Project Evaluation for Business and IT Alignment with Enterprise Architecture for Water Distribution Company

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Abstract. Actually, there are gaps exist in the development of many large companies, which related to the automation and integration between the business and technology information systems within the company. Enterprise Architecture (EA) helps in aligning the business functions of a company with existing applications to optimize the existing business processes for the purpose of growth, revenue and satisfaction. For the creation of a well-integrated system, EA provide logical design to build the sequence of connecting each function either in the structure, task and technology to achieve company goals. A well-designed information system (IS) architecture can be one of the best solutions to enhance the ability and capability of the company in serving its customers especially with the sustainability, maintainability, extendibility and maintainability. Furthermore, good information system can accommodate the company's needs to improve the company's performance process where the useful information system have been generated through careful planning and preparation. EA is a solution that can be used in designing systems within the company by integrating 4 (four) domains namely Business, Data, Applications, and Technology. This study provide the evaluation within the company that is expected to give preliminary result of process to be dealt with in order to increase the performance and support the business processes in the company.

1. Introduction

In general, economists divide all economic activities into two broad categories, which are goods and services. The goods is related to the industry that produce certain quantitative product to be utilized by the customers such as agriculture, mining, manufacturing and construction. Meanwhile, the service industry is the part of the economy that dominantly provide the opportunities to turning the economy wheel by providing qualitative solutions to satisfy customer instead of real product or tangible goods. The outcome of the service commonly exist in the banking, wholesale, retail trade, engineering, software development, medical diagnose, defence and judicial, which is involving the presentation, consultation, administration or communication. In less developed countries, most people are employed in key activities such as agriculture and mining, while the service industries is in the field of water distribution, which in its development has experienced some improvement including the achievement of the indicator of the adequacy level of clean water and various attempt to frequently mapping the water condition in specific region. It also has to require a function that accommodate the logistics and maintenance process to support in the delivery service of clean water, but in fact, the performance has not optimized due to the lack of automation and integration. The common issues are faced by Water Distribution Company related to the frequent, pipeline leakages and burst, inadequately workforce skilled, water quality degradation, huge operational cost, environmental impact, and so on. Thus, companies need to improve their ability to deal with various problems by developing well-planned IS architecture. To eliminate any gaps during the information system development process, integration is
required in the planning, design and management of IS known as Corporate or Enterprise Architecture [1]. EA is a discipline that proactively and thoroughly directs the company to identify and analyse the implementation of development or change the desired vision and business output [2]. To develop EA, framework could be used to provide the structure that is required more easily and accessible. The Open Group Architecture Framework (TOGAF) is one of the frameworks that provides a detailed explanation of how to build, manage and implement frameworks and IS used to draw EA development models [3]. The TOGAF framework has detailed methods on how to build, manage, and implement frameworks and information systems called the Architectural Development Method (ADM) that can be built on integrated systems development [4, 5, 10, 14]. TOGAF ADM is the result of the ongoing contributions of architectural practitioners describing methods for developing and compiling the enterprise architecture life cycle. Therefore, this study utilize the flexibility of the framework to execute project evaluation to provide borderline and readiness in determining the efficiency and success of the project, especially the multi years or continuous type.

2. Risk Analysis in Project Evaluation

In evaluating a project by considering the risk, the consideration step is to examine the cash flow from the project variables, so that the risks arise from the uncertainty of the projected variables can be identified, thus, the risk analysis is required. There are several steps that need to be done in analysing the risks in project evaluation [6]:

1. Creating a model of financial projection, which is a mathematical relationship between the project variables to provide future cash flow from the project.
2. Determining risk variables, which are obtained from project variables that contain elements of uncertainty.
3. Determine the probability distribution of risk, which can be determined using historical data, observation and interviews to the experienced parties.
4. Conduct a MonteCarlo simulation which the value of risk variables is randomly generated according to the probability distribution of risk. The resulting value (in this case the NPV or IRR) is calculated for each running simulation.
5. Analysing the simulation results, which is obtained to be analysed and interpreted to create decision making or to provide the result of the project evaluation.

In evaluating a public project, it is necessary to evaluate financially (Financial Cost Benefit Analysis) and economically (Economic Cost benefit Analysis) aims to assess the feasibility of a project. Therefore, the steps taken to perform cash flow modelling are as follows:

First, to determine the amount of discount rate by the WACC method.

\[
WACC = \left(1 - \text{tax}\right) \times \text{rd} \times \text{id} + \left(1 - \text{rd}\right) \times \text{ie} \quad \ldots \quad (1)
\]

Where:
- \( \text{rd} \) = loan composition
- \( \text{id} \) = interest of debt
- \( \text{ie} \) = rate of return on equity
- \( \text{tax} \) = income tax

Second, to determine the amount of investment cost (BI) issued in the initial year (year 0).

\[
BI0 = TA01 + TA02 + TA03 \quad \ldots \quad (2)
\]

Where:
- \( BA0 \) = Investment Cost year 0
- \( TA0 \) = Tangible Asset Value in Year 0

Third, to determine the amount of revenue.

\[
TPi = VAMi \times TAMi \quad \ldots \quad (3)
\]

