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Operational Data Integration Technique for Intelligent Profile Graduate Entrepreneur System

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ABSTRACT

Business Intelligence (BI), which is the process of collecting, analyzing, and transforming data using Data Warehouse (DW) is seen as one of the growing approaches to provide meaningful information for the Malaysian Ministry of Higher Education (MOHE). MOHE is responsible for managing various activities to encourage graduate entrepreneurs to venture into the businesses and ensure that the country has many successful entrepreneurs. Therefore, systematic and accurate information needs to be available for planning, implementing, and monitoring entrepreneurs' performances. This paper proposes the modeling and designing of the graduate entrepreneur profile system - Intelligent Profile Analysis Graduate Entrepreneur (iPAGE) using the BI and data integration approach. Two main methodologies were used namely: Conceptual Design Model Operational Data Store (CoDMODS) and Rapid Application Development (RAD) to model and design this system. The iPAGE was validated and evaluated by users, entrepreneur's personnel and DW experts. Indeed, the approach will be used to benchmark the development of an entrepreneurial information system in the future.

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INTRODUCTION

The Malaysian Ministry of Higher Education (MOHE) requires quality information to evaluate the performance of organizations, understand the needs of customers and competitors, and to expedite decision making within the ministry. The use of information technology is seen as an advantage for MOHE to manage the information by developing various application systems to support the operations of the businesses. As a result of that, numerous application systems have been developed to facilitate MOHE in managingthe large amounts of data and the wealth of information in organizations. These data are often processed using various applications, undergo multiple stages and are stored in different departments. As a result, management often finds it difficult and problematic to acquire accurate information for decision making within the organization (Mohanty, S., 2006; Rainer, R.K., 2007). One of the crucial information is required by the MOHE currently is data related to graduate entrepreneurs in Institutions of Higher Learning (IHLs).

This study focused on modeling and designing the iPAGE application usingthe Operational Data Integration technique in the BI approach. The subject areas of this study is the profile analysis conducted by MOHE to manage the graduate entrepreneurs. In the following section, information management activities, based on, BI, data integration, the Operational Data, and graduate entrepreneurs' profiles are discussed.

BI is an approach used by organizations today to get qualitystrategic information to predict the future trend.BI refers to the use of technology to collect and use of information effectively for enhancing business effectiveness. Wu defined BI from the perspective of data analysis that "the process of gathering highquality and meaningful information about the subject matter being researched that will help the individual (s) analyzing the information, draws a conclusion or makes assumptions" (Wu, J. 2000). BI is a process to convert data into meaningful information and knowledge to determine the current situation, making decisions and predict the circumstances that will occur in the future of the organization (Imhoff, C., 2003). Based on these definitions, BI is generally a business management term which refers to applications and technologies used to collect, pursue, analyze and present quality and strategic information for the operations of an organization. The basic concept is to take a BI operational data from various sources, clean these data, converting them into DW and then organize the data by using BI tools in order to get strategic information within the organization.

Data integration is a fundamental, deceptively challenging, and component of any organization's business intelligence and data warehousing strategy. Data integration involves combining data residing in different data

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repositories and providing business users with a unified view of this data. Data integration becomes increasingly important in cases of merging systems of the two companiesare consolidating applications within one company to provide a unified view of the company's data assets. This technique is useful for operational data in the organization for operational data analysis and management.

Inmondefines the ODS as "an architectural construct that is subject oriented, integrated, volatile, current valued, and contains only corporate detailed data" (Inmon, W.H., 1999; Inmon, W.H., 2000). In a different view of system development, Baragoin defined ODS as "an environment where data from a different operational database is integrated" (Baragoin, C., 2001). Many researchers have included ODS in the operational data integration to provide integrated information to the user community within the organization. The approach that combines the ODS and DW technology have successfully provided a BI environment to support strategic and tactical information within an organization. According to them, the ODS has a data capacity which is frequently updated and integrated with operational data. ODS is used to make tactical decisions as compared with the DW to support strategic decisions. Figure 1and 2shows the characteristics of ODS and the relationship between operational data and information for decision making.

