

Review

E-management development and deployment strategy for future organization

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In today's global networked economy, integrated information system is a vital fundamental to a competitive advantage. In order to survive or succeed in the future characterized by radical pace of changing, organizations need to think of ways to integrate, automate as well as intelligentize their operational systems, both internally and externally. This paper firstly conceptualizes what a future organization is to establish a possible objective to achieve. Secondly, it explains the definition of the so-called e-management with some key principles interpreted. Thirdly, the conceptual design of e-management is proposed from both aspects of attributes and strategies such as database design strategy and application design strategy. Finally, some advices are provided on how to prepare for the implementation of e-management, leaving how to practically implement it for our future work. Worthy to note, all the strategies suggested in this paper have already been successfully experimented by two universities in Malaysia.

Key words: E-management, organization, life cycle, artificial intelligence.

INTRODUCTION

Organizations always find difficulties in implementing an IT Project (Kartam, et al., 2000; Marco and Federico, 2006), especially when relative theories are hardly to be taken advantage of in reality. For example, the standard development life cycle (SDLC) has been proved to be a good and structured approach for the development and deployment of IT project (Arthur, 2008; Cathal, 2001). However, enterprise-wide IT project is not a straight forward project focusing only on itself; but rather, it relates 100% to the environment and human beings in the organizations.

According to William Lekse (2009), millions of dollars were spent on big enterprise-wide IT project, but the return on investment was unfortunately very less than expected. Thus, many organizations are not willing to invest in enterprise-wide IT project, or they do not dare to invest in a large scale enterprise wide project (Hashim et al, 2010). How this happens? Isn't there any strategic method to ensure the success of the project, so that every organization can enjoy the benefits of information technology available today? Or basically, is it worthy or needy to risk their fortune to invest in enterprise-wide IT

project? (John and Robert, 2002; Andrea and Astrid, 2006; Fumei et al., 2010).

This paper introduces strategic and practical approaches to implementing successful enterprise-wide IT project. It attempts to cover all the critical elements that deserve serious considerations by the organization before the project takes off. The proposed strategies have been experimented by two universities in Malaysia. The first university took around 4 years to complete the whole e-management project costing about 10 million dollars. The second university, adopting the same approach and strategy explored in the first experiment, only took 6 months to complete their e-management project with 100% enhancement at just half of the total cost. Hopefully, the next organization using this strategic approach shall complete their 5 million enterprise-wide IT project within 5 months.

FUTURE ORGANIZATION

E-Management is designed for future organizations in facing future challenges. Then, what is future organization? Or what characteristics an organization should have in the future? The detailed elaborations of those characteristics are as follows (Zheng et al., 2010; Wen-Wei et al., 2009).

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Strategy-based

'Strategy-based' means to be driven by the organization's vision and mission. The processes and operations shall be based on the organization's vision and mission as well as be re-engineered from time to time to adjust to the current internal and external situations in order to keep align with it. All activities, events, programs are driving towards the organization's vision and mission. All relevant members of the organization including stakeholders, customers, suppliers and etc., shall keep alert from time to time to ensure the commitment and planning done towards the organization's vision and mission (Alam et al., 2010). A strategy-based organization will compete organically and aggressively in the borderless world in the future.

Rapid and dynamic

'Dynamic' means to be able to change from time to time to adjust to the current need, challenges, opportunity and situation. A dynamic organization is always alert to the internal and external signals of problems or challenges that need changes to be done. All the elements in the organization are dynamic including processes, strategy, planning, schedule, stakeholders, customer and suppliers. The organization structure should be dynamic, too. Accordingly, Staff position and post would be very dynamic. They can be promoted or de-promoted upon merits or job performance to ensure efficiency and accountability. All staff shall be ready to accept a dynamic move, even non-linear movement of their career path or task. But how to maintain their enthusiasm raises another question that needs to be carefully considered.

Knowledge-based

'Knowledge based' means to treat knowledge as the organization's asset and weapon for the future battle. The total environment of the organization is based on knowledge. Data and information shall be processed through intelligent tools such as data mining or intelligent business tools to explore a new pattern which could produce new knowledge to the organization. All the staffs shall become knowledge workers including the clerks, typist, secretary, officers, supervisor, technician, middle managers, senior managers and top managers. All the knowledge workers will be able to improve their efficiency and productivity from time to time based on new knowledge gained from their sharing with each other or research or through experiential learning. Totally, the organization shall be a learning organization.

