December 2001

Executive Support System For Public Higher Education Institutions In Malaysia

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Abstract

Public higher education institutions in Malaysia are growing rapidly and increasingly, interested in the use of fast and effective decision-making. Executives need the knowledge and information to be able to make these fast and effective decisions. This article discusses on the suggested executive support system framework that can be used by executives for decision-making and analysis. This study will also investigate the level of strategic decisions in the public higher education institution of Malaysia. Using the information gathered from these investigations, an executive support system framework is identified. This framework can be used to support the education, research and administrative activities of a public higher education institution. It is divided into 3 sections that are interrelated. The first section is the support component of the framework. This section provides information and model that will aid executives in their analysis during decision-making. This section will also provide executives with news and messages that can be use in a decision-making. Next, executive knowledge analysis allows analysis to be experimented for each case of decision-making. Finally, intelligent scanning agents will filter important information from the web as well as the database in order to formalized accurate solution as well as reasoning for each problem encountered.

Keywords: Executive Support Systems, Decision-Making and Strategic Decision-Making

1. INTRODUCTION

In recent years, limited expansions of resources, shifting enrollments and demands have confronted public higher education institution (IPTA) with greater accountability for their constituencies. The heavy burden increases, as the need for transformation of the local public universities from mainly national education centers to an internationally recognized body especially in the Asia Pacific region (Ministry of Education, 1998). It is therefore important for each IPTA to restructure its policies and regulations with the aim of attaining greater financial autonomy. In doing so, there is a need for a tool that is non-technical to aid decision-makers in making fast and effective decisions.

Over the last few years, there has been significant increase in the use of computers in almost all-large educational institutions. Software applications have been developed for variety of areas such as accounting, personnel, registration and record, inventory management, as well as library systems. The important section that needs to be looked into is the use of computers by executives in its decision-making (Turban et al., 1988). The concept of using computers to support decision-making has existed since the 1970s (Keen et al., 1978). Executive support system (ESS) allows executives to collect, analyze, process and disseminate information (Mintzberg, 1975) in an ever-changing business environment

(Watson et al., 1991; Turban, 1995; Watson et al., 1997). This concept is enhanced to provide executive with current and reliable information from the web by using intelligent agent (King et al., 1996; Cardenosa et al., 1998; Kuo, 1998). Besides this, executives or decision-makers within an IPTA need relevant information to envisage the future, support their decision-making or justify intuition-based decisions (Liu, 1998). Currently, there has also been researched in the area of active decision support to provide more advanced computer based analysis software for executives (Fazlollahi et al., 1997; Carlsson et al., 1998; Feng et al., 1999).

Currently, there is no ESS framework in any of the public higher education institutions. Therefore the main objective of this study is to develop an ESS framework that can provide executives with information, knowledge as well as analysis for fast and effective decision-making. With respect to this, section 2 of this article will investigate the strategic decision-making framework of an IPTA. This investigation will proceed in identifying the levels of decisions in an IPTA. Meanwhile, section 3 will discuss briefly on general framework of a decision support tool before a further discussion on the suggested ESS framework for an IPTA. This framework is divided into two components, which are the supporting components as discuss in the general framework with slight modification. Followed by the main component, which identify new components that are needed to create a more robust and sophisticated system. These levels are as discussed below.

2. PRELIMINARY STUDY

One of the major processes in suggesting this framework is the process of determination information required by executives. With respect to this, the development process consists of a few steps including information gathering as the preliminary study (Mohamed et al., 1999). Information gathering processes involves the identification of management activities, responsibilities, critical success factor (Davis, 1982; Collins, 1985; Wetherbe, 1991) and its strategic business objective (Volonino et al., 1991) as well as its end and means analysis. The techniques used to gather this information involved interviewing, phone and questionnaire survey (Watson et al., 1992; Crockett, 1992; Watson et al., 1993). Consequently, the process will provide insight to the organization task, which is used to investigate the framework of strategic decision-making and the level of strategic decisions in an IPTA. Later this information will be used to suggest an ESS framework in an IPTA.

