

BUILDING A CULTURE OF DATA DRIVEN DECISION MAKING IN HIGHER EDUCATION USING DATA WAREHOUSING.

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In this era of swelling global competition for students, disjointed data sources, snowballing education costs and intensified regulatory requirements are driving the need for insight and analysis of the core business of higher education. Currently, majority of learning institutions rely on numerous transactional database systems standing in silos to manage their data and information. In order to perform data mining, regular data bases must be converted into a single integrated data source better known as data warehouse. Strathmore University has managed to centralize all its operational/transitional databases into an informational warehouse useful to decision makers to conduct analysis, prediction, and forecasting. The data warehouse has been implemented in four stages of data migration namely: data extraction, data cleaning and transformation, data archiving, and data visualization.

INTRODUCTION

With the embracing of technology in most of the University's departments, many systems tailored to handle various routine work have sprung and the resultantly has led to existence of many transactional databases. This has left most institution drowning in volumes of data while at the same time starving for information that can be relied upon for decision making (Baranovic, 2003). Integration of numerous databases to a single centralized system can be achieved through data warehousing (DW). The basic idea behind the DW concept is the periodical extraction of data from the numerous transactional systems that support daily business process which are copied onto a special dedicated computer. Here, the data is transformed, validated, reorganized, summarized, structured and augmented with data from other external sources (Guerra & Andrews, 2011). The DW hence provides a centralized access to timely, accurate and consistent data for reports, dashboards, analytic application, and ad hoc reports that aids strategic decision making.

There has been relatively sparse research on data warehousing and its impact in high quality data within higher education processes. According to (Almabhouh & Saleh, 2008) much of the publication has concentrated on the technical bit of developing a DW. To a large extent this has left the understanding and development of the data warehouse to the IT technical professionals at the expense of other non-technical users. To demystify the process of developing a DW for the benefit of all stakeholders, this paper concentrates on user requirements analysis. This is one of the major non-technical process that shapes the other stages of developing a data warehouse, namely: data extraction, data cleaning and transformation, data archiving and data visualization. Specifically, this paper presents the concept of user requirements analysis by giving an overview of its application in a DW project we are undertaking in Strathmore University.

BACKGROUND

Strathmore University consists of numerous subsystems crucial for the internal processes, transactions, and operations. These systems include; student registration system (AMS), financial system (Kuali), payroll system, human resource system (Orange), and alumni system (Devman). All these systems are connected to many underlying databases that are employed for everyday transactions and processes. However, these systems run independently in their operations and do not provide a centralized platform where they are all integrated. This posed a challenge in handling university data in terms of analysis, forecasting, prediction and decision making. This put great pressure on the university to come up with a centralized database system to provide timely and accurate access to information for strategic decision making.

The Institutional data analysis office was given the mandate to come up with the Strathmore University DW. The DW has enabled the decision maker to leverage on the information that is collected from the various transaction systems for decision making processes. Key analytical subject areas have been identified within the University through a prioritization effort and the DW has become very helpful in various areas of the day to day running of the University. We took a step by step approach in developing the DW where, one data mart (subject area) at a time was designed and deployed before proceeding to the next data mart. This approach has not only been efficient but has also led to the DW scalability. The scalability has enabled other succeeding data marts to spring forth from the pioneer data marts in a spiral way as the university data needs continue to expand.

In an effort to make sure that the DW met all the information needs of the university community, a detailed user requirements exercise was conducted. This process was to ensure that the users of the DW get the information that they need to run the institution effectively and at the same time ensuring that the developers get a proper understanding of what the users want.

USER REQUIREMENT ANALYSIS

Abai et al. (2013) reveals that, one of most critical phase in a DW development cycle is the user requirement analysis phase since it influences all other development phases. This phase identifies all the organizations goals and articulates the user requirements that measures the performance of the organization. Studies have proven that 85% of DW that skip the user requirement never realize their business goals. Data to be incorporated in the DW should not be driven simply by the availability of data rather it should address the business goals of the institution. User requirements therefore, becomes an opportunity for the user to specify what they would wish to see from the system and in an easily understandable way.

USER REQUIREMENT ANALYSIS APPROACH

According to (Jukic & Nicholas, 2010) user requirement analysis approach basically falls within four major categories: data-driven, user-driven, goal-driven and mixed-driven approaches. Data driven approach focuses on the operational data as the main basis of establishing the data warehouse, while for the user driven approach, the emphasis is in determining the information needs of the users (Abai et al. 2013). On the other hand, goal oriented approach entails involvement of top management in aligning the DW with the institution strategic goals. Giorgini et al. (2008) proposed a mixed driven approach called GRAnD that combines data and goal driven approaches. GRAnD is centered on the stakeholders and the decision makers. The choice for the most suitable approach is driven by characteristics of the said organization depending on whether the organization gets its high commitment from the management or end users. It is with this knowledge that we settled on GRAnD as the most appropriate user requirement approach for our DW project in Strathmore University.

