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Business Intelligence and Analytics in Managing Organizational Performance: The Requirement Analysis Model

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Abstract—Today, data has growth tremendously. It has been one of valuable resources to determine success and failure of an organization. The need to manage and analyse the data for organization's performance has increased. Suitable technology identified for this purpose is Business Intelligence and Analytics (BIA). BIA implementation is a huge project and one of success factor identified by previous researcher is clear requirement analysis process. This paper presents the requirement analysis model for the implementation of Business Intelligence and Analytics in Performance Management (BIAPM). It was developed based on literature review and empirical study using phenomenology approach. The model explains the required process, input and output of requirement analysis for BIAPM implementation. It help researchers and practitioners the capabilities to better understand requirement analysis process in three difference perspectives that are Business Intelligence, Analytics and Performance Management.

Index Terms—requirement analysis, business intelligence, business analytics, performance management

I. INTRODUCTION

The evolution of Information Technology era had led to the tremendous growth of data in organisations. Data has become an important asset in the organization and it had increase awareness in the importance of data management. Data not only important for report purposes but also to gain insight of data. Thus, data collection and analysis process has become major concern in business performance management. Business Intelligence and Analytics (BIA) is a suitable technology to collect, integrates, analyse and view data for this purpose. Its capabilities include both report generation from

integrated data and data analytical processing to obtain data insight.

Previous research studies have been conducted to measure BI implementation in Malaysia and had found out that its implementation is still in moderate level [1]. It also reveal that BI implementation in Malaysia is lack in analytical practice. This indirectly impacts the organizational performance management, such as strategy formulation and increasing performance effort. Therefore, a research for Business Intelligence and Analytics implementation in managing organizational performance (BIAPM) needs to be done especially in requirement analysis aspects.

Requirement analysis had been identified as one of success factor and become important base in software development [2]–[4]. Therefore, to implement Business Intelligence and Analytics in Performance Management (BIAPM) it is important to perform requirement analysis systematically. However, there are still some weaknesses in requirement analysis of Business Intelligence and Analytics (BIA) that needs to be focused [5]. Past research had identified that current requirement analysis methods are unable to cover BIA needs due to its complexity [6]. In addition, BIA implementation covers various levels of users such as top management, managers, executives and data analyst. This increases the difficulties and challenges in its implementation.

Therefore, the objective of this research is to identify requirement analysis process suitable for BIAPM process. To achieve this objective, theoretical and empirical study has been conducted. During theoretical study has analyzed previous researches in three main areas that are Business Intelligence, Analytics and Performance Management. It is to identify current process and practice that had been discovered by other researcher. Meanwhile the empirical study is conducted by interviewing business intelligence, analytics and performance management

experts to identify current process and practice, issues and problem arise in their organization towards BIA implementation.

Section II of this article explains previous research in business intelligence, business analytics, performance management and requirement analysis in BIA. It then follows by discussion on empirical study and findings in Section III. Section IV presents the proposed model. Finally, section V concludes this paper with a conclusion.

II. RELATED RESEARCH

A. Business Intelligence

Business Intelligence (BI) technology is well known in business world which basically support decision making process especially for the executives, managers and analyst to improve their decision making [7]. It consists of application and technology to extract, synchronize, integrate and store data so that large amount of data could be accessed and analyzed [8]. BI assists organization to analyze the past and what has happened by turning available data into information and delivers for decision maker [9].

BI architecture consists of five main components to support its implementation. The first component is data source that contain databases from various platform and external formatted data files. All these data will be extracted by second component known as Extract, Transfer and Load (ETL) application. ETL will extract data from data source, classify them into subjects, merge and purify the data before load into Data Warehouse (DW) [10]. Next, data will be stored in DW as the third component. It stores subject oriented, integrated, non-volatile and time variant data [11]. The fourth component is analysis engine that consist of online analytical process (OLAP) server that enable fast data access and analysis. It also consists of data mining engine to process algorithm for analytics activities. Final component is end user application as interface for user to visualize data in dashboard, scorecards and reports.