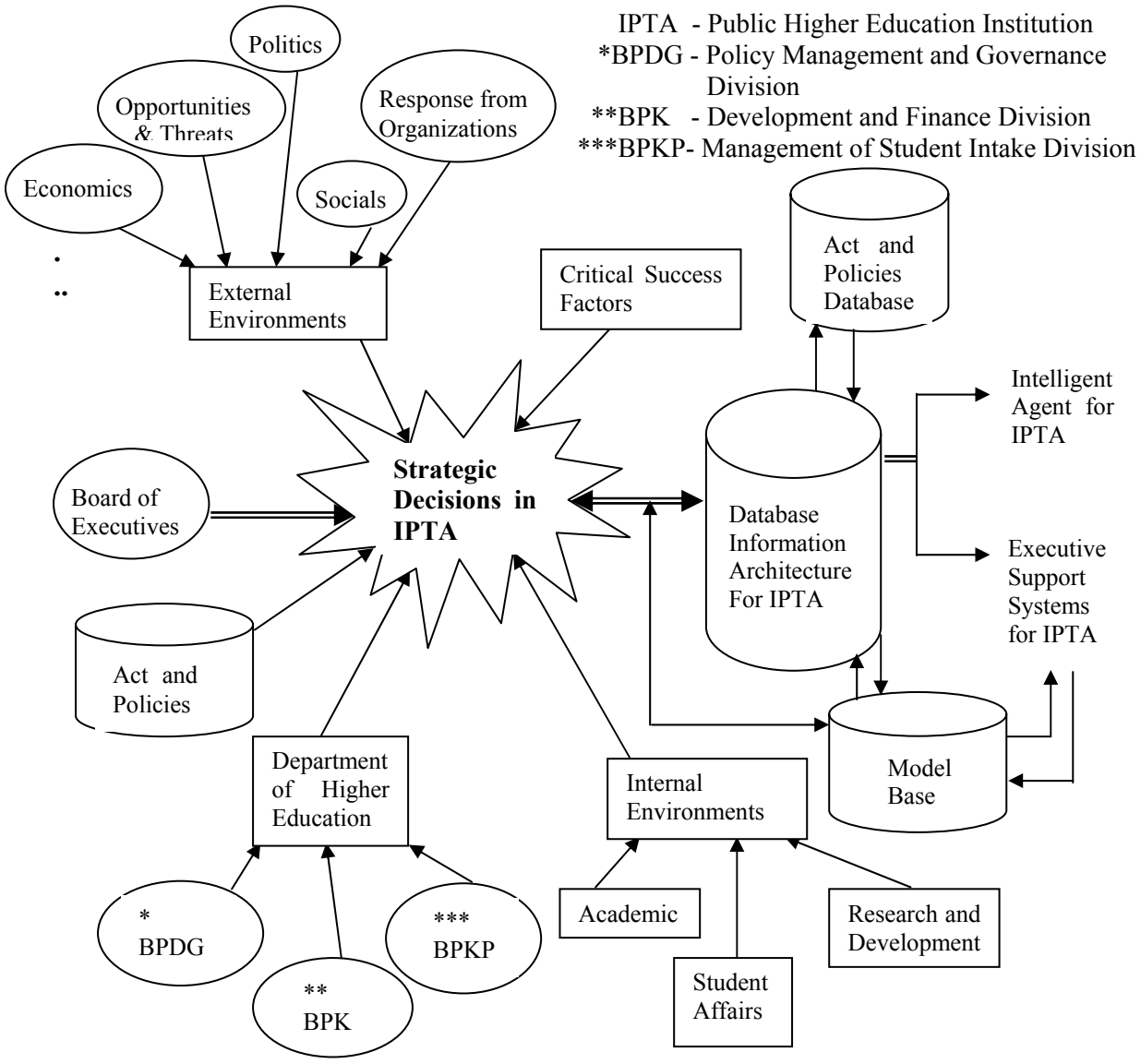
This framework focuses on the decision-makers of an IPTA (Mohamed et al., 1999). These decision-makers have been teaching and serve within the organization for a number of years. There are also cases whereby the decision-makers are from a different body such as semi-government organization with the ability of management administration background. These decision-makers basically will have different management activities. However, these management activities are inter-related. Therefore, decisions made by each decision-maker might need assurances or information from other unit within the institution. The next section will discuss briefly on the preliminary studies discussed by Mohamed and Hamdan (1999).

2.1 Strategic Decision-Making in Public Higher Education Institutions

The preliminary study (Mohamed et al., 1999) shows the process of strategic decision-making in an IPTA consists of a few components. These components and its relationship are shown in figure 1. Referring to figure 1, strategic decision-making in an IPTA involves

components such as the board of executives, external environments, internal environments, JPT and critical success factors of the organization. These strategic decisions must comply with the act and policies of the institution. External environments in an IPTA include the news or documents collected on subjects such as economics, politics, socials as well as response from agencies. These documents are those that will influence the planning and development of the institutions. Basically, this information is soft information, which is collected from documents, news, and magazines. However, in current situation some of the information is able to access through the web, e-mailing systems and so forth. Meanwhile, internal environment involves three major units in an IPTA. These units represent the whole purpose or goal of the entire institution. These units are academic, student affairs as well as research and development of the institution. Units, centers and departments are among the components that represent the organizations. Head, dean, professor or director represents each of this unit, center or department. Decision-makers from each unit, head of bursar and registrar as well as the head from each departments, centers and faculties are among the members in the board of executives.