DEFINITION OF E-MANAGEMENT AND ITS CHARACTERISTICS

E-Management is designed to support an organization

through the development and deployment of the enterprise wide IT projects. It can be defined as a strategic approach of managing future and dynamic organizations through the implementation of a high-performance and technology-based system. It focuses on integration, automation and artificial intelligence by using Rapid Development and Deployment Methodology towards the creation of knowledge environment to achieve the organization's vision.

Basically, e-management is a strategic approach. It starts with vision and mission. It stresses the value gained by the organization through information technology capabilities. It focuses on core value of the applications which will give the best quality output, effective cost and benefits to the organization. And the true efficiency and cost effective operations can only be gained through the strategic approach of e-management considering the future business style and organization style.

Technology-based system

E-management is designed with technology-based system which offers high performance and capability to support heavy processing, intelligent processing, dynamic processing and fast and rapid processing of all the processes in the organization. The technology used shall be an enabler to react to future challenges. Technology-based system has several characteristics that allow it to be as an enabler and supporter to the future organization. The characteristics are:

Connectivity enabler

With current information communication technology (ICT), the technology-based system can connect the organization to the outside world as fast as possible. It connects people inside and outside the organization in a few seconds through such systems as information system, email system, chat system and through all the information in the internet.

Intelligent engine

The technology-based system is intelligent, with the capabilities of simulating, thinking, predicting and planning. Also with the capability of exploring, self-learning and reacting, it can support the organization with less human resource especially at the operational level. Thus, it can improve the organization's efficiency and help the organization to react fast and intelligently to all the new challenges in the future.

High performance processor

The technology-based system has the capability to

process all the problems much faster compared with the human's processing capability, with the new ICT including high performance memory, CPU, Storage Management, Network system, Operating System, Database system and other necessary info-structure and infrastructure.

E-management principles

E-Management system is designed with combination of technology-based system and characteristics of future organization in future world. Combining those elements produces e-management principles as follows:

Integrated system

In today's global networked economy, integrated information system is merely a fundamental to a competitive advantage. If a company wants to remain a player in the future, they need to think of ways to tie the supply chain and demand chain to the integrated systems, both internally and externally. But before the organization can integrate their system with other external systems, they need to integrate internally all the departments and staffs to be one system, or it will cause burdens or problems to the organization. Then the internal integrated system will integrate with the external system to tie the customers and the suppliers. Failure to integrate externally can cause major damage to the supplier and customer since the external requests need to be immediately processed by all the related departments in the organization. There are two major integrations in practice: database integration and system integration.

Automated system

In E-Management environment, the integrated system is designed to automate all the processes in the organization. It is not just like a normal conventional computerization where it just automates a certain or critical part of the whole processes. Full automation means that it avoids total manual process or manual transferring of information between all related entities in the organization. All the processes within a department or inter department will be done automatically by the Integrated System. There are four principles of automation: process reengineering, real-time data transferring, minimum manual process and minimum human interference.

Intelligent system

Most of the conventional computerization projects are only record management system, lacking the intelligent

value, especially in analyzing, thinking and planning. E-Management System is designed with Artificial Intelligent (AI) in all of its processing engines which are incorporated with formulas, algorithms, procedures, policies and processes. Thus, it can simulate the 'Experts Mind' in the system to avoid human dependence. It can ensure that all members in the organization are following the rules and regulations in the best practice. It can also avoid misuse or misconduct of the operation. Future business world demands a lot of high level of thinking and strategic planning and controlling to face the world's challenges. There are also several principles accordingly: optimizing and tuning, predicting and forecasting, summarizing, analyzing and proposing, self-trouble shooting and machine learning.

Paperless system

Paperless environment is one of the most important elements in e-management, and all the Information Systems shall be designed towards a paperless environment. Printed reports shall be converted to online queries. All applications, approvals, meetings or reporting mechanisms shall be changed to ensure the use of online information instead of printing the hardcopy of the reports, since printed information will be out-dated once printed in a dynamic organization. Only those documents needed by external users which cannot be connected online are justified to have printed hardcopy, other than that shall be accessed online. Some of the attributes are: online information access, online announcement, online application and approval, online notification and online reporting.

Dynamic system

A dynamic organization shall manage changes in the most fast and efficient manner. The E-management system, which is the supporting element in the organization, shall be very dynamic and flexible to allow any changes needed by the organization.

The system and procedure in E-management's environment shall be designed to cater for changes at any time as required. It has to balance between standardization and flexibility. Characteristics of dynamic system are: scalable, configurable, customizable and personalizable.

