drafted as below.

**Systems Security Policy Statement**

- **Environment**: The Local Servers of the member institutions and the Central Server of the cluster must be kept in separate secured air-conditioned well lit strong room/s with restricted entry to visitors or unauthorized persons. The Central Server must have a 24-hours power backup provision through a digital converter attached with it. The client machines may be kept in the departments under the control of the department head. The responsibility centers must be clearly defined.

- **Selection of Technology**: The client machines should be desktops with standard Pentium IV configurations. The local servers may also be Pentium IV with higher configurations than that of the client machines. The Central Server must be a branded server system in the category of a mini-computer system or preferably a lower-end mainframe system. The client-server
machines may be connected through a LAN, with ADSL Modem with wi-fi router. The inter-institutional connectivity may be done through Internet in case of the geographically scattered campuses, though Intranet option is more preferable particularly in inter-departmental clusters (like Jadavpur University, Calcutta University Rajabazar campus, etc.). Apart from the inbuilt ‘Uniform Mechanized Office Management System’ software installed in each of the campus, Windows based operating system, UGC approved ‘SOUL’ software for library management and RDBMS environment through Oracle are preferred. LINUX environment may be the next option to be selected.

- **Additional Hardware Protection**: Some additional re-programmable card which has its own memory and software called Access Control Card, may be inserted on the PC. The user can program up to ten complex account codes. Anyone wanting access to a PC has first to pass through authentication routines through this card. Only when he/she passes, is allowed to access to the PC itself. Through this, the basic problem of preventing access to the operating system of the PC can be solved to a large extent.

- **Refresher Training to Staff**: Short-term training programs at regular intervals, once a year, may be arranges to promote a culture of security consciousness and ensuring up gradation of technical knowledge for the operational and technical staff.

- **Antivirus Protection**: Updated anti-virus and firewall softwares must be installed with the servers and clients in the system.

- **Data Backup**: External hard-disk must be used to keep backups of all the files in the system every month, and must follow the principles of data
warehousing. Such backup activities must be done both at the local level as well as in the Central Processing & Monitoring Cell of the cluster-institutions.

- **Limited Access to System and Data:** Identification of authenticated dignitaries and authorization to get access ensure that only a given user, terminal or other resource, can access data to which permission has been granted to read, write or alter. Thus a matrix can be created to indicate which users have access to which file, records or fields. If the user request passes the matrix, he/she is allowed access. In cluster-institutional management, the system monitoring work may be entrusted onto a Systems Manager appointed by the Board of Association of the cluster-institutions. At the local level, the Principal and his nominated operational and technical persons may have access to the system.

### 6.3 Limitations of the Study

#### 6.3.1

The Management Information System Model of cluster based educational institutions has been designed, keeping in view the educational policy of the Government of India that exist at present and is projected to exist in future. So the design of the Model is compliant with the Government rules and regulations that are applicable in the administration and management of the government funded universities and colleges in India (particularly that in West Bengal). Though the basic format of the design is kept universal with provisions for revision, the output requirement analysis is done strictly based on Indian rules, regulations and educational policies. So, with the change in policies and regulations, the inbuilt calculations that generate output reports and the design of report-formats will need revisions from time to time.
6.3.2 The State Policy demand socialistic oriented welfare service rendering approach from educational sector rather than to run strictly on profit maximization business model. As a result, many of the colleges operate from rural or semi-rural locations with weak financial and operational infrastructure. The recruitment policy in college and university has the limitations to appoint IT experts with high pay at par with commercial IT firms. The result is that there is scarcity in well trained IT experts, willing to work full-time in rural locations. The present time demands technically trained non-teaching staff, which require replacement of older generation with new workers acquainted with the new ways to do the same old works. Such replacements are not always feasible because of socio-economic and political considerations. Though the present MIS Model is designed after keeping into consideration these factors, it is required to be made more user friendly and simple to operate by the existing staff with little IT orientation. As the system will operate through a RDBMS based Transaction Processing System, the basic data entry works at the grass-root level also need some operational training and political willingness to work in new methods.

6.3.3 The MIS Model so designed is not an Educational Enterprise Resource Planning Model that generate ‘just-in-time’ information in real time, but a system to organize data into functional information module-wise, and then to generate object oriented management information based on the functional information so generated through a transaction processing system. Therefore, the system so designed will run in asynchronous mode and not in synchronous mode like ERP Applications. ERP Packages can generate any-time up dated object-oriented information in real time to Decision Support Systems, but the
present model is designed to produce historical information for operational level of the management, very fast, accurate and with better efficiency. The system is designed not in line with the Educational ERP because that is not needed in our environment at present, where our educational institutions are required to follow the educational policies and financial directives of the State and cannot operate like commercial multinationals to base their business model in line with profit maximization principals. However the design of the present model have provisions for upgraded to an Educational ERP. If the works of data entry through multiple terminals of all the modules are designed on the principles of data redundancy and normalization, and the management of data, its distribution and consolidation through data warehousing and data mining are planned through real time operations in synchronous mode, the present MIS Model can become ERP compliant.

6.3.4 The major goal of computer-based information system is not merely to do the processing of data generated by business operations, but to provide information that support management in decision-making. The present MIS Model is designed to be an integrated system that gather data in a manner consistent with daily program operations, and make that data available in a variety of formats, but it lacks the feature of generating decision support information automatically. It is therefore, not yet a Management Support System, but have the provisions to be upgraded.

6.3.5 The present research work is intended to generate a logical model of MIS and not the development of a software solution. The analysis followed the way as guided by the Waterfall Model for systems analysis and design, which
required the work of preparing data flow diagrams of the different operations as obtained through Requirements Analysis. The present case study is done to get the overview of the system, for which DFDs up to second level are prepared to get the overall picture of data flow of the functional modules, which is sufficient for the construction of the logical MIS Model. However, for the practical work of systems development through software solutions and its installation and testing, DFDs up to fifth level may be required, which is beyond the scope of this research study.

6.4 Scope for further Research Work
The MIS Model so designed is not the ‘Enterprise Resource Planning’ model that can generate ‘just-in-time’ information in real time. The design of the present model may be upgraded to that of an ERP through further research by incorporating on-line transaction processing system in Client-Server Architecture. The construction of a ‘Geographic Information System on Educational Facilities Management’ linked with the ‘Educational ERP’ may be the further extension to this research work.

With an ability to combine a variety of datasets in an infinite number of ways, GIS is a useful tool for nearly every field including governance of cluster institutions. GIS is as dynamic as the teachers and youth group leaders who use it to enhance the education experience through explorative teaching-learning methods. The administrators may use it for finding the real time strategic data required to monitor the group performance, scenario analysis, logistic management and in decision making. GIS may work together with Integrated Workplace Management Systems (IWMS) and Computer Aided Facility Management (CAFM), as they have the ability
to support the broadest range of facility management activities more efficiently and effectively than either one independently. The visualization and data management capabilities of GIS and the geo-database provide landscape-level visualization and the tools and technical infrastructure to generate and manage location data, including very precise locations, which are required for truly comprehensive and integrated management.