[Figure 1] Framework of Strategic Decision-Making in a Public Higher Education Institution



In addition, the framework of strategic decision-making involves executives from the department of higher education (JPT). There are three divisions that are directly monitoring, planning as well as keeping track the development and planning of public institutions as shown in figure 1. These divisions are the channels in which government represents its views, suggestions and sometimes instructions to institutions. Therefore, this department plays an important role in executive decision-making either in supplying information needed for the planning and development of the IPTA or requesting information needed from IPTA for the process of updating and planning for the future of the country. Information gathered from these sources is used for making strategic decisions. In making these decisions there is the need to use data from databases, which will be process, according to the needs with the aid of appropriate model. The executive support systems will aid decision-makers in their decision-making and provides intelligent agent when needed for the purpose of providing the ability to reasons and make cognitive decisions. Next, decision within an IPTA is identified and classified into different levels as shown below.

2.2 Levels of Strategic Decision in an IPTA

The preliminary findings, shows that there have been a lot of computerized systems developed since the early 80's in order to provide better services in public education institutions (Mohamed et al., 1999). Most of this system concentrates on routine and structural processes with respect to strategic decisions. As indicated in past studies, Shirley (1983) identified four levels of strategic decision-making in a non-profit institution. The study by Mohamed and Hamdan (1999) shows three levels of strategic decision and distribution of information systems needed by executives in their decision-making. The three levels are institutional or executive, functional and program level. The overview and explanation of the three levels of strategy for a public institution of Malaysia and its organizational information systems needed are as follows. The detail overview is as described in appendix A.

- Institutional Strategy illustrated the scanning of information from external environment for any opportunities as well as threats to the institution. Meanwhile, internal environment should be able to give insight of the institution in terms of its strengths and weaknesses that needs to be worked on. Through inputs gathered from Department of Higher Learning, the match of this strength and opportunity will allow a significance constructive planning on the development of the institution. This match will determine the objective and mission as well as long-term planning of each unit.
- Level two provides the main unit functional strategies. The mission and objective provided from level 1 would then focuses on the plans of each unit. Appendix A provides the tasks and function planned for each unit. These tasks might vary from one institution to another. The implementation of the planning will involve the whole of the campus as well as the branch campuses. However, in implementing this planning there must be some controls and constraints in order to provide better and efficient decisions.
- Program Strategies discusses the need of these constraints, control and priorities. In a complex and big environment such as a public institution some controls and priorities need to be implemented as to monitor the development of an effective planning. Some of these controls or constraints are within the rules and regulations of an institution. These controls, constraints and priorities will differ among institutions.
- Organizational Information Systems provides the kind of system that should be developed by institutions in order for the smooth implementation of each planning. Appendix A listed the core system that will provide executives with kind of information systems needed in their decisions as well as planning.

This approach provides a framework of strategic decisions and planning in a public higher education institution as well as the structure of information systems needed. The knowledge attain from the above information will provide discussion on the next section.

3. EXECUTIVE SUPPORT SYSTEMS OF AN IPTA

According to Sprague (1980), decision support systems are an adaptive system that operates with participants and with technology that changes over time. This is supported with a number of researches that try to improvise the system with the rapid increase of demand and changes in technology (Franz et al., 1981; Dos Santos et al., 1989; Piramuthu et al., 1993; Chuang et al., 1998). The same principles are adopted in an ESS. ESS is a specialized decision support system that helps executives analyze critical information and use appropriate model to address the strategic decision of an organization (Mizoguchi et al., 1991; Belardo et al., 1994; Norbis et al., 1996; Sauter, 1997). Systems at executive level should be able to access information specified in a format of interest to the executives, provide analysis as well as reasoning, explanation and other intelligence properties.

ESS systems are capable in providing the intelligent and flexible features as mentioned in a number of studies (Beulens et al., 1988; Spengler et al., 1997; Gallegos, 1999). These support tools are intended to help decision-makers identify and access information that are useful in processing semi-structured or ill structured problems (Liu, 1998; Kuo, 1998). Furthermore, it will aid decision-makers in understanding problems, opportunities and possible solutions better. The next segment will study the general framework of a support tool and eventually will be used and modified to suit the decision-making environment of an IPTA. Some of the components are separated due to its significance within the structure of a decision-making in an IPTA.