CONCEPTUAL DESIGN OF E-MANAGEMENT

E-management's attributes

The conceptual design of e-management is based on the integration of all the major attributes (Figure 1) in e-management environment. The following will focus on

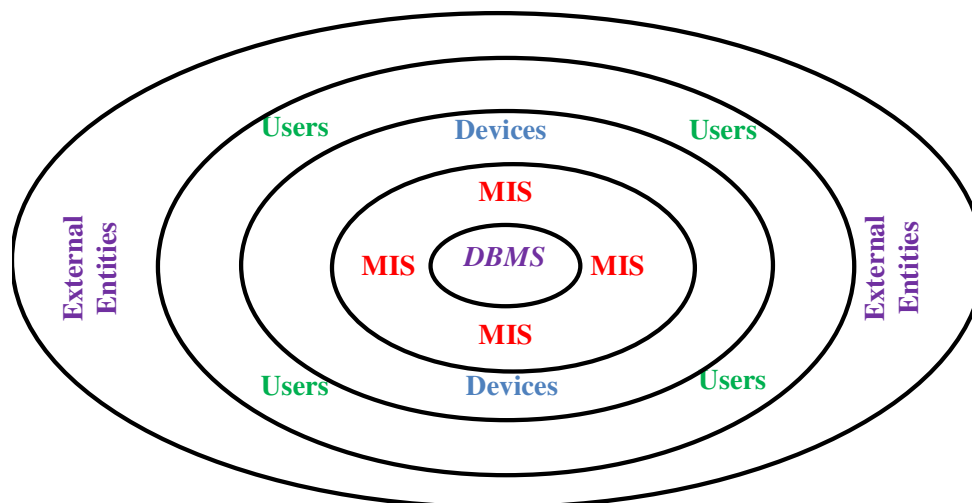


Figure 1. The attributes of E-management.

those attributes:

Database management system (DBMS)

The core or the heart of the whole system is the Enterprise Database, which is a central warehouse where all data are collected, stored, analyzed and retrieved in an efficient and structured manner. In E-Management environment, the Enterprise Database should be a single integrated database in order to ensure data integrity and security. And this database shall be supported by the actual Database Management Systems such as Oracle, Informix or Sybase database management system.

Database management system (DBMS) is a system designed to manage a database. It has several major attributes which are: controlled field, record and table structure; Auto-link and auto-control through constraints between tables; Uniqueness checking; Auto-integrity control; Auto parent-child relationship control; Auto lookup table relationship control; Auto-locking control at field, record and table levels.

To choose a DBMS is a very critical task. In e-management environment, the DBMS shall be managed by a dedicated Database Administrator (DBA). DBA will make sure the database is running smoothly and efficiently. General functions of DBA include: Establish database design policy for overall system; Establish up-to-date data dictionary for system people and end-users; Organize and maintain database structures; Establish database documentation, e.g. ER-diagrams; Advise the other project team on the efficient data manipulation approach; Develop security procedures to safeguard the database; Develop backup procedures; Resolve any issues on data management and manipulation; Maintain the database management software.

Management information system (MIS)

Management Information System (MIS) is a complete and integrated application system to support the operation of the organization. It is designed on top of E-Management's Principles to achieve E-Management's vision and mission.

With MIS, all levels of users will be interfaced with the Enterprise database, as it consists of all the applications needed by all staff, customer, supplier and management of the organization in order to do their task or job efficiently. It shall cover all processes in the organization with no exclusion of any single department or unit. Everyone in the organization will be provided with the appropriate applications and everyone has a right to be part of the system to tap all the benefits from the e-management's environment. It shall be designed as an integrated process across all the department, unit and faculties. It shall base on the processes, not on the individual needs or interest. In e-management environment, the development of MIS will follow all e-management's principles which are integrated, automated, intelligent, dynamic and paperless. All applications in MIS will be interacted with a single enterprise database through DBMS. All MIS applications shall also update and retrieve data from the single enterprise database (Figure 2).

Devices management

E-management will utilize all available devices in the industries in order to increase the level of automation. The devices will be interacting with MIS application and Database Management System. It will update the data into enterprise database through MIS applications. In