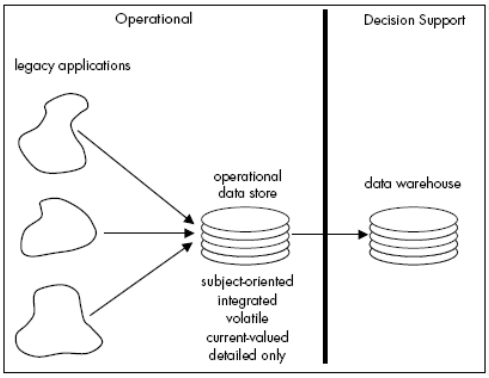

Fig. 1: Characteristics of ODS.

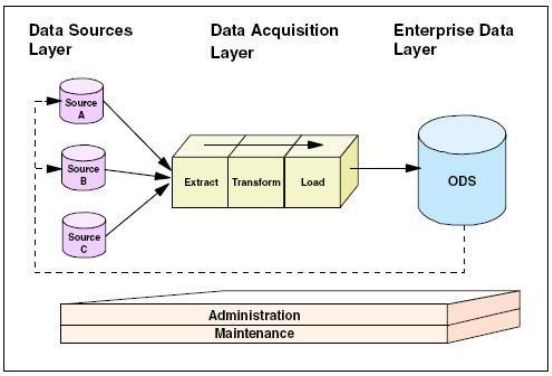

Fig. 2: General Architecture ODS.

Using ODS components in the DW architecture is a good approach to obtain information across borders that organize the business function data from multiple applications into one subject area (Kimball, R., Caserta, J., 2004). ODS not only serves as data storage, but also serves as a component that provides facilities to integrate, process and presents data in subject areas assigned to user communities within the organization. Among them is ODS provides access to critical data in the operational data, capable of achieving and presenting information in real time, capable of generating better operational reports from the transaction system and reduce time to implement the DW system because some data in the ODS can be used in the DW.

Graduate entrepreneur is an entrepreneur who plans, manages and develops individual business or group in the context of the entrepreneurship university program (Kirby, 1992). The entrepreneur refers to two categories: graduate entrepreneur and siswaniaga entrepreneur. Siswaniaga entrepreneurs are university students who are still studying in a university, and conduct business under the monitoring and supervision of a University'sEntrepreneur Unit. Development of a systematic profile for graduate entrepreneurs is a major challenge for the institutions that are responsible for managing the graduate entrepreneurs' information. The graduate business profile is a collection of personal information and information related to the entrepreneurs' businesses. IHLs usually manage the graduate entrepreneur activities using their own methods, and this is performed either manually or using a computer system. Through its Entrepreneurship Unit, the MOHE is responsible for managing the entrepreneurship program at 20 local public universities. Therefore, the MOHE requires accurate business information to plan policies for the development of graduate entrepreneurships. Difficulties in obtaining accurate profile of the graduate entrepreneurs would complicate the efforts to plan the entrepreneurship programs (MOHE, 2010). Most of the graduate entrepreneur's information managed by respective universities, whether in digital form, text, files and directories are based on the format specified by each university. Therefore, a big challenge for the MOHE is to build a database for graduate entrepreneurs, entrepreneur profiles and can be accessed quickly and accurately.

The Proposed Approach:

ODS data model in BI architecture is used to develop the iPAGE application. The ODS data model is capable of integrating data from heterogeneous data sources and structure that can facilitate the construction of the operational, tactical and analytical reporting. Thus, analysis of requirements and development of iPAGE applications requires a suitable model to ensure the objectives of BI applications are achieved. There are two main methods used: Conceptual Design Model Operational Data Store (CoDMODS) to determine the needs of BI-

based iPAGE applications and Rapid Application Development (RAD) that is used to design and develop the iPAGE system.

CoDMODS model that focuses on the analysis requirements of BI uses the ODS data model to develop this iPAGE application. In this model, the requirement analysis is divided into three phases: Organization Level Requirements, ODS Level Requirements and Requirement Management. In each phase, the activities were involving requirement gathering process and analyzing information. The organizational level requirements' phase begins by defining the business domain and ends with the requirement specification of the organization. Meanwhile, the ODS levels' requirement's phases were determining the subject areas and producing the ODS requirement specification. For requirement gathering, three orientation approaches were used: business-oriented, data-oriented and consumer-oriented. These approaches were presented in the CoDMODS model as shown in Figure 3.