3.1 The General Framework

In building basic decision support systems, there is three components need to be considered: a database, a model base and a user-system interface (Sprague, 1980). These three components are the basic components of decision support systems. Over the years there has been various kind of framework to support applications required by organizations (Sprague, 1980; Holsapple et al., 1996). There have been attempt to improvise the basic components to be able to create a better and intelligent environment. Therefore, a component is added to the system to assist with knowledge from the expert as well as the database and model base. This component is known as knowledge management (Turban et al., 1998) or knowledge engine (Marakas, 1999).

Besides this, there have been steps to improvise the framework by incorporating intelligence to the systems. Reasoning (Liang, 1988; 1993; Liang et al., 1993) is one of the concepts added to the systems to allow it acts as an expert. In another aspect of a research focuses on the cognitive ability of a human being. There are attempt to improve or add the ability of perception in a system for creating an environment that can act and think as managers in order to provide maximum aid in decision-making (Kuo, 1998; Singh, 1998).

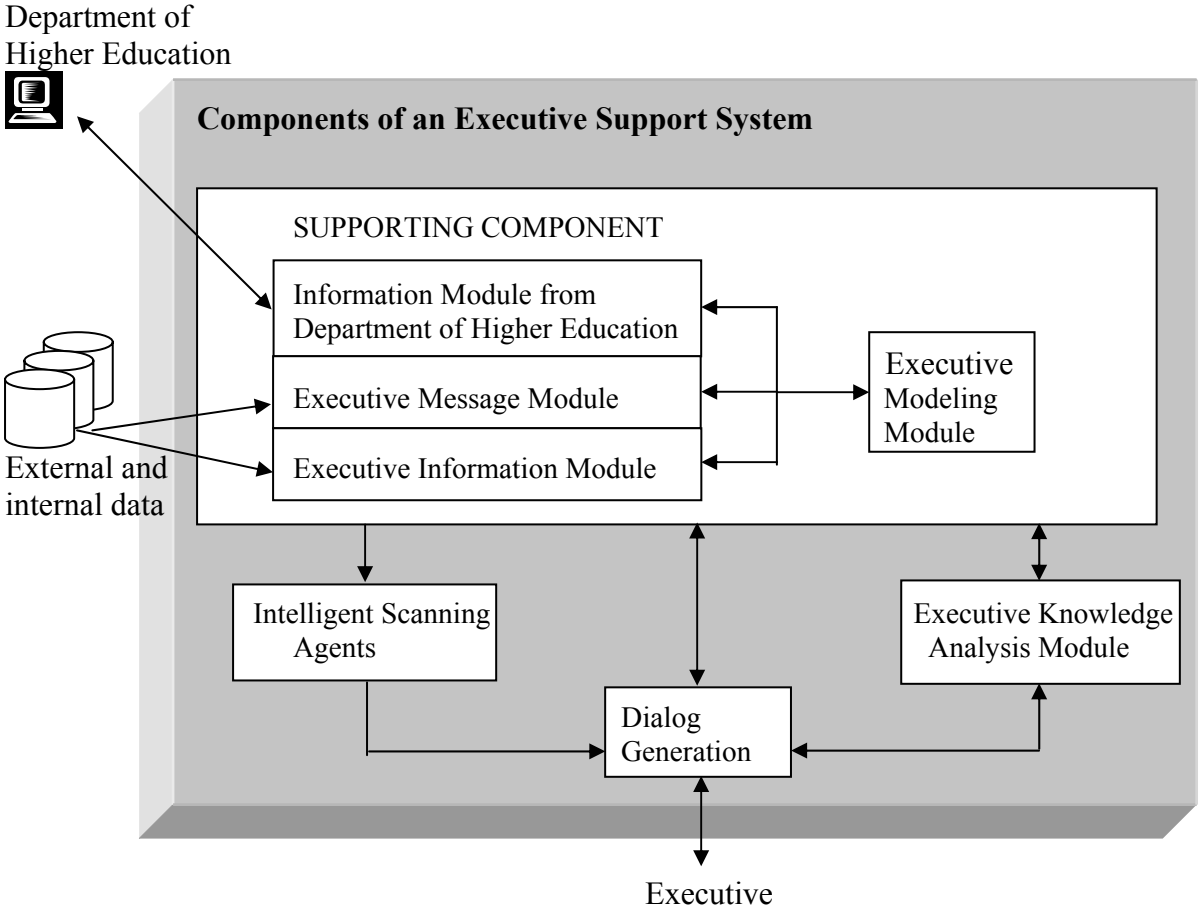
The next segment will discuss the suggested framework of executive support systems for executives in public institutions. These frameworks will show the components within the systems and components that support the systems. These components are the basic

component needed in each public institution in order to support the implementation of an executive support system. Furthermore, some institutions might want to add other components to show the originality or uniqueness of their institution, which depends on the necessities.