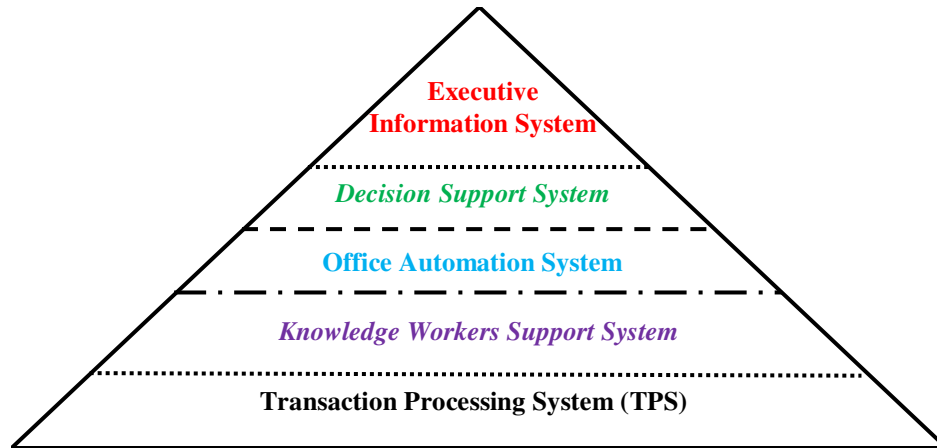


Figure 2. Management Information System (MIS).

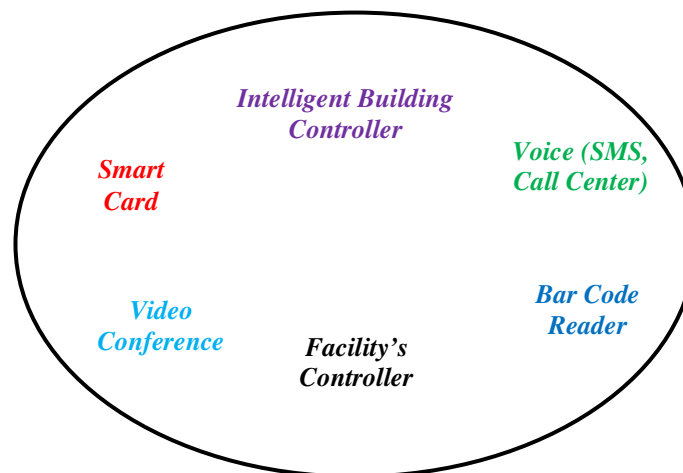


Figure 3. Devices used in e-management.

e-management environment, there won't be any temporary database at the device level, since this temporary database will cause error in batch updating to the enterprise database and most of the time the data in enterprise database will not be up-to-date as it is not real-time updated from the devices. Typical examples can be seen in Figure 3. The devices shall be changed from time to time based on the available technology. Everyone in the organization shall be alert with the new devices in the market, and grasp the opportunity to use the new device in order to improve the automation in the processes.

User management

The fourth layer is all the users who are involved in using the system either as a process owner or an end-user. All the users must be identified and categorized properly to

ensure every type of users are given a proper attention in terms of planning, designing, development and implementation. The critical categories of users are Data owner, Process owner, System owner and End users (Figure 4).

Data owner: This is the person, unit or department who is responsible for any aspect of data in a particular system. The same data owner can exist in several sub-systems. Also for one single sub-system, there could be more than one data owner. In E-management environment, the responsibility of data owner is distributed to the actual or real data owner, and the real data owner will be responsible to enter the data, update the data, delete the data and maintain the data (Table 1).

Be sure that all the data will be updated online by the actual data owner directly into the main database in a paperless environment and all data in the main database

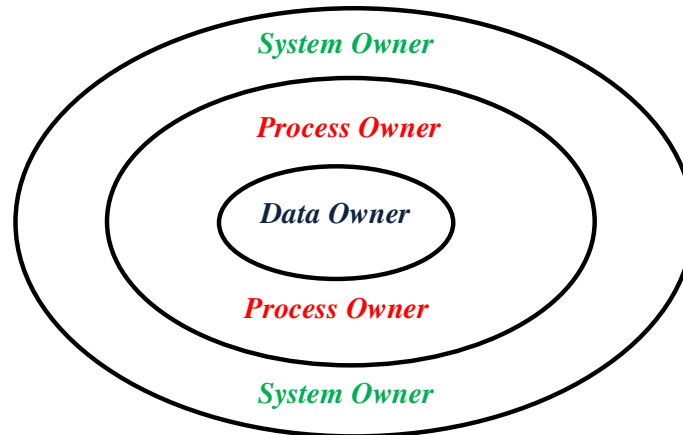


Figure 4. Category of users.

Table 1. Examples of data owners.

