

## INTELLIGENT PROFILE ANALYSIS GRADUATE ENTREPRENEUR (iPAGE) SYSTEM USING BUSINESS INTELLIGENCE TECHNOLOGY

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**ABSTRACT.** The increase use of information in Malaysia Ministry of Higher Education (MOHE) is resulted from the process of huge and complex data in several stages and at different locations. This situation leads to the difficulties of data management and problematic usage for decision making. 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. The MOHE is responsible for managing various activities to promote the graduate entrepreneurs to venture into the business and ensure the country has many successful entrepreneurs. Therefore, systematic and accurate information needs to be available for planning, implementation, and monitoring entrepreneurs' performances. This paper proposes the modeling and designing of the graduate entrepreneur profile application called Intelligent Profile Analysis Graduate Entrepreneur (iPAGE) using BI technologies and supporting by a DW approach. Two main methodologies were used namely: Requirements Centric Operational Data Store (ReCODS) and Rapid Application Development (RAD) to develop this system. The iPAGE system was validated and evaluated by iPAGE users and DW experts. It is used to be a guideline for the development of an entrepreneur information system in the future.

**Keywords:** Graduate Entrepreneur, Business Intelligence, Data Warehouse, Operational Data Store, Rapid Application Development

### INTRODUCTION

Today's Ministry of Higher Education (MOHE) business environment requires quality information to evaluate the performance of the ministry, understand the needs of customers, competitors and identify the ability to make decisions within the organization. The use of information technology is seen as advantages for MOHE to manage the information by developing various application systems to support the operation of the business. Thus, more and more application systems have been developed to lead MOHE to manage large amounts of data and the wealth of information in organizations. In addition, the data is processed in the current application system consists of several stages, various applications and placed in different departments. This situation will lead management difficulty and problematic to acquire accurate information for making decisions within the organization (Mohanty, 2006; Rainer et al., 2007). One of the crucial information is student entrepreneurs in Institution of Higher Learning (IHL).

The MOHE has set a target to make the students of the Institution of Higher Learning (IHL) to be excellent in academic and become a successful and knowledgeable entrepreneur after graduation. It is important for entrepreneurs to compete where they have the knowledge

to plan and manage the business well to face the business world that increasingly complex and competitive. Consequently, MOHE has set up entrepreneurial units, committees, councils and cooperation between the universities to conduct entrepreneurial culture programs such as Graduate Entrepreneurship Program (GEP) and the Student in Free Enterprise (SIFE). Currently, the MOHE did not have complete information for the analysis of entrepreneurial profiles that determines the success or failure of the entrepreneur programs. In addition, the MOHE must monitor entrepreneurial units in more than 20 universities that have different organizational structure, scope and entrepreneurship programs. In Universiti Utara Malaysia (UUM), this unit is Cooperative and Entrepreneurship Development Institute (CEDI). Therefore, the objective of this paper is to present the development of the Intelligent Profile Analysis Graduate Entrepreneur (iPAGE) system by using BI approach.

## RELATED LITERATURE

The study involved a number of theories related to information processing in organizations such as Organization Information Processing Theory (OIPT) and A Systems Theory of Business Intelligence. These theories were used as the basis of this study to understand the relationship between an organization, information processing activities and the importance of information in an organization. Based on these theories, the research is conducted and includes all the entities that exist in an environment of resource information systems in an organization, regardless the internal or external sources of data. Importantly, understand the environmental conditions and methods for connecting these system entities need to be considered to ensure the developed system can run smoothly and achieve the organizational goals. ODS, DW and BI technology is innovation that resulted in a complex process in which information technology can be contributed to the OIPT for information creation and dissemination within the organization.

### Business Intelligence

BI is an approach used by organizations today to get a better quality and strategic of information to predict the future trend. Gartner (2010) predicts by 2012 more than 35 percent of 5,000 large companies fail to make the right decisions related to business and marketing due to insufficient information. Additionally, in the same year, 40 percent of the overall information technology budget will be invested in BI applications to obtain accurate business information. There are many studies discussed the implementation of BI applications in the organization. In the health sector, BI is used to integrate the objectives of the organization with information technology as a component of an integrated management model in health care. Generally, the coordination between business and information strategy in a banking sector is to help the banks more competitive. Moreover, BI projects are implemented in the areas of utilities such as electricity, gas and water supply.