BI has been implemented in many organizations to ensure continuous improvement efforts as efficient as possible. Its ability had influence the global market of BI software to increase each year and it is predicted that total spend of global spend in BI software will reach USD 17.7 billion by 2016 (Computerworld, 2013). However, requirement analysis is an important factor in the successful BI implementation [2]–[4].

Indeed, few studies have been done about BI requirement analysis methodology, still there are no standardization of methodology has been outlined [12]. There are two main phases in Requirement Analysis Model; the first phase known as Early Requirement while the second phase is Late Requirement. Covering the whole process of requirement analysis, BI practitioner could choose between three (3) main approaches in BI implementation that are data driven or also known as supply driven, goal driven and user driven or also known as demand driven [13].

B. Business Analytics

Business Analytics (BA) systems encompass the people, processes and technologies involved in the gathering, analysis and transformation of data used to support managerial decision-making (Negash 2004; Watson and Wixom 2007; Jordan and Ellen 2009). Decision-makers use comprehensive reporting, dashboarding and online analytical processing (OLAP) technologies to improve and enhance their decision-making capabilities. BA also includes statistical analysis, data visualisation, predictive modelling and forecasting systems. BA is widely used as an umbrella term that includes earlier and complementary systems such as decision support and business intelligence systems [14].

There are several factors leading to the rise of analytic phenomena, such as complex and competitive organization environment nowadays. Most organizations are aware that the level of competition to maintain organization position in market is very intense and requires immediate action to preserve the continuity of the organization's performance. This improves the analysis needs to identify and to anticipate trends and respond more quickly and accurately [15], [16].

Factors that require analytical emphasis is the need of continuity of planning, operation and management of a more holistic assessment. The organization not only requires data for planning and action but the data need to be analysed to evaluate and further improve the existing planning and action [17]. It is these factors which led to the more analytical attention in the implementation of BI. The number of organizations is using analytics to gain a competitive edge sharp increase to 57% within a year [18]. Organizational awareness of the importance of data analysis to improve decision-making processes has also increased. This resulted in many organisations intend to improve the existing system with multiple BI tools and analytic [19].

There are two main analysis groups in data analysis that are descriptive and inference analysis. Descriptive method is a method that organises, summarize, and display data in an easy and full of information. It includes graphs and numerical techniques. This method is the most popular use for displaying data in the BI system and it has been used by many organizations. However inference analysis technique had been less explored. It is the method used to draw conclusions about the characteristics or population based on data from a sample. Most analysis tools that use inference methods are applied in generating expectations, estimation or decision making. Among the analytical tools identified are analysed interdependence between causal link analysis 'what-if' analysis and regression [16], [17]. The combination of various analysis techniques will enable organisations to control performance, identify how it differs from the target and make corrective measures [19].

C. Corporate Performance Management

Performance management is a process of planning, controlling and managing organisational and individual performance. Therefore, the term Corporate Performance

Management (CPM) is used to differentiate the use of managing performance at organisational level and individual level. Based on previous research, CPM could be define as a process to manage information to ensure strategy development and implementation could increase organizational performance [20], [21].The main objective is to understand organizational condition and control organizational performance to achieve stakeholder goals. It consist of a few main process that are identify vision and mission, identify key success factors, define organizational structures, develop strategy and action plans, identify key performance measures, setting target, evaluate performance and define reward system [22]–[25]. The implementation of Business Intelligence and Analytics in CPM could increase effectiveness in managing performance especially in providing closed-loop support that integrates strategy development with data management technology.

D. Requirement Analysis

Requirement analysis in BIA development is more challenging than the traditional application development since it involves different level of users expert. It also needs to visualize integrated information according to different user needs. Past research has suggest three approaches of requirement analysis in Business Intelligence that are data driven approach, user oriented approach and goal oriented approach [4], [26].

Data-driven approach, also known as supply driven approach focuses on sources of operational data as the basis for the study requirements before building the scope and functions of Business Intelligence [11], [27], [28]. This approach is the first requirement proposed collection methods. However, after identify drawback from Data-driven approach, user-driven approach had been proposed. User-driven approach emphasizes the involvement of system users in getting the needs of Business Intelligence [27], [29], [30]. The third approach is goal driven approach that requires high involvement of the top management of the organization. Corporate strategy and organizational objectives must be aligned with the needs of the development of business intelligence [31]–[34]. In this study, all approaches have been merged and integrated to strengthen the requirement analysis process and overwhelm and minimise its weaknesses.