Data	Data owner
Staff profile	Each Staff must update his own data and Validated by Human Resource Division
Traveling and transport	Each Staff must update his own data and Approver – the superior
Staff Leave	Application – Own staff and Approver – The superior
Student Profile	Each Student must update his own data and Verified by Student Record Office
Subject Registration	Each Student must register his own subject and Approver – Academic advisor
Student Marks	Academic Staff (Lecturers and Tutors)
Staff Salary	Human Resource Department
Financial Budget	Each Department, Unit or Faculty
Inventory	Each Department, Unit or Faculty

shall be considered valid and verified by the data owner at any moment of time. Thus, everyone authorized to retrieve the information can retrieve the data at any time with no need to check the validity of the data. And those data that need to be approved will be approved by the actual approver.

Process owner: This is the unit or department who is responsible for some of the processes in a particular system. Specifically, it is supposed to be responsible to design and finalize the process flow, policy and procedure of a particular process in the overall system. For example, in Traveling and Transport Management System, process of work-order shall be owned by Human Resource Division since it involves staff hierarchy and

staff's personal information; Transport process will be owned by Transport Unit and Traveling claim will be owned by Finance Division. One of the process owners will be appointed as system owner to coordinate the design, development and implementation of all processes within the system.

System owner: This is the unit or department who is responsible for the overall system starting from planning, designing, developing, and deploying to enhancing. In conventional system development, normally the system owner is the Computer Center, which needs to develop all the systems. So if meanwhile they become the system owner, their workload would be unbalance, which could cause big problems to the system. In other words,

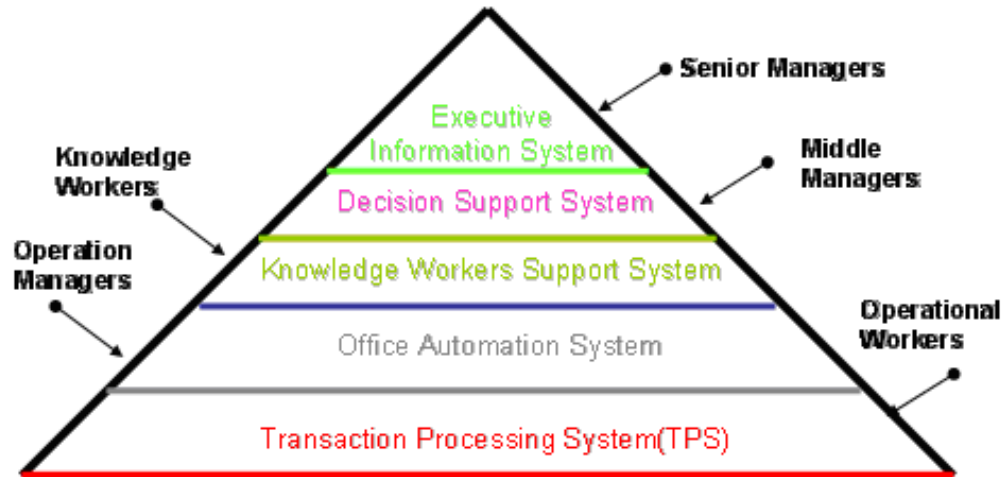


Figure 5. End user category.

Computer Center is better to only concentrate on technical process, leaving the whole coordination of the system development and implementation conducted by the system owner in business area. As an owner, there are certain criteria need to be adopted in order to support the whole development and implementation of the system, such as coordination ability, knowledgeable and experience, creative and innovative, etc.

End users: This can be categorized according to the levels of MIS (Figure 5), since different levels of systems require different types of users.

Transaction Processing System is to help Operational Workers to keep tracks of daily or elementary activities or transactions of the organization, like by providing Purchasing module, Account Payable and Receivable module in Financial System, Staff Profile, Payroll, Leave in Staff Management System, Student Profile, Subject Registration, Marks Entry in Student/Academic Management System. And most of the applications at this level will be in terms of data entry screen and detail transaction listing reports.

Office automation system, embedded with all procedures, algorithm and formulas, is to support Operation Managers to manage and automate all the integrated processes, such as payroll processing, result processing and financial processing. Most of the applications at this level will be in terms of processing buttons, process statistic report after each processing, checklist report for errors and unresolved listing for unresolved transaction.

Knowledge worker Support System is to support knowledge workers to integrate new knowledge into the organization. Examples are Knowledge Portal through Knowledge Management System, Academic Advisory Module, and Counseling System. Most of the application at this level is in terms of knowledge-based screen with full of information and knowledge.

Decision Support System (DSS) is to provide middle managers with the reports and on-line access to the organization's current performance and historical records depending on transaction information System (TPS) for monitoring, controlling, decision-making and administrative activities. Examples are actual cost exceed budget analysis, comparison between lecturer and student's performance, comparison between SPM and University's result, Comparison between budget of each department.