3.2 Framework for Public Higher Education Institution

Executive support system for an IPTA takes into consideration the components that exist in the strategic decision-making framework (please refer to figure 1). Therefore, the components of an executive support system are divided into components needed to support the system and components of the system. The components that support the system are systems from department of higher education, executive information module including data on policies and acts, executive message module that includes internal and external messages also executive model module. Meanwhile, other components are executive knowledge analysis module, intelligent scanning agents and dialog generation, please refer figure 2.

[Figure 2] Framework of an Executive Support System in Public Higher Education Institutions

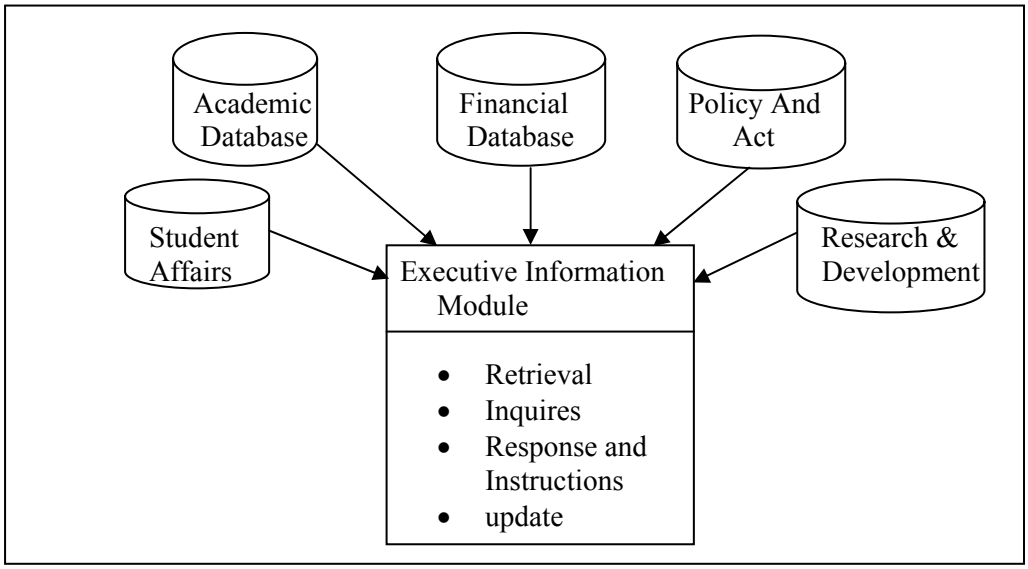


3.2.1 Supporting Components

Illustrated in figure 2 and as discuss before, one of the government agency that plays an important role in an IPTA is JPT. Therefore in this structure of ESS for IPTA include the communication between JPT and IPTA. Executives must be able to access systems from the JPT as well as messages as to see any relevant matter that can be use in decision-making. At

the same time, JPT can access through the executive database for any information or relating new instructions to the database module. The communication suggested includes an online system within JPT and accessible system for both executives in JPT and IPTA. Meanwhile, the executive information module provides the internal information of the institutions, as described in figure 3. The policy and act database as well as an integrated information database provide the information needed by executives in their decision-making.

[Figure 3] Executive Information Module



In order, to prepare information required by executives in their decision-making, a proper basic information database is needed. This basic information database architecture, identified four major databases, please refer to figure 3, as discussed below:

- Academic Database provides information regarding personnel, research produced locally and internationally, existence of faculty or center, enrollment, program provided every semester or term, examination and degrees or other equivalent scroll provided by the institutions. There will be list of systems that classify this information such as system on personnel, system on research and so forth. These systems interact with each other to support decision-making by executives when needed.
- Research and Development Database provides information on the development of the institution with respect to each center, faculty, department or unit. Besides this, it should also holds information regarding researches taking place and currently worked on. These involve information on the budget, manpower and location as well as the equipment needed. In addition, information on the possible market of research as the basis of income regeneration. Basically, this database will also provide information on maintenance needed and the technical support currently undertaken or provided.
- Student Affair Database provides information regarding student and services provided for students. This information includes registration, welfare services, health, transportation, and placement. Information provided is accessible through different systems provided.
- Financial Database will support systems such as the profit and loses, costing, auditing and other budgeting systems. This database will also provide information on the amount of financial aid available for each unit, center, department or faculty.

These systems are the basic systems needed in providing the information needed by executives and organization as a whole. Furthermore, other relevant information is to be added in accordance to the needs of the institution. Some of these systems have already exists in public institutions but probably on a different platform. Therefore, it is important that they are integrated to allow cross-references among data within the systems. Meanwhile, the act and policies module is to provide constraints, checking and cross-reference so that decisions made are valid with the policies and acts of the institutions.

