BUILDING MANAGEMENT INFORMATION SYSTEMS TO COORDINATE THE UNIVERSITY BUSINESS PROCESSES: A PROPOSED MODEL FOR DOKUZ EYLÜL UNIVERSITY

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Abstract: Management information systems are computer based information systems, which collect and analyse data, and transform this data to the information, which is valuable for the managers who are responsible from the organizational activities. A management information system, established in a university may increase the in-house activity by improving the decision making process of the senior management. Software development life cycle has essential steps. These steps involve planning, analysis, design production and maintenance. In this study, a software application planning, analysis and design processes are implemented in order to create a model management information system for universities. Planning phase include feasibility and requirement specification. Analysis phase include an examination of an existing organizational structure of a university and exposure of the essential problems and requirements. Design phase include the basic software structure in order to meet the requirements. Despite the complexity of the administrative and academic organizational structure, this study is important because it offers a design and implementation model of a management information system for the universities.

Keywords: Management Information Systems (MIS), Organizational Structure Universities, Decision Support Systems (DSS), Software Life Cycle.

ÜNİVERSİTE İŞ SÜREÇLERİNİN KOORDİNASYONU İÇİN YÖNETİM BİLİŞİM SISTEMLERİNİN İNŞAASI: DOKUZ EYLÜL ÜNİVERSİTESİ İÇİN MODEL ÖNERİSİ

Öz: Yönetim bilişim sistemleri, örgütsel faaliyetlerle ilgili yöneticilere kararların alınması ve kararların yürütülmesi sürecinde veri toplayarak, analiz eden ve bu veriyi bilgiye dönüştürerek raporlayan işlemler dizisine sahip bilgisayara dayalı bilgi sistemidir. Üniversitelerde kurulabilecek ve üst yönetimin karar almasını kolaylaştıracak bir yönetim bilişim sistemi kurum içi etkinliği artıracaktır. Yazılım süreçleri yaşam döngüsünün temel adımları vardır. Bunlar planlama, analiz, tasarım, üretim ve bakımdır. Çalışmada üniversite örgüt yapısı içinde uygulanabilecek ve üniversitelere örnek teşkil edebilecek yönetim bilişim sistemi kurulması amaçlı yazılım uygulaması için planlama, analiz ve tasarım süreci gerçekleştirilmiştir. Planlama kısmında fizibilite çalışmasının gerçekleşmiştir. Analiz aşamasında var olan sistem örnek bir üniversite örgüt yapısı incelenerek örgütün temel sorunları ortaya konulmuş ve gereksinimler açıklanmıştır. Tasarım aşamasında gereksinimleri karşılayacak

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yazılımın temel yapısı oluşturulmuş, yazılımın içerdiği bileşenlerin tanımlanıp açıklanmıştır. Üniversitelerin idari-akademik organizasyon yapısının karmaşıklığına rağmen gerçekleştirilen çalışma, üniversitelerde yönetim bilişim sistemi süreçlerinin incelenmesi ve bir tasarım modeli önermesi adına önemlidir.

Anahtar Kelimeler: Yönetim Bilişim Sistemi (YBS), Üniversite Organizasyon Yapısı, Karar Destek Sistemleri (KDS), Yazılım Yaşam Döngüsü.

I. Introduction

Today, management information technologies which have been used to process the data and product and store the knowledge by organizations have become a strategic competitive weapon. It is very critical to make decision by using management information technologies and it may generate structural consequences for the organization. By the aid of management information technologies, organization structures will become more flexible, not only simple ones but also complex ones. In this context, it is very important for the organizations to build the most accurate and appropriate MIS to get effective and efficient results.

In the structure of MIS, business organizational structure, process schematics and data sheets can be listed as the basic variables (Gökşen, 2009:24). According to Şimşek et al. (2010:13), in today's world; knowledge is a strategic source for the organization and, management information systems are hearts of the organizations, in a sense. MIS consistently produces the information which is necessary for the survival of the organization and allows the knowledge to reach the required place (Oğrak, 2010:94). According to Karim (2011:459-460) incomplete or lack of management information systems reduces the efficiency of the decision making process of the organization.

In general, information systems can be divided into technical approaches (computer science, management science, operations research) and behavioral approaches (sociology, economics, and psychology) (Laudon and Laudon, 2006:26-27).