Executive Information System (EIS), with Drill-down & Data Mining features, is to help Senior managers to tackle and address strategic issues and long-term trends inside and outside the organization. It can even match changes in the external environment with the organization's existing capability. Examples are Intelligent Search Engine, Financial Forecasting System, Academic and Financial Performance Analysis, Trend System- Student, Staff, Financial, Human Resource Development Planning System and Strategic Planning System.

External entity

The last layer is the external entities of the organization such as parents, ministry, sponsors, suppliers, customers, banks or anyone who has interaction with the organization or who needs to access the information from the Enterprise Database. In conventional IT environment, there won't be any online access given to any external entities, due to the security and capability of the internal system. But in e-management environment, with its security, authorization management system and infrastructure strategy, all these problems can be managed properly. It will allow the external entities to enter the main database without any worries. They will be given access with customized information they need, and they can access it any time anywhere. All transactions will be

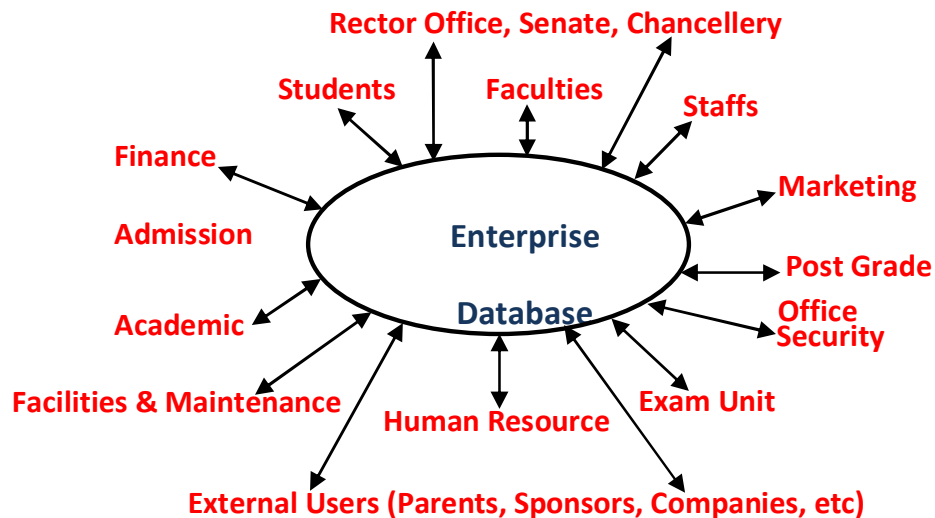


Figure 6. Integrated Database Management System.

done online in paperless environment.

E-management design strategy

To design e-management system, there are several strategies that need to be addressed.

Database design strategy

The database shall be designed with the fundamental principles of database designing agreed in Software Engineering Discipline. The major elements in database design stressed in e-management are:

Database integration: All tables for all applications shall be designed as a single application in a single and integrated database (Figure 6) without any duplicate tables, records or fields. All tables shall be shared by all applications. The design of tables shall support dynamic system development, fast access, easy and efficient database maintenance. The procedure of creating tables and fields shall be coordinated by Database Administrator (DBA) in order to ensure that the integration of all the database objects is properly done.

Table normalization: In e-management environment, levels of normalization will vary from one table to another table. It will depend on the data updating and retrieving constraints. At least, level of table normalization should be followed in order to ensure data integrity and avoid data redundancy and performance problems.

Table and field Indexing: Indexing shall be applied whenever needed and possible. Not all the tables and

fields need to be indexed. Decision on which table that needs to be indexed should be analyzed based on functions of the tables. Heavy update table cannot be indexed with many fields since it will slow down the updating process since it needs to update all the indexes for the tables. Heavy retrieval table should be indexed more for faster retrieval of records.

No hard-coding: Field, record and table control shall be done at database level, not in the coding, in order to allow flexibility in managing the database object linking and controls. Most of the attributes and properties of fields can be set in the database, not in the application. This is crucial since some of the developer might update the data through back-end database engine, and without these control, it might cause error and mistake in the process of updating or troubleshooting.

Database constraints: Field, record and table constraints shall be incorporated in the database. Parent-child relationship shall be controlled properly in the database. Proper primary key and combination key shall be created to control record uniqueness and table relationship between tables. Lookup-table relationship shall be defined through proper foreign key constraint.

User access control: User access to the database shall be controlled properly by user authorization procedure. It shall incorporate all the users including technical and normal users. Technical or developer will be restricted to access the database, since they are not the owner of the data and they cannot update the data. Any testing involve data updating will be done in development database.