### Operational Data Store (ODS)

Inmon (1999) defines the ODS as "an architectural construct that is subject oriented, integrated, volatile, current valued, and contains only corporate detailed data". In different angle of system development, Baragoin et al. (2001) define as "an environment where data from a different operational database is integrated." Many researchers have included ODS in the operational data integration to provide integrated information to the user community within the organization. Kimball and Ross (2002) also said the ODS is a data component that can be positioned along the DW system development. The approach that combines the ODS and DW technology have successfully provided a BI environment to support strategic and tactical information within an organization. This research focused on the ODS approach in modeling and designing the BI system for graduate entrepreneurs in IHL.

## Graduate Entrepreneurship

Graduate entrepreneur is an entrepreneur who plans, manage and develop individual business or group in the context of the entrepreneur university program. This entrepreneur refers to two categories: graduate entrepreneur and *Siswaniaga* entrepreneur. *Siswaniaga* entrepreneurs are university students who are studying in university and conducting business under the monitoring and supervision of the university entrepreneur units. The encouragement of a graduate entrepreneur aims to develop knowledgeable entrepreneurs who can support economy as well as business culture among graduate students. Among the programs organized by the government are the Graduate Entrepreneur Scheme (GES), the Graduate Entrepreneurs Fund (GEF), Student Entrepreneur Training (SET), Student Entrepreneurial Program (SEP), and Graduate Development Program (GDP). SEP is supported by the University Entrepreneur Unit and University Student Entrepreneurship Council Malaysia (MAKMUM), which was established to coordinate and monitor the implementation of the Small Medium Business Enterprise (SMEs) at the university level.

## ODS MODEL FOR iPAGE

iPAGE application development is focused on the use of the ODS data model in BI application development approach. ODS data model 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 require a suitable model to ensure the objectives of BI applications are achieved. There are two main methods used: Requirement Centric Operational Data Store (ReCODS) to determine the needs of iPAGE applications and Rapid Application Development (RAD) that used to design and develop iPAGE system.

### ReCODS Model

ReCODS model that focuses on the analysis requirements of BI is using the ODS data model to develop this iPAGE application. In this model, the requirement analysis was divided into two phases: Organization Level Requirements and ODS Level Requirements (Shahbani & Norshuhada, 2009). In each phase, the activity was involving requirement gathering process and analyzing information. The organizational level requirements' phase begins by defining the business domain and ends with the requirements' specification of the organization. Meanwhile, the ODS level requirement's phases were determining which of the subject areas and producing the ODS requirement's specification. For requirement gathering, three orientation approaches were used: business-oriented, data-oriented and consumer-oriented. These approaches are presented in ReCODS model as shown in Figure 1.