MIS must be established correctly and the structure able to provide accurate information to the all level managers, operational, tactical and strategic. Therefore, MIS should have access to the entire organization. Hence, it should be emphasized that, working with an integrated database to share information with all organization is very critical.

In the context of university, efficient information management provides a framework for keeping, maintaining and providing for the disposition of information for managerial decisions (Momoh and Abdulsalam, 2014:107-108). Although university organization has men, machines, materials and money, yet the characteristics of their participants differ from other organizations and therefore, their decision making processes are unique or different in some respects (Gupta et al., 2010:174). Administrative and academic growth of the

university increases the importance of sharing and managing information. Therefore, the managers should use effective information system and establish the most appropriate MIS to make a difference in favor of the organizations in the sector.

In this study, the proposed model to develop a MIS will be based on waterfall model. Waterfall model which is one of the software development models have been used to design a MIS by considering the organizational structure of the university. Two phases of the software process which are analysis and design have been implemented in this study and also the basic variables that have been told will take part in the model. In the study, based on the waterfall model, Dokuz Eylül University's organizational structure will be examined and analysis and design process stages will be established for the university by considering the existing situation. (Existing situation of the organizational structure of Dokuz Eylül University have been handled from Strategic Plan of TC. Dokuz Eylül University for 2011-2015)

Computer-based information system is the backbone of many organizations, but also is a phenomenon that not created and not recognized of its importance. In this study, we try to resolve the lack of such a concept and we suggest a MIS model for the universities which are center of the science.

II.Study's Object and Scope

Management information systems are the most important part of organizations since they are the strategic resources. MIS continuously produces the information required to the existence of the organization. MIS are systems are fed by the sub systems and supports data for the decision processes. In the study Dokuz Eylül University has been chosen as a case study. In order to develop this MIS software waterfall software methodology and its related analyze and design steps have been implemented. In order to develop this MIS software waterfall software methodology and its related analyze and design steps have been implemented.

Universities, as their nature, host many information systems inside themselves, as well as they need to communicate with the software systems outside the institution. Personnel information system, academic information system or student information systems can be given as an example for the internal systems; and Central Civil Registration System (MERNIS), Council of Higher Education Information System (YÖKSİS) can be given as samples of the outside systems. The purpose of the study is to settle robust and accurate analysis and design steps for the software development processes by the perspective of dynamic factors. By considering this analysis and design steps for the MIS system to be implemented, other software processes would be more accurate and thereby ideal MIS software could be constructed. Accordingly, an accurate information flow for the strategic and tactical managers of the

university can be provided, and various software systems or projects would have the ability to communicate with each other.

III. Methodology

MIS; defined as a system, which collect the data from different sources and processing, storing and reporting the data to get necessary information for decision-makers (Tekin et al., 2000:83). According to Polat (2007:187), the main thing needed in making the right decisions in the organization's processes is accurate and timely information about resources and processes. MIS aims to provide this information to the managers. The management of information which is a strategic power should be complete, accurate and timeable, and it needs managers who are believers of transformation and change. In an organization, it is possible to supply the information needs of management with the establishment of information systems. At this point of view, Table 1 outlines the outputs which MIS will provide the organization.

Table 1. *MIS Descriptions Outlines* (Yılmaz, 2009:5)

- Data Collection, full fills recording and processing functions. - Provides managers not the raw data for decision making, but selected, processed and edited data, in another words; information. - Meets changing information needs of the organization.	- Is a computerized system that collects and transfers information. - Provides its managers with structural information which they can get easily and in time. - Collects data from various sources, under an integrated database.

MIS, not only provide information to the organization for rational decision-making, but also help to connect the different disciplines of the organization, create a series of systems that perform the flow of information in the organization.

Organizations continue their lives with the decisions made on the process and these decisions determine the location of organization on the market and competitiveness power of the organization. Decision-making; with very simple definition, is selecting one of the options. There are many advantages of Management Information Systems for the organizations, such as to convert the data to the information and to make simple the planning (Heidarkhani et al., 2013:81). If a manager knows how good his organization and can have how much information about it, the management process also works so much healthier and also accessible to corporate goals. It is clear that information using and sharing is very cruel for the organization. Table 2 outlines the information usage in an organization.