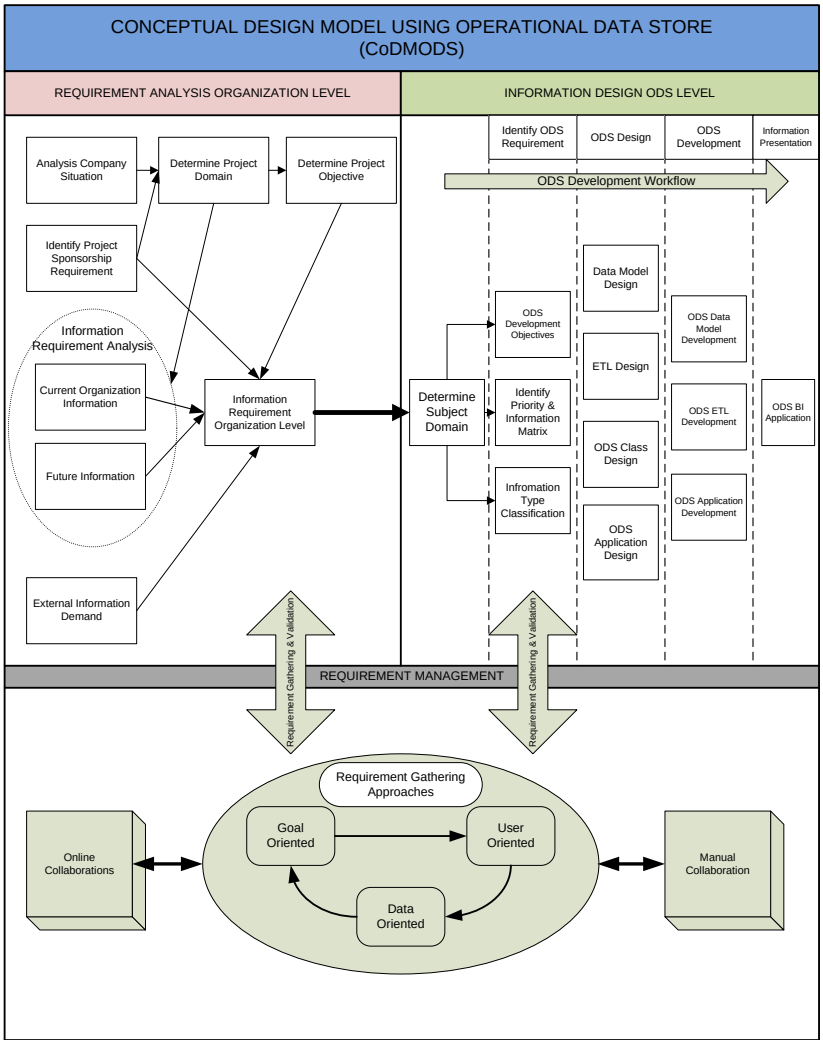

Fig. 3: Proposed CoDMODS Model.

The ODS structure integrates BI information from the various data sources, and develops a BI data model and the ability to present information systematically. The ODS data structure is modeled by using the Entity Relationship (ER) model and dimensional (DM) model. ODS data modeling requires several stages of the requirement process such as ODS integration, OD characteristic and ODS classification.

The methodology used to develop iPAGE application is RAD. Generally, RAD is utilized to support the development of two main applications within iPAGE: Web Portal Entrepreneur Profile and Entrepreneur Profiles System. RAD was chosen to develop iPAGE because this methodology provides a systematic plan for system development life cycle, which combines two techniques of evolutionary prototyping and development phases.

The design of the entrepreneur data warehouse is constructed according to dimensional modeling (Kimball, R., 2004). Dimensional model emphasized on data structures that focus on providing information to the decision makers. Thus, the components of fact, dimensional, and measures are identified and addressed properly.