The next supporting component is executive message module. This module process both internal and external messages. Internal messages are events occur within the organization such as meetings reports, evaluation reports from each unit, research reports and more reports that need to be included to provide executives with a better understanding of the decisions to be made. Meanwhile external messages are messages, news or documents gathered as when requested by executives such as reports on the current development in technology, academic and research as well as response from other agencies. Knowledge of these events is gathered probably by using a forefront technology or documents gathered from magazines, news, electronic mail and so forth. In addition, it could also be information from peers that are important enough to be added in the knowledge for analysis and therefore in decision-making.

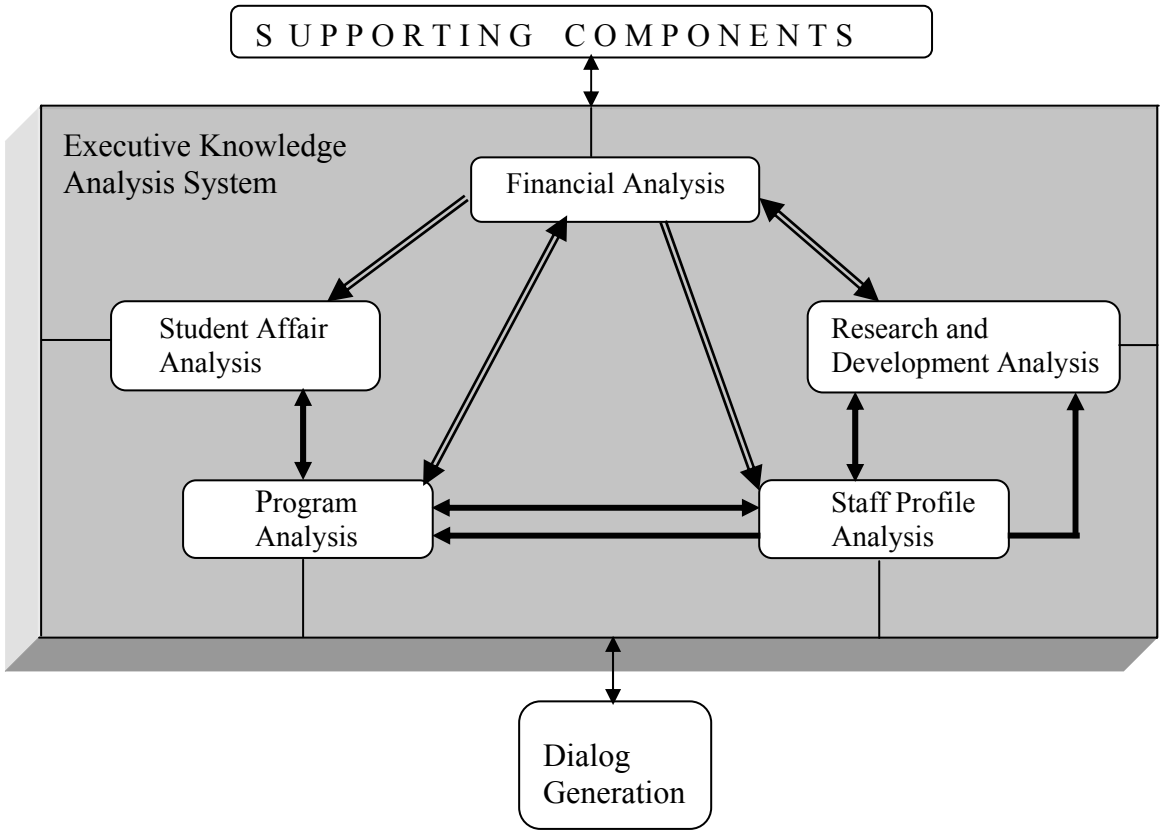
Information gathered from each of the above module will then be manipulated and processed by the next important module that is executive model module. This module will create, generate, maintain, update and use models in order to help executives with analysis as well as to provide a well-defined problem or decisions. Some of the built-in models provided are mathematical, statistical and financial/budget models. Analyses method found to be helpful for executives are forecasting and sensitive analysis. Figure 2 also shows the relationships of these analysis components with other components of the suggested executive support systems. The relationships provided are based on the information required from systems and databases as well as new information derived from analyses that need to be added. Model required depending on the needs of the analysis and executives.

The next section discusses the analysis component of the system that is executive knowledge analysis module. This module will show the main design of the knowledge analysis framework and also the characteristic of each suggested analysis.