Table 2. *Information Systems and Information Usage* (Yılmaz, 2009:25)

Management Information Systems	**Information Usage**
Data Processing System	Gives information about the organization's routine activities
Office Automation Systems	Digital data for operational level
Management Reporting Systems / MIS	Information aimed for planning, control and decision making of the general management level
Decision Support Systems	Internal and external graphical information for top managers
Top Executive Support Systems	Analytical information consisting of interactive support
Expert Systems	Artificial intelligence aided top level information, consisting of expert advice on specific issues.

MIS supports the data processing function in the organizational processes and by integrating with subsystems -which was configured for processes within the organization especially with its integrated database to generate data from operational level processes reports regarding tactical level processes. To build a good MIS, the subsystems which it was meant to be integrated should be configured properly and also systems need to communicate with each other via web services or other software technologies and the processes should be well-managed even though the systems are located separately around the organization. Involvement of the management in design and development process, disregarding the global improvement of the system, lack of proper selection of hardware and software technologies of the system, lack of management support for the building of the system, stillness against the change can be addressed as the reasons of failure of MIS in organizations (Erdem and Younis, 2014:6-8). At this point, support of the senior management level can be vital for a properly working MIS. Also for an effective organization, the ability of MIS to be fed regularly by the data processing systems which has the records of all the work done in the organization is an important aspect along with its outcome to contribute to decision makers and upper management on information system level.

There are also some studies about MIS in education field. One of them is the study on the Nigerian Colleges of Education which written by Abdulkareem and Fashiku (2008b:143). According to them MIS is positively utilized for organizational effectiveness. According to Adamov et al. (2010:4-5) a right university management information system should have, modular structure, web-based architecture, focusing on the end user and a safety management. MIS provides many contributions to the organization and it increases the organization's efficiency about operational, tactical and strategic level decisions (Oğrak, 2010:94). Regarding another University Management Information System; integrated database is based upon four basic structures which include; profile management of people, objects and security factors; application architectures, smart digital services and information portals (Guard et al., 2004:176).

IV. Building MIS

A. Literature Discussion

Long argues that MIS has two perceptions. MIS has been used as a term for computers and information processing technologies that are related to the process, procedures, systems and human resources; on the other side it is used as the name of the information system in supporting business functions. (Long 1989:3 written: Benshir 2002:79). In the study done by Benshir, it has been stated that the confusions caused by the use of the terms knowledge, information, information technology and informatics have been in use since MIS began to develop in the 1970s (Benshir 2002:100). He thinks that this case has negative effect on the development of the discipline. Abdulkareem ve Fashiku (2008b:135), stated that the MIS developed during the study they did in 65 colleges and with 1670 people had positive effect on organizational efficiency. But at this point, they haven't introduced any solution for MIS in the literature involving the whole organization. At this point Ismail (2008:158)'s study about Public universities in Malaysia, While The University is already enjoying a relatively good IT infrastructure, the main challenge is to harness that infrastructure to meet the needs and expectations of students, lecturers, administrative staff members and university management. For the solution The University should support some main sub systems for university main activities such as research and academic, teaching and learning, and administrative. In Liang ve Lan'ın studies (2010:18-20) they analyse the existing problems and the causes of these problems during the process of management information in present local universities of China. The improvement of the traditional management information platform should be in the framework of web services. They stated that such an organization may be in interaction with the structure of the whole organization. Studies carried out at this point, wiev, table authorization, function and procedure will be granted and both internal projects and external projects can be contacted with the help of Web Service tools.

When the literature is studied, it can be seen that these were developed for the different information systems, developed for different sections of the organization. Studies done nationwide are not satisfactory from the point of setting and running and when international studies are done, it can be seen that there are some efforts on technical systems but there is not an MIS which comprises the whole organization. In addition, more stress is given to one aspect of the structure and the whole structure was neglected. It has been understood that waterfall model of software was the best model for the objective conditions of the organization where the study was carried out.

Software's attributions, enhancement and recognition are implemented differently for various models with divergent combinations and forms. Organization's requirements, a pretty good comprehension of the software capabilities and cohesion between necessities and capacities are needed for the

software development process. Software Development Process (SDP) infers to the required strategy needed for software's existence. Every selected model has its own exclusive advantages and disadvantages. The choosing of the appropriate model desired for the resolution is of vital importance.