III. THE EMPIRICAL STUDY : ANALYSIS AND FINDINGS

This research investigated the integrated process of requirement analysis for Business Intelligence and Analytics (BIA) in Corporate Performance Management. The main objective of this research is to understand current requirement analysis implementation and to identify its holistic process view by integrating business intelligence, analytics and performance management needs. Therefore qualitative research using phenomenology approach has been chosen to understand research subject through participants experience and perspectives. Phenomenology approach is an investigating strategy to identify essence of human experience about the phenomenon describe by participant

[35]. The understanding of real human experience is the main findings of this research. It applies deep information digging process to discover pattern and relation for each process.

This empirical study is conducted using interview method to gain input from experts. It is divided into stages, namely planning, interviews and data analysis. At the planning stage, the interview questions were designed based on findings obtained from the literature review. It consists of three parts, namely the implementation of business intelligence, analytics and performance management. Next appropriate and relevant respondents have been identified to ensure the reliability of the information obtained.

A. Demographic

The respondents selected in this research consist of BI practitioners and consultants who involve with BIA development and implementation. Each participant has extensive experience in BI development and held high position in their organization. For the purposes of this study, purposeful and snowball sampling technique was used to identify the participant. As a result, a total of 7 participants were identified from the various backgrounds of the organization. The determination of sample size for this study is based on several factors, among them time, resources and the degree of saturation [36].

B. Data Analysis and Findings

The collected interview data was analysed using qualitative approach suggested by [35]. It had gone through 7 analysis steps, started with data preparation that transcript audio into text. The process continued with read the text, data coded, theme construction, identified relation between themes, defined theme and information verification. Inductive and deductive techniques applied to identify the processes involved in identifying the requirement analysis process of the BIAPM. Based on the collected data, main items in BIAPM Requirement Analysis had been extracted as shown in Table I.

TABLE I. CLASSIFIED ITEMS WITH SAMPLE RESPONSES

Item	Sample Response
Requirement Elicitation	So first we need to identify their requirements [P1] First we identify requirement of our organisation [P3] Usually, I will ask when you got BI, what do you want to analyse? Probably for decision making or just to show the overall company performance [P4]
Identify Data Source	To integrate it you should study all data source available in the company. Then you should map it so that you know which data is identical with other. [P6] After define requirements, we should identify its data sources [P1]
Determine Data Security	Normally we identify level of data access and security in requirement analysis process [P2]
Design Storyboard	Storyboard design should be sketch in requirement analysis process. It is better to sketch it for user so they can visualize their needs. [P2] Then I need to know whether they want to view it with tablet or mobile.[P4]

Identify software & hardware	From user requirements that had been identified, we can match it with suitable software. [P1]
Data Model	From the requirement analysis process, the most important is the data model to help understand the business. [P6]
Identify organizational objectives	First we need to identify their target towards customer and check their business rules. Then check their company strategic objectives, its role and what they want to achieve. Then need to clarify business improvement opportunity. All this information need to be analyse to identify the requirements [P1]
Develop strategy	It is better if requirements from top management are translated into organizational strategy. It will help developer to identify their needs and from where those data could be retrieve. [P5]
Define KPI & targets	Before start, they should refine their goals and KPIs [P1] It is important for user to identify their KPIs, it will be a bit difficult for BI development if the user not clear with what they want to achieve [P2]
Identify success factor	They should done their gap analysis and identify key success factors. It should be clear before start build this technology [P1]
Data definition Documentation	Normally we identify the needs from our experience and we also get opinion from head of each university. We define each words to unify its meaning [P3]
Requirement Specification Documentation	We will discuss about their requirements and prepare requirement report [P7]

IV. THE BIAPM REQUIREMENT ANALYSIS MODEL

As a result, the information been divide into three main themes that are the requirement analysis process, input for requirement analysis and output from requirement analysis process that useful for other BIAPM implementation. Fig. 1 shows the BIAPM Requirement Analysis Model.