3.2.2 Executive Knowledge Analysis Module

The important component that provides the support for problem identification, analysis and choice is executive knowledge analysis module. Intelligent agents embedded within the system provide the ability to scan for any problems within data collection, analysis and reasoning of choices made. The framework of this system consists of the main components within the basic information database architecture of an IPTA (please refer to figure 3) with a slight modification in the academic section. The academic section is divided into two components that are the program analysis and staff analysis. Other analyses identified are student analysis, research and development analysis as well as the financial analysis. These components are identified as the main component for any strategic decision need to be made and monitored. Besides that, these components are involved in analysis to predict the future development and mission of the institutions. The results of each analysis can be an important input for other analysis component as shown in figure 4.

[Figure 4] Executive Knowledge Analysis Module



As mention above, this framework consists of five analyses, which are the Program Analysis, Staff Profile Analysis, Student Analysis, Research and Development Analysis and also Financial Analysis as discussed below:

- Financial analysis create the ability to provide analysis on the cost, budget provided by government and other contributors as well as auditing system that will alert the executives for any problems with its budget, inventory and other financial mishaps.
- Student affair analysis provides analysis on student welfare that involves every aspect such as student transportation, financial ability, placement, problems, health, counseling, co. curriculum as well as students performances.
- Program analysis provides functions involving all aspects of program development, termination and restructuring. At the same time, information on the current running of programs such as curriculum, subject levels and other information in each institution is provided for executives to do any necessary analysis. Besides this, environmental scanning on the current programs development in other local or foreign institutions for program expansions as well as consolidation.
- Staff profile analysis provides information on staff performances and profiles that can be used in identifying necessary position, salary improvement and other aspect of individual motivational and development program.
- Research and development analysis provides information on research development as well as physical development of the institution. This information will provide the knowledge on the future development and financial ability of the institution. Development analysis provided are divided into physical development of the institution taking into consideration its maintenance and technical procedures required, staff

development program which include its research and other training procedures required and program development that involves the consolidation and termination of program.

These reports are information attained from the basic information database architecture. The reports are developed depending on the necessities of the analyses or instructions performed by the executives. These reports are summarization information that can support executives with their enquiry and analyses. The detail reports summarization for each analysis is as shown in appendix B.

The paradigm shift among institutions has made financial institutions as an important component where its output is an input to all other components. Besides this, there are also relationships among other components since there should be a cross-reference of task in real world situation. Some of the output of this analysis will be use by other components as an input to other analyses. The reuse of model is among the modern and current features that need to be enhanced.

Furthermore the modeling module will supply analysis with existing model that are apparent to the current problem solving. These models are those created from each analysis made or build-in model with intelligent features. The intelligent agents within executive support system are the important features in supporting executives in their decision-making. Currently, this agent is an important gadget in a lot of computer-based information systems and database systems. The knowledge of this implementation is also incorporated within the systems in order to create support tools that are able to the best and optimal support required by the executives.

The next section discusses the intelligent scanning agents. Scanning is one of the major properties and interest to the executives in an IPTA. The time needed in recognizing and identifying useful as well as important information are among the tedious work of executives. They welcome any suggestion of improving the ability to extract information quickly and efficiently. The next section will briefly discuss on the aspect of scanning that is suggested by the executives.

3.2.3 Intelligent Scanning Agents

Intelligent scanning agents provide the ability to scan, watch and sense making for useful and important information continuously on behalf of the executives. This includes identifying possible potential business information and other potential resources on the world web. Moreover, the agents will remain active all the time to visit periodically the information sources, monitor information, look for trends in similar organization, identify new information, fuse the information with other relevant data, extract implied information and finally, distribute the results to executives.

Information extracted and analyzed is information that provides future development, opportunities and threats to the organization. Besides that, the agent will also scan for any weaknesses that are of interests to the executives. These abilities allow continuous scanning of internal and external environment.

Lastly, the important component of a support tool is the executive interfaces. Next section will discuss on the dialog generation of the framework. It provides the executives with a comfortable and easy environment to work with the system efficiently and effectively.

3.2.4 Dialog Generation

User interface will create a platform comfortable for the user to interact with the computer. This includes the use of intelligent features to support executives in placing its need clearly and prompt. Executives are able to use system by adopting comfortable environment provided. Therefore dialog generation will need to identify executives' need and ability in using computer.

There has been a great deal of studies on dialog generation that includes the natural language processing. This process provides the knowledge of the systems in order to create effective use of the system. In addition, the language action provides features of communication that are relevant and easy to the executives through various simplified techniques available. Also, the display language provides executives with options of presenting results or outputs using current development of display techniques.

4. CONCLUSION

The framework of an adaptive executive support systems described above attempts to show the dimensions and scope of ESS in a way that will promote the further development of ESS in the administration of public institutions as well as other agencies in Malaysia. The discussion shows the important procedures needed by decision-makers in public institutions for decision-making. This framework also described the systems of executive support systems in public institutions.