Based on the user requirements in the requirement phase, the data warehouse model for entrepreneurs is shown in Figure 4. The ETL will allow raw data from data sources available to be transformed into the entrepreneur's data warehouse according to the ETL process design specification. In general, the ETL process specification is defined in the Logical Data Map (LDM). The LDM records each activity in data processing, which contains information about data sources, target data, and transformation activities.

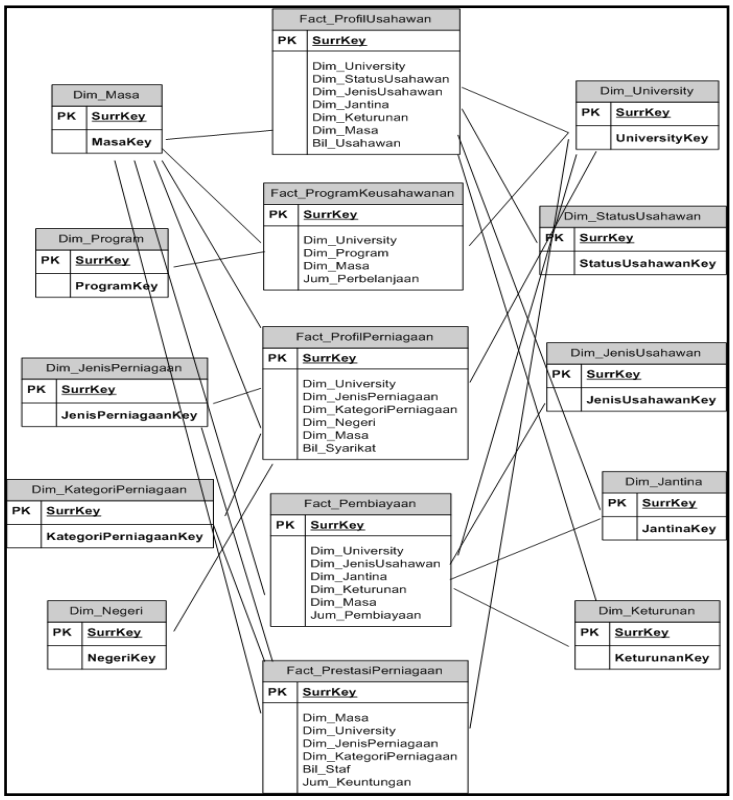

Fig. 4: Dimensional Model for Entrepreneur Profile.

The iPage prototype, which was developed based on the CoDMODS model is the main deliverable of this study. iPAGE has two main system components that focus on different functions and roles to users, namely: Web Entrepreneur Profile that contains the functions for managing and accessing entrepreneur profiles, and Portal Entrepreneur Profile, which act as dispersal agents for entrepreneur information to entrepreneurs itself, universities, MOHE, and the public. Interestingly, the information provided in the form of facts and analysis that supported its production by Artificial Intelligence technologies that are central to this study. The implementation of iPAGE involved several organizations and people who are organizing the entrepreneur from the data is created by the formation of BI-based application. Thus, the concept of the physical architecture of the iPAGE implementation is shown in Figure 5.

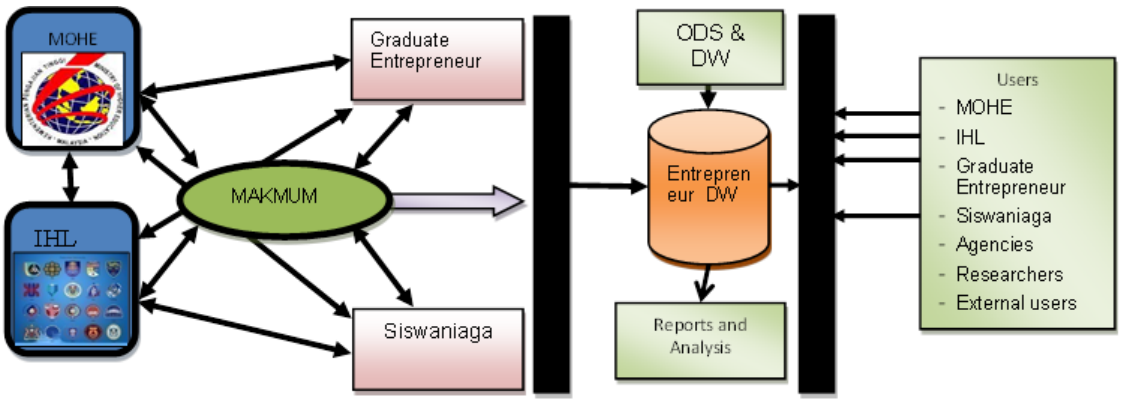

Fig. 5: iPAGE Implementation Architecture.