On the whole, the models are Prototyping Model, Rapid Application Model, Evolutionary Model, Incremental Development Model, Iterative Model, Spiral Model, Information Based Software Engineering Model, Waterfall Development Model (Munassar and Govardhan, 2010:95). In prototyping model, requirements are gathered briskly to begin with and developers and users determine the software processes collectively (Ocak and Yıldıztekin, 2011:339). In spiral model, some portion of the user's exact requirements are designated, then these requirements are achieved, after the emerged product is tested, it is delivered as a version. In evolutionary model, the purpose is to generate a product stage by stage. In incremental development model, the principle is improving a specific product as versions and the process starts with basic requirements (Sarıdoğan, 2011:73-74). Rapid application model bears a resemblance with prototyping model but it is much more favorable for operating systems. Sommervile (1996:271) argue that, the most appropriate software process model depends on the organization developing the software, the type of software being developed, and the capabilities of the staff. There is no "ideal" model and it makes little sense to try to fit all development into a single approach. Analysis and design processes take a lot of time in the waterfall model and is preferred by the organizations having a regular process. Fort his reason, this model was chosen as a model in this study.

B. Reference Model

As emphasized in the purpose and scope section the waterfall method is chosen as the application method. Waterfall model consists of the parts by the order of; analyze, devise, achieve, put to test, integrate, maintenance and repair (Mahizharuvi and Alagarsamy, 2011:254) Waterfall Development Model can be considered as the most primal and most widely-used model of all the software development models. In this model, it is possible to move on to another step by accomplishing one. Activities featured at each level of the waterfall are fulfilled thoroughly. It possesses a linear SDP. It is favored for the projects that define their demands appropriately. Demand requirement is performed at the starting point of the process and the process progresses in accordance with those demands. In summary, Waterfall Development Model should be used within the flexible projects where the conditions are recognized well, in which the product definition can be achieved distinctly, that require ambiguous needs. The model should also be preferred under circumstances where the quality of the project is much more essential than its process and cost. If a software project is developed without a direction, it may not meet the deadline, or even it can never be

accomplished. The thought is that in the initial stage of founding MIS at Dokuz Eylül University, compared to the other models, as long as it is adjusted to the establishment's structure, waterfall model is much more advisable.

Even though it is possible to return inside of the models, during the analyzing process user and system requirements must be determined down to the finest detail. Also the designing process needs a detailed study which should meet all the requirements of the software. Therefore, the time which is used for the software processes which realized with waterfall model, most commonly used in the about those two stages. Waterfall method of software development consists of five stages as following: requirements analysis and requirements definition, system and software design, coding and unit testing, integration and system test, operation, maintenance and repair (Bassil, 2012:2). Each stage takes what produced by a preceding stage at the start point. And every stage makes some changes on production to make usable for another stage. Establishing the MIS on Dokuz Eylül University waterfall model will be used. And the proposed model will be shown on real organizational chart of the university.

While establishing the most suitable MIS for university, system owners should not be expecting a sudden change. The implementations should progress step by step and needed performance will be provided. Table 3 outlines the current situation in Dokuz Eylül University.

Table 3. *Current Situation*

Organizational Structure: Two different organizational charts which are classified as academic and administrative, though just one united organization and institution ***Internal Stake holders of the Organization: Academic Staff, Administrative Staff and Students*** ***External Stake holders of the Organization:*** Service Areas (Domestic and International Universities, Other Public Institutions), Main Partners (Higher Education Council, the Ministry of Industry and Commerce, etc.), Strategic Partners (Higher Education Council, OSYM, Ministry of Finance, etc.) ***The Information Technologies Used:*** MySQL, SQL, Oracle Database, Excel Technology Linux and Windows Server Technologies Apache and IIS Server Technology PHP, Java, C # and Python Programming Language Working Environment as Zen Php Framework, Net Framework ***Constraints: S***oftware projects were created those facilitated business processes of many. These projects are not able to unite the organization under a single roof. So it is a problem that projects cannot provide information to each other and thus there is a communication problem. The cause of this situation is existence of different unit trees and unit descriptions under a Project and regarding each project as independent from each other.	***Information Systems Used By The Organization:*** Oracle Forms Projects with Technology: Student Affairs, Personnel Affairs, Scientific Research Projects, Construction Department, Medical Ethics Committee, Budgeting and strategy development GDB Projects, Data Processing Department, Oracle Forms Software Projects ***Web Projects:*** DEBİS (Dokuz Eylül University Information System), Various Website Applications (Content Management Systems and Static Web pages) Smart Card Systems: Cards used by people within DEU to get Access into the facilities or to satisfy nourishment needs at specific dining halls. ***Document Management System:*** System that performs the tracking documents within the University.