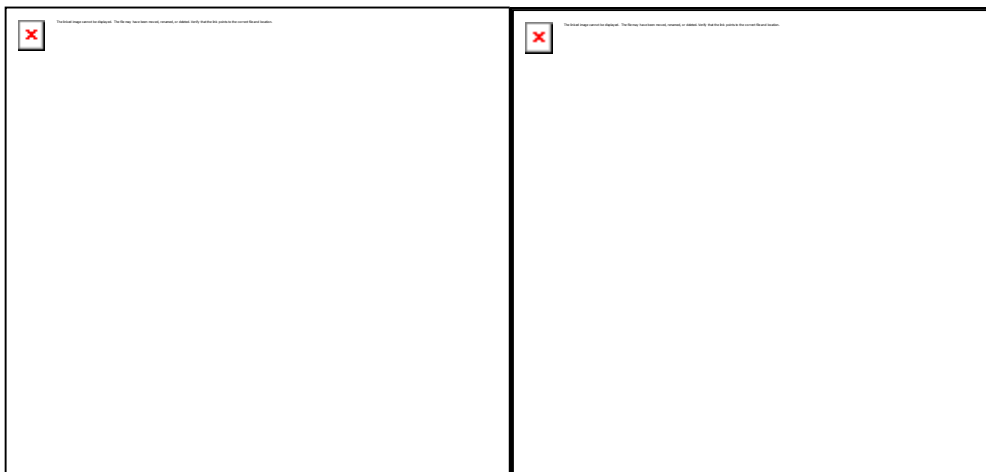


Figure 12. ReCODS Model

Figure 2. ReCODS Architecture

In ODS requirement phase, the collection and analysis requirements were focused on the subject areas that have been set from the previous phase. This phase involves five steps: determining the subject areas, requirement gathering of subject areas, the analysis of subject areas, determine the ODS operation, and specify the ODS requirements' specifications. In this phase, requirement gathering and analyzing are more focused to develop iPAGE applications.

### ReCODS Architecture

ReCODS architecture describes the process of getting a whole requirement to develop iPAGE applications that focused on the structure of the ODS data as illustrated in Figure 2. This architecture begins by determining the community involved in the iPAGE applications, such as the MOHE, CEDI, MAKMUM, entrepreneurs, and developers. These communities involved in the application development are interacted by manual or online communications to discuss about the application requirements. In addition, this architecture also is connected to the existing applications to be integrated into the structure of iPAGE data. Furthermore, the functions of extract, transform, load (ETL) begins with data collection from various sources, interpreting and entering data (load) into the ODS component. The updating of data sources from transaction systems should be coordinated with the data in the iPAGE application to ensure the information is accurate within the given time variant. Clearly, the architecture focuses on the presentation of information in the form of a pyramid of information, which is classified the information into an operational, tactical and analytical report.

### RAD Methodology

The methodology used to develop iPAGE application is RAD that utilized to support the development of two main applications of iPAGE: Web Portal Entrepreneur Profile and Entrepreneur Profiles System. RAD 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. These techniques are combined with ReCODS model to support the need BI components as depicted in Figure 3.

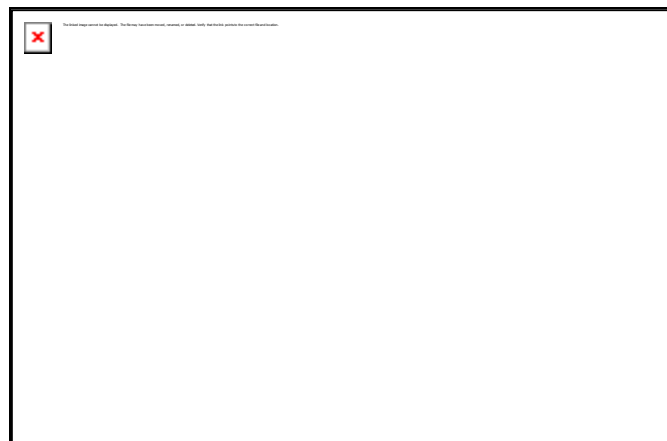


Figure 3. RAD Methodology with ReCODS Model

In summary, the development of graduate entrepreneur's BI system, the ReCODS model that specializes in BI development methodology is combined with RAD system that known in agile software development methodology. This research was using the advantages of RAD and applicability of ReCODS model for planning, modeling, designing, developing, testing, and implementing the iPAGE applications successfully.

### iPAGE SYSTEM DEVELOPMENT

The development of iPAGE prototype is the main result of this study, which based on the ReCODS model. The prototype is based on *vertical prototype* approach that provides the

functions for inserting and storing data in a database, and displays the data through the screen inquiries and reports. 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 entrepreneurs profiles, and Portal Entrepreneur Profile, which act as dispersal agents for entrepreneur information to entrepreneurs, universities, MOHE, and public.

### Web Entrepreneur Profile

The design of web entrepreneur profiles is conducted in steps: requirements analysis, process design, database design, interface design, and reports or queries design. In requirements analysis, the requirements are identified as entrepreneur profile, academic profile, fund profile, business profile, and entrepreneurship program. In short, part of the design process is shown in the Use Case diagram model shown in Figure 4.