Locking management: DBMS shall be able to control the record or table locking automatically. It should also allow the DBA to specify a specific locking mechanism for

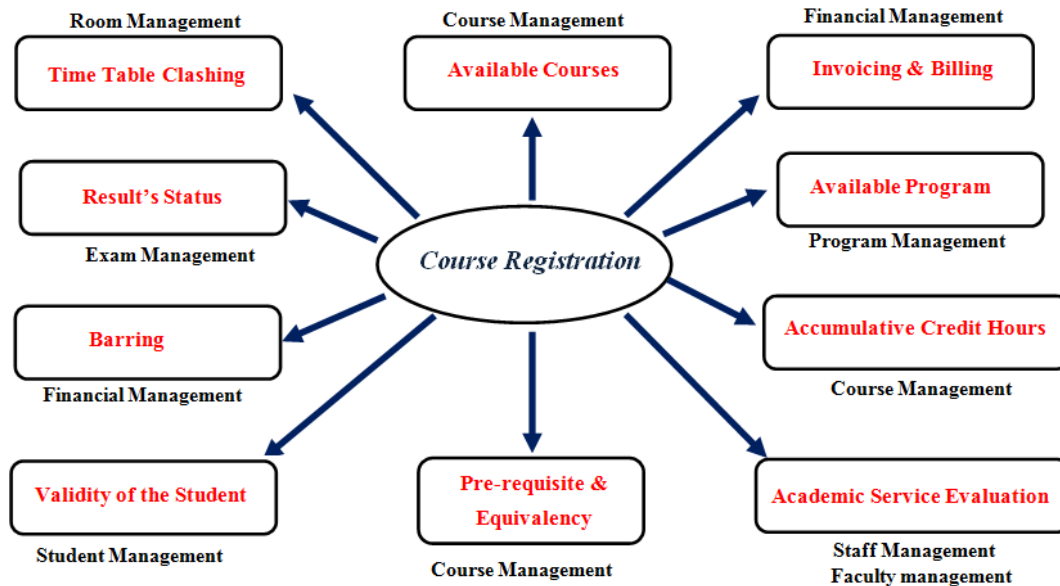


Figure 7. Application integration principle.

certain environment.

Application design strategy

Application shall be designed with e-management's principles as explained in section 3, which are integrated, automated, intelligent, paperless and dynamic. Application is just a sub-module of an integrated enterprise application. But all applications shall incorporate the maximum automation and intelligence. In conventional environment, most of the applications are just a record management. It does not have the intelligence and automation, and the purpose is just to enter, store and retrieve data for reporting. In e-management environment, all applications will utilize all potential and capability of IT technology to improve the whole process. The major elements of application design are:

Application integration: All forms, reports, query screens and any application objects shall be designed as an integrated application in a single application environment (Figure 7). All applications shall be treated as a sub-module or program unit of a single enterprise application.

Object oriented application: All applications shall be designed in an object oriented environment. The structure of the application shall be divided into small program units with each program unit stored in the database to be accessible and shared by other applications. All program units should be treated as procedure or function to allow parameters to be passed by any application.

Flexible and no hard-coded: All applications shall not have hard-coded setting. Any change of the application shall be done through the database changes. All formula, procedures and algorithm shall be specified in the table in the database, in order to avoid heavy maintenance of the codes. Maintaining codes will cause interruptions in the production environment.

Comprehensive design: All applications shall cover all steps in the process (Figure 8) without exclusion, covering from thinking, planning process until decision making after the process completes for improvement and enhancement. Element of paperless should be incorporated in order to allow online interaction in the applications.

CONCLUSION

All the aforementioned are the ideal ideas of how to design e-management for future organization. It projects the promising vision or trend for enterprises to follow to change. But it's not an easy task to manage changes in an organization (David, 1995; John and Robert, 2002). Normally, there will be a lot of resistance or obstacles from the senior or veteran staffs since most of the organizational members will get into their comfort zone after sometime implementing certain process or system (Zheng et al., 2010). So the changes in the organization shall be planned and strategized well before it takes place.