The processes in Dokuz Eylül University are similar with other universities. It could be said that, the communication problem between the information systems of university's units is common problem for many universities. Universities live this problem because; people in organization which project implementers or owners couldn't see system completely. Besides, people's perfection on processes sometimes is not enough. It should be thought that MIS is the heart of the organization which collects the data and information from every unit and presents these data and information to the top of organization. MIS should be reaching to all over organization like a bridge. Besides, unit managers and workers should have province about MIS which relevant them.

The place of the MIS in the organization and its way of work are shown in Figure 1.

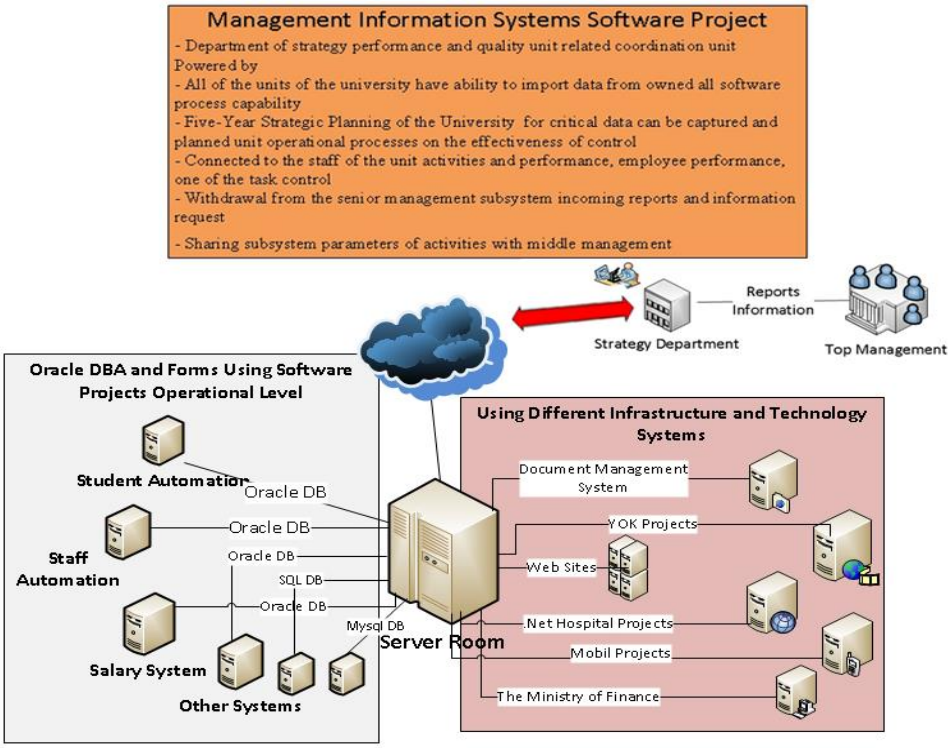

Figure 1. *Proposed Position of MIS in Organization*

Responsible units of MIS are as follows;
MIS Operators: DEU Strategy Department, DEU Performance and Quality Unit
Reports will be submitted to: Rectorate, The University Senate, University Executive Board, etc.
Data suppliers for MIS: Whole Organization