This article has provided the understanding of strategic decisions as well as the guideline in the architecture of basic information database systems needed in a public institution organization. It also provides the basic information systems required in each of the public institution in order to provide the suggested executive support systems framework of an IPTA with correct and reliable information. It also outlines the executive knowledge analysis, which took into consideration the main factors within the framework of a strategic decision-making in an IPTA. The prototype of this framework shows the potential growth of the ESS in the future in an IPTA, which, later hopefully can be adopted by other higher education institutions.

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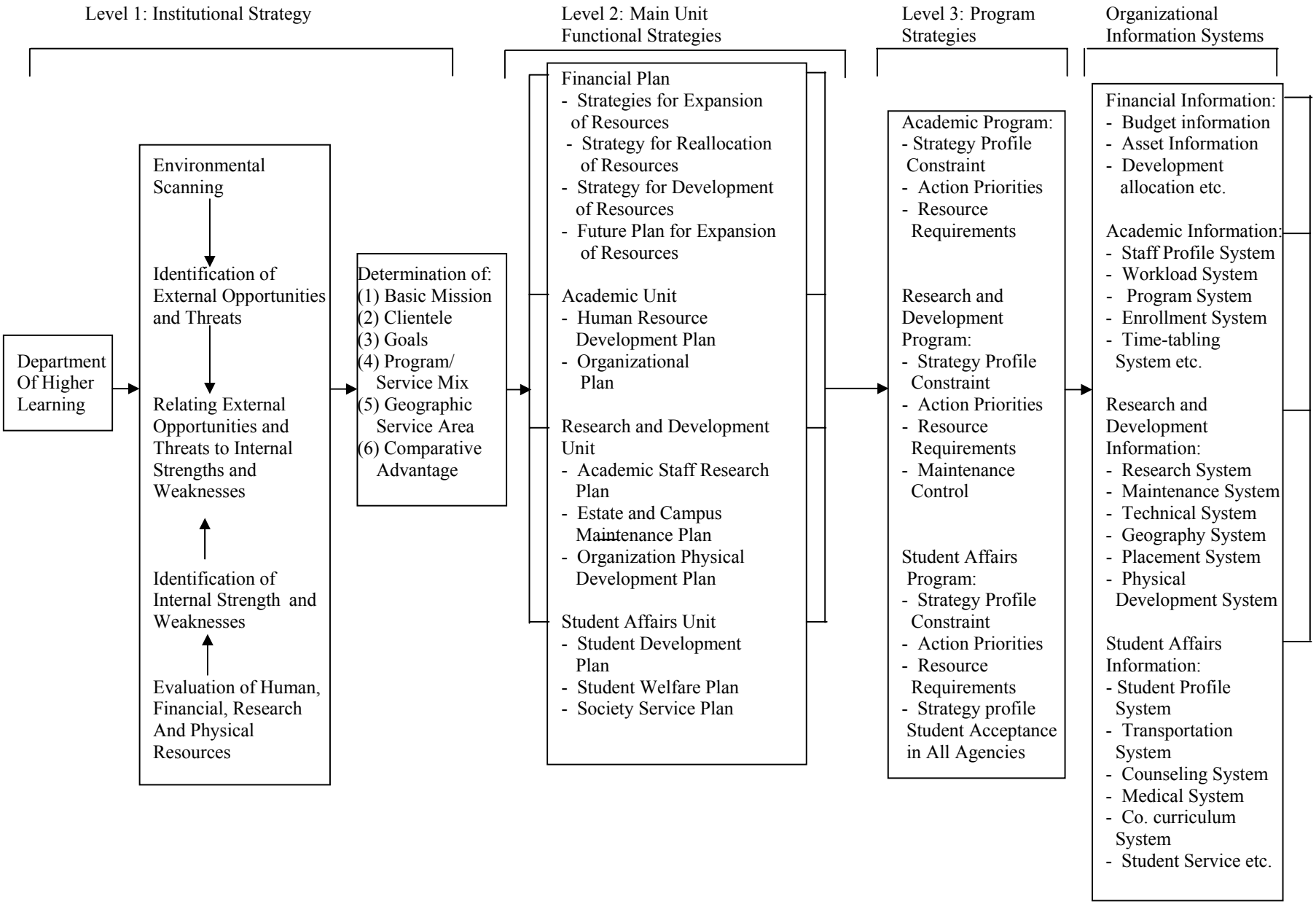
APPENDIX A – LEVEL OF STARTEGIC DECISIONS IN AN IPTA



APPENDIX B

EXECUTIVE KNOWLEDGE ANALYSIS DESIGN