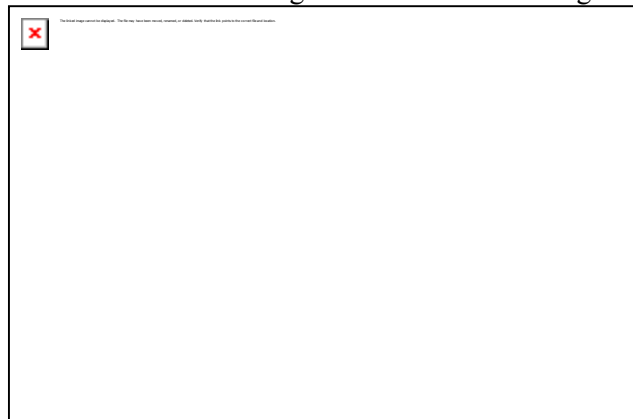


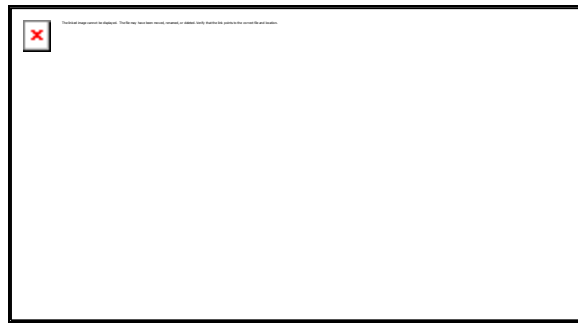
Figure 4. Main Use Case for Entrepreneur Profile

Process flow for each use case is represented by the activity diagram. The activity diagram for inserting and verifying the entrepreneur profiles data begin by reviewing the data received from the entrepreneurs of each university. This process is continued for all the requirements specified. The database design strategy is based on attributes that exist for every entity from the requirements analysis and represented by class diagram model.

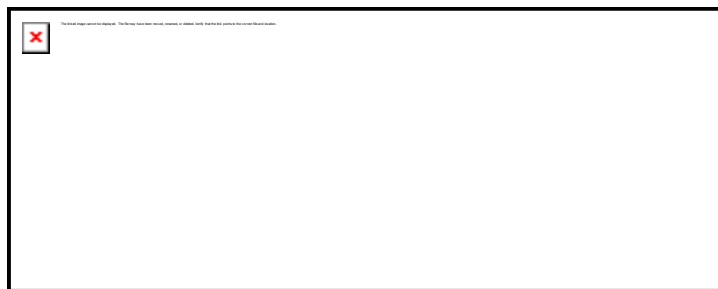
### Portal Entrepreneur Profile

This application serves to disseminate entrepreneur's information more easily and understood by users. The information presented is based on an entrepreneur raw data that processed and analyzed entrepreneurs through BI functionalities. The information is accessed through the portal personalization features and the latest security system. Importantly, the raw data is provided in *dimension modeling*, which focused on fact, dimension, and measure as shown in Figure 5. To allow data sources available for the DW entrepreneurs, an important process ETL is implemented. ETL process that involves drawing, cleaning, merging, conversion, and other activities conducted accordance to the design of ETL processes that determined by the developer. The ETL processes design is defined by a Logical Data Map (LDM) method.

The types of reports in the portal can be classified as a simple, detail, statistics, and analysis. These reports are generated from the data warehouse architecture by BI functionalities. The examples of report design are shown in Figure 6. Formative testing was conducted to ensure the iPAGE function is working properly, particularly in terms of usability, easy to use and meet the needs of the users. In addition, the assessment for iPAGE in the BI environment is also made by involving iPAGE users, DW experts and entrepreneurship subject domain expert.



**Figure 5. Dimension Model for Entrepreneur Profile**



**Figure 6. Example of Graduate Entrepreneur Business Performance Report**

## CONCLUSION

The development of web entrepreneur profile and web entrepreneur portal has been successfully implemented and used to be implemented in a real environment. Both were incorporated in iPAGE system that complements the concept of operational system and BI in an information system. Information provided may be directly accessible by users through the various stages of portal facilities. Testing and evaluation system has been shown that iPAGE is very suitable for applications in a BI environment that is based on data warehousing technology. 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.

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