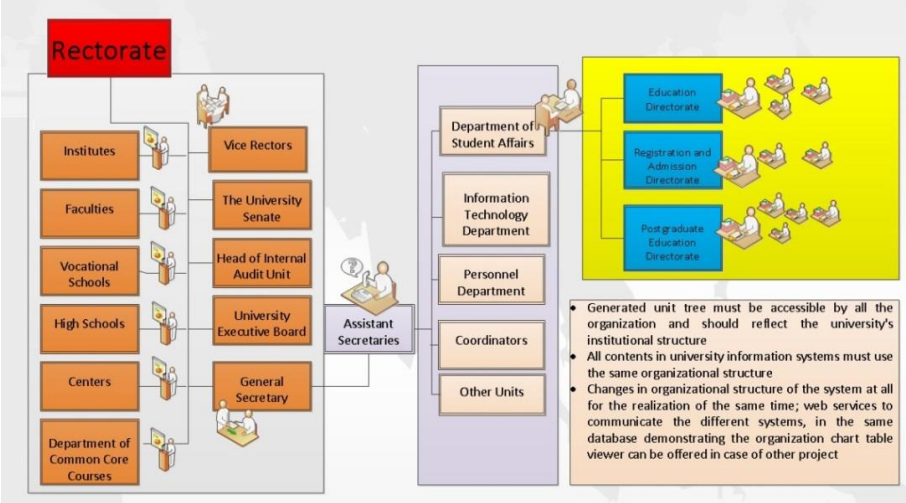

Figure 2. *Organization Chart and Process Distributions on Units*

The units could be established on different technologies. At this point, to make connection in different technologies, web services should be used. By using web services, a consistent structure within the organization will be provided and touching all internal stake holders (students, academicians and administrative staff) and reaching all units will be possible. A MIS which access the entire system could reveal more realistic and consistent reports.

Communication with web services and how will design processes and the structure of organization chart on database can be seen from Figure 3.

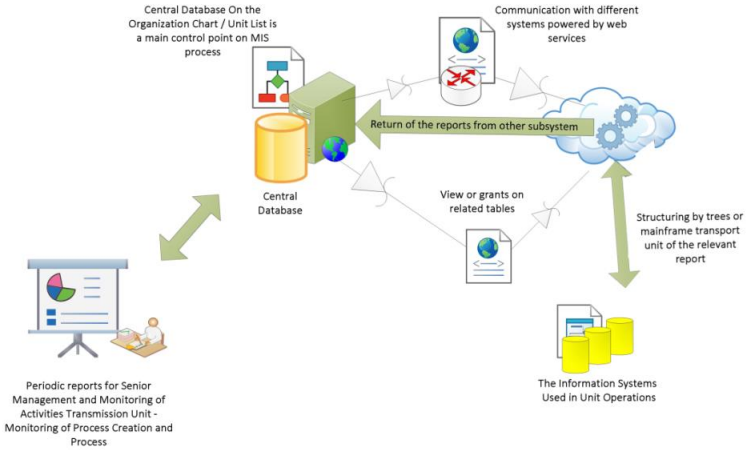

Figure 3. *Communication Mechanism of MIS with Other Units*

With the aid of XML outputs, the data transfers on web services have an independent structure. Some of the major problems of MIS are taking reports from subsystems, communication and interaction with all the units. By using web services; it is possible to solve these problems. Because working on web services makes not important anymore which software languages were used in subsystems.

V. Result and Conclusion

Knowledge is the basic source for an organization and when it is shared with the establishment, it scales as an information facet. It is the computer grounded systems that maintains the transition from the traditional form to the contemporary association. The right handling of the data which is the source of the knowledge, reviewing and turning them into information and conveying them as a report to the managers who are in need is essential at the point of carrying a rational resolution. The senior management' s trust in the transition of information, establishing a fully integrated informatics texture and the appropriate choice of the software that fits the frame of the organization appear to be the key points of the organizational competition.

Feiler and Humphrey (1993:30) state that for the proper definition of the software processes, the integration of many different forms of information is needed. They also note that the various ways of information which people demand to attain, correspond to the responses of questions; what, who, when and where, how and why, to whom. The usage and the benefits of process modeling can be arranged in five titles (Curtis et al., 1992:76): serving as the purpose of the processes' meaning and intercommunication, sustaining the process enhancement, supporting software process management, promoting the automation of process guidance and reinforcing the automation of process operation.

With the decisions passed upon the processes, organizations move on to their existence. And those decisions determine the quality of living and the life span of the operation. In the study, analysis and designing work sections have been performed in order to execute management information system software founded on a model university (Dokuz Eylül University). MIS, when constructed and applied precisely within the public and private establishments, proves useful for the organization's operational, tactical and strategic levels of decisions.

In the study, the organizational structure of Dokuz Eylül University has been discussed and a model has been set as an example for MIS integration. The most significant element in the model is the right formation of the organization structure upon the systems, and thus receiving proper and coherent reports from the systems. Process design is the abstract screening of a process' architecture, within the focal point of this fact, by presenting an example in framing up MIS; the study aims to generate awareness.

It has been emphasized that within the university system, the bedrock servers should explicate the relations and the needs of MIS, and thus by preparing right data for all the users' needs, the related data will supply the system requirements. For the success of the corporate system the need for the data processing center has been made clear. In addition, a coordinator should be assigned for the right coordination of MIS services.

Ultimately, it has been reflected that the subjects explicated in this study can be supportive about the new studies for the application of MIS's in universities.

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