UNIVERSITY MAIN STAKE HOLDERS

It was very crucial that the user requirements be derived from the goals of stakeholders and the decision makers. This was aimed at minimizing the possibility of the DW failure due to scanty requirement definitions. The stakeholders' choice was majorly informed by their familiarity with the overall goal and vision of the University plus their decision making capability. The stakeholders considered in this process comprised of: management board, vice chancellor, deputy vice chancellors, deans and head of departments.

STAKE HOLDER'S REQUIREMENT INTERVIEW QUESTIONS

This process of user analysis requirements was guided by the following questions to the stakeholders; what are the expected goals of your area? How do you measure results? What are the critical success factors of your job? How do you identify opportunities and problems? What business dimensions are important to your analysis and decision making? What are your current source of information? What is your vision for the future of your area? Do you have access to all the information that you may require for decision making? When do you want to see the information (frequency of refresh and reporting)? How do you want the information formatted (tables charts,

graphs)? Where would you want to see or access the information (web, application)? Who should see the information (security, publication)?

USER REQUIREMENT PHASES

The user requirements process was broken down into three phases. The first phase entailed understanding the university objectives by interviewing the stakeholders. Then, the second phase involved interviewing the decision makers with an aim to get a picture of the business strategic goals. The end users helped in breaking down these strategic goals into more specific decision and information goals. It is from these information goals that the technical team got the facts, dimension and measurement that helped in coming up with the DW business model. The third and final phase involved mapping the business model to the data and making sure that the user needs are met.

SYSTEM DESIGN AND ARCHITECTURE

Our current Academic Management System (AMS) met all the functional requirements we required to host the DW. To effectively drive the user requirements, we thoroughly scrutinized key features of each data set so as to transform the data into design considerations. Each departmental unit articulated their data flow (input and output) by considering who has the information, what the information is, to which end user and the anticipated end results. With a good understanding of business requirements we started designing the DW by taking into consideration the data sources, technical setup, user's expectations and the required budget. In order to build the informational database (DW), four vital steps were required to aid completion, namely: data capture/extract, data cleansing/transformation, data load/archive, and data visualization as depicted in figure 1.

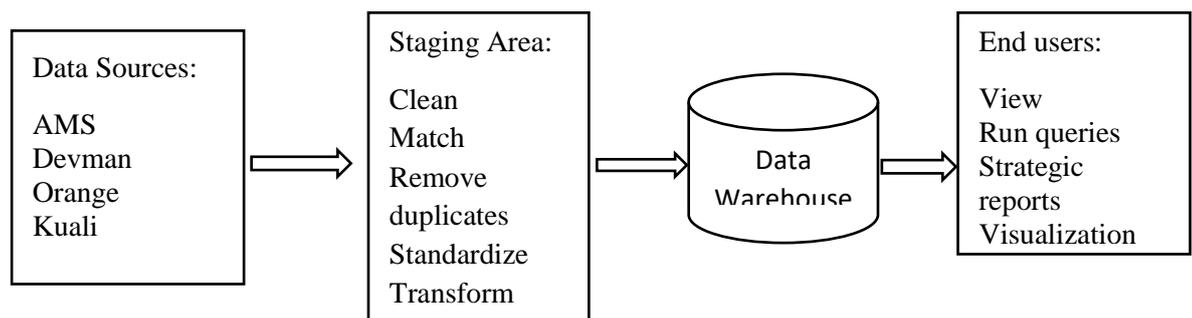


Figure 1: Data warehouse architecture

As show in figure 1, relevant data is first extracted from the various transactional data sources and stored temporarily in the staging area. Here data pre-processing takes place by cleansing, fixing data entry errors, removing duplicates, merging, transforming, and validating along with other quality checks. After cleaning the transformed data is loaded in to the data warehouse where the end users can mine and query data for analysis, reporting and decision making.

CONCLUSION

In this paper, we have summarized the user requirement analysis exercise as applied in Strathmore University DW project. Inclusion of users' needs in the DW development helped to manage user's expectations and satisfy their requirements. The DW has provided a one stop data shop and has enabled the University community to embrace a culture of data driven decision making. The DW is said to be a process and not a project. Hence, its development is widely considered as an evolutionary process where key subject areas, based on the university requirements for information are added in an iterative manner as demand for information continue to grow.

Choosing an appropriate approach in conducting user requirement analysis should be done by tailoring it to organization characteristics to avoid any form of draw backs in development of the DW. The main challenges that we encountered in this project were: integrating various transaction systems standing in silos, missing data, and organizational culture. An effective User requirement analysis enabled us to navigate through most of these challenges smoothly. With the continuous

evolution of the DW, plans for the future involve introduction of artificial intelligence and data storytelling to the Strathmore data management tool box.

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