In summary, the CoDMODS model that specializes in BI development methodology using data integration technique is combined with a RAD system that is known in agile software development methodology for developing the iPAGE. This research has been using the advantages of RAD and applicability of CoDMODS for planning, modeling, designing, developing, testing, and implementing the iPAGE applications successfully.

Validation and Evaluation:

Formative testing was conducted to ensure the iPAGE functions are working properly, particularly in terms of usefulness, ease of use and meeting the user requirements. In addition, the assessment for iPAGE is also made by involving DW expert and expert domain of entrepreneurship. A formative testing of iPAGE applications using questionnaires was adapted from Davis (1989), who suggested the component of the Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. It was also an adaptation of the Technology Acceptance Model (Venkatesh & Davis, 2000). The questionnaire is divided into two categories: i) testing for usefulness; and ii) ease of use. The numbers of questions are 12, and each question has a Likert scale degree from 1 (unlikely) to degree 5 (Likely). The feedbacks collected from 32 respondents were analyzed for each of the usability categories. The results of the statistical components of the usefulness and ease of use are shown in Table 1 and Figure 6.

Table 1: Descriptive Statistics Results for iPAGE Application Testing.

Group	N	Mean	Std. Deviation
Mean iPAGE			
Perceived Usefulness	32	4.375	0.54732
Perceived Ease of Use	32	4.4375	0.53784

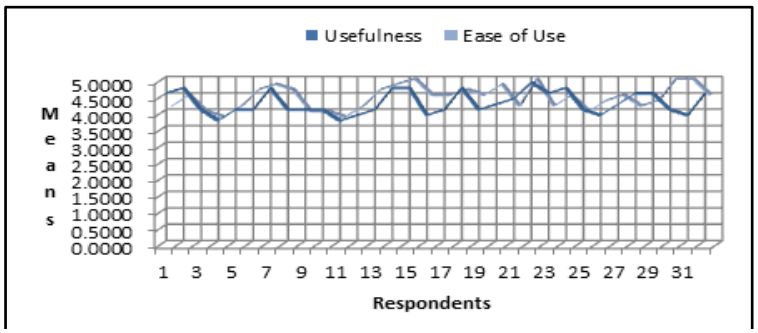

Fig. 6: Graph for Usefulness and Ease of use of iPAGE.

The validation process also involved the DW experts and specialists in the field of the graduate entrepreneurship domain.In requirements analysis, the experts have stated three important issues to be considered in the development of iPAGE. These issues are: i) the application requirements should take into account the target iPAGE organizations such as vision, mission and key objectives of the organization; ii) DW data model should be flexible to new requirements in the organization; and iii) strongly agreed that the requirement analysis for BI applications should involve participation from all communities, and it can be done manually or through online collaboration. Moreover, the experts agree that entrepreneurship information from iPAGE can be used asa key reference point among graduate business management either at MOHE, public and private universities, and Majlis Keusahawanan Universiti Malaysia (MAKMUM).

Conclusion:

An operational data integration technique in BI can transfer data, convert data, import or export data between applications or within applications without manual intervention. This approach focused more on operational data for operational reporting.The web entrepreneur profiledeveloped using this technique have been successfully implemented in a real environment.iPAGE system complements the concept of operational system and BI in an information system. The provided information is directly accessible by users through the several stages of portal facilities. The various styles of reporting havebeen used to support MOHE for planning a public entrepreneur policy in more systematic and holistic manner. Moreover, testing and evaluation system have shown that iPAGE can be used for implementing the BI for entrepreneur system. However, user feedback is important to ensure conformity with the requirements analysis and reporting of the information required. This has been proven in iPAGE validation and evaluation process. It is hoped that the iPAGE can be used to be a benchmark for the development of a comprehensive integrated entrepreneur information system in the future.

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