Here proposes several prerequisites or major elements to be considered by the organization before they can

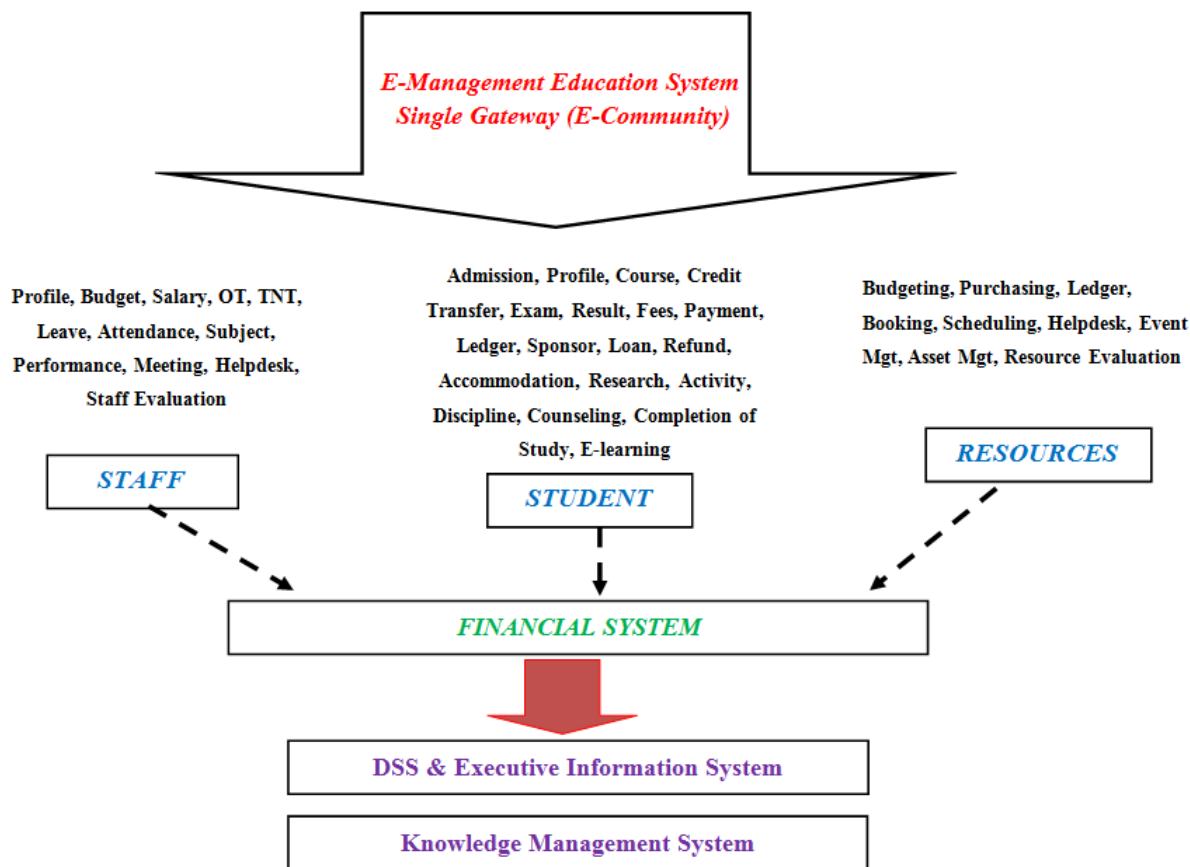


Figure 8. Example of comprehensive design (education system).

implement the e-management. Firstly, organization strategic planning is a mechanism to identify organization's vision, mission, philosophy, goals, objectives and the processes. It stresses on process reengineering to reduce the number of supporting staff, reduce operating cost, increase profit and expand the business, upgrade all staffs to be knowledge workers and finally transform the organization into a Knowledge Business organization. One of the strategies is to implement Total Quality Organization (TQO). There are certain standards set by TQO that need to be followed by the organization. It also involves Standard Operating Procedure (SOP), Balance Score Card (BSC), etc.

Secondly, a proper organization structure shall be designed to support e-management. All critical department or coordination department shall be structured as the highest level management such as Knowledge Management Center, ICT Center, Academic Service Center and so on, because most of the ICT projects fail due to wrong organization structure or wherever ICT services center is structured as a second level management (Farhad, 2008; Roy and Abraham, 2009; Farid et al., 2009). The ICT Center who manages the e-management cannot coordinate properly when it is not within the same level of management as other

departments. For new organization, it is better to have a flat organization with only one CEO and no any deputy. This is to allow direct problem reporting to the most top management, and also to avoid any political games in early stage of the organization.

Thirdly, before the organization can integrate their system with other external systems, they need to integrate internally among all the departments and staffs to be one system, or it will create burdens and problems to the organization. And then, the internal integrated system will integrate with the external system to tie the customers and the suppliers. Failure to integrate externally can cause major damage to the supplier and customer since the external requests need to be immediately processed by all the related departments in the organization.

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