A. Input

In Input theme, the source for user requirement has been identified within four main processes. The first process is strategic planning that consists of activities to increase the target achievement of strategic goals. Among activity that generate inputs for requirement analysis process is identify corporate vision, mission and objectives; strategy development; and defining KPIs and targets. Within analytics process, the process of identifying success factor and development of analytics

model also contribute to BIAPM requirement. Nevertheless, the reports generated from performance monitoring activities and decision making process in various meetings also could be used as important inputs to draw holistic requirements in BIAPM projects.

B. Process

The second theme that has been constructed is requirement analysis process itself. The process begins with requirement elicitation which analyses all gathered inputs. It is a process to identify, refine and consolidate detail requirements based on organizational objectives, KPIs, targets and organizational success factors from every level of user. Then the requirement analysis process continues to identify data source required to support user requirements.

In addition, data security levels need to be identified for BIAPM development and adaptation. It will enable BIAPM to be used in different management level with data access restrictions. Next is the process of identify visual requirement that is a process to sketch storyboard to translate user requirement visually. Finally is to identify software and hardware requirements in BIAPM implementation.

C. Output

Final theme that has been constructed is output from requirement analysis process. It consists of requirement specification documentation that will be as guide in BI development. The requirement specification consists of functional and non-functional requirement that has been highlighted by the user for BIAPM development. Another output that produced by requirement analysis process is data definition documentation that contains reference of data definition used in BIAPM. It will preserve consistency in the data dictionary that will be used by different levels of users.

Another output from requirement analysis process is data model that maps data sources into one standard format. Data model could be used as reference in data warehouse and ETL development. It also will produce storyboard design that had been approved by user for visual and interface development. Final aspect from requirement analysis process is to produce software and hardware requirements. Since BIAPM is large technology project, its development normally will be done by stages and these documents will help scalability software and hardware preparation.

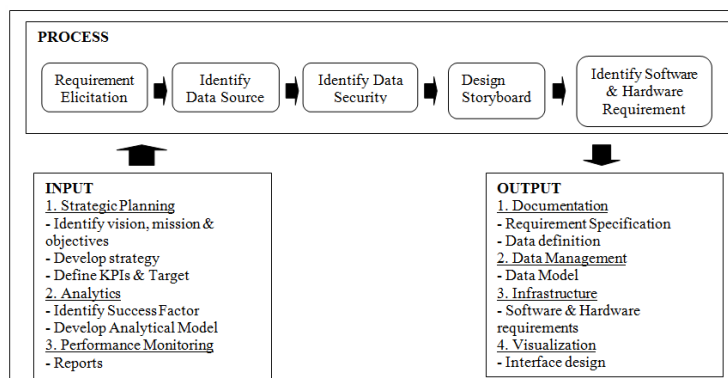


Figure 1. BIAPM requirement analysis model

V. DISCUSSION

This study has proposed a requirement analysis model in implementation of Business Intelligence and Analytics in Managing Organizational Performance. Six processes in analytics and performance management that become input in requirement analysis process have been identified. In requirement analysis process, five main stages need to be executed that are requirement elicitation, identify data source, identify data security, storyboard design and define software & hardware. These processes produce documentations and assist in software and hardware strategy and plan.

One of the main challenges in this study is to obtain view in analytic perspectives since it is consider as a new area and exposure in BI implementation in Malaysia. However, the propose requirement analysis model is strengthened by the findings from literature study as well as the empirical findings discussed in this paper. To determine the applicability of this model, it has been applied in a case study conducted in two different organisations. The case study has validated the model.

VI. CONCLUSION

Implementation of business intelligence and analytics in managing organizational performance is a trend nowadays. However, many organizations still face difficulties to obtain user requirements for its implementation. In this paper we have presented the empirical study which has been done to discover requirement analysis process in Business Intelligence and Analytics implementation. The approach involves interviewing business intelligence experts in various domains. The proposed model can be used as a guideline for practitioners in analysing requirements for BIAPM.

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