Where:
- \( TPi \) = Total revenue in year i
- \( VAMi \) = Volume of drinking water sold in year i
- \( TAMi \) = The rate of drinking water in the first year per m3

Fourth, to determine the amount of production costs (BP)

\[
BPi = VAMpi \times (BE + BBB + BBK + BTK)i \quad \ldots \quad (4)
\]

Where:
- \( BPi \) = Cost of production year i
VAMi = The volume of drinking water produced in i
BE = Energy cost per m³
BBB = Raw material cost per m³
BBK = Chemical cost per m³
BTK = Direct labor cost per m³

Fifth, to determine the amount of the total cost of production costs, maintenance costs, general and administrative costs

\[ TB_i = BP_i + Bpei + BU_i \]  

Where:
- \( TB_i \) = Total cost in i year
- \( BP_i \) = Production cost in year i
- \( Bpei \) = Maintenance cost in year i
- \( BU_i \) = General and administrative expenses in year i

Sixth, to calculate the amount of income before tax and depreciation, which consists of total revenue and total cost. Seventh, the amount of depreciation is calculated by using the straight line method, which is this method is used in accordance with corporate depreciation methods.

\[ \text{Dep} = \frac{(TA-NSA)}{N} \]  

Where:
- \( \text{Dep} \) = The amount of depreciation in year i
- \( TA \) = The value of tangible assets
- \( NSA \) = Value of Asset Time
- \( N \) = economic life

Eighth, to calculate the amount of income before interest and taxes which the earnings before interest and taxes are calculated in the yeari. Ninth, to determine the amount of debt with interest expense (d) on the project.

\[ \text{Debt} = \text{principal of debt payment} + \text{interest payable} \]  

Tenth, to determine the amount of income before tax is the amount of income minus debt interest expense. Eleventh, to determine the amount of net profit from the operational (NCF) project after tax deductible.

\[ NCF_i = P3_i - (P3_i \times \text{tax \%}) \]
Twelfth, to calculate net cash flows by adding depreciation expense and residual value of assets.

Thirteenth, to calculate the magnitude of FNPV and FIRRII.

\[ \text{Asset Time Value} = 10\% \times \text{Asset Value} \]

3. Business Strategy and IT Alignment

The Strategic Alignment Model of Henderson and Venkatraman\cite{7} distinguish four components, which are business strategy, which relates to the choices pertaining to the positioning of the business in the product-market arena, then IT Strategy, which considers the positioning of the business in the information technology marketplace. On the other hand, organizational infrastructure and processes that discussing the selection to the particular internal arrangements and the design of management structure and work processes while Lastly, the IS infrastructure and processes that contains all the components related to the IT infrastructure and applications used in the organization. It is defined in terms of choices pertaining to internal arrangements and the processes that determine the range and types of IS products and services delivered to the organization. Meanwhile, there are also four perspectives for keeping the business and IT aligned, which are strategy execution, technology transformation, competitive potential and service level \cite{7}. The first two perspectives are driven by the business strategy, while the last two perspectives are driven by the IT strategy. For this research we particularly deal with the Technology Transformation Alignment and the Competitive Potential Alignment as they first align on the strategic level and then on the internal operative level. The model presented is widely accepted but a strong and appropriate relationship between business and IT is still hard to set. The same conclusion regarding the difficulty to reach the strategic alignment is expressed by who state the strategic alignment is an actual critical issue which is affecting IS and IT executives \cite{9}.

In supporting the vision of a company's mission, one of the core functions that greatly support the services provided by the company is the logistics and maintenance functions. In order to support the company's business processes, it requires optimal household management with the help of appropriate IT application and device to provide the requirement of the company in delivering the services to the customers. In general, there are some problems that directly affect other functions immediately, which related to the asset management system. It is not executed optimally in the system due to mistake and error that occur frequently due to manual process of storing and documentation. To solve these problems, the design of enterprise architecture should consider the value chain diagrams that describe the company's goals consist of the primary and supporting activities to identity the opportunity to generate the value-added margins for the organization. With regard to the rapid changes in the conditions and needs of the business environment, organizations must adapt their business processes and IT systems to have a new structure of terms and resolutions. Extensibility is the most important feature of the IT architecture. It is also important that the organizational structure to be attached in the enterprise architecture design due to significant affects every project's aspects \cite{12}.
Because of the flexible and abstract nature of EA, there is an EA breeding framework in practice. Comparative studies, however, are far from satisfying because they do not have a theoretical foundation for comparative criteria and do not interpret differences in a meaningful way [8]. The organizational structure provides comprehensive specifications about strategies, main activities, information, techniques, organizational functions and their impact on business processes. Organizational structures must be used to carry out to protect sensitive, confidential and important data to deliver better performance of the organization [12]. Therefore, to describe various types of information technology and their use in organizations, many models, styles and documents are used. To compile most of the concepts must be defined in a frame. In fact, this framework is to build to regulate the models and methods that have been stated in project re-engineering [13].

| Human Resource | Internal Monitoring | Finance | Research and Development | General and Logistics | Production | Distribution | Service |
|----------------|---------------------|---------|--------------------------|-----------------------|------------|--------------|---------|
| Recruitment    | Activity Planning   | Budget Planning | Standard Operational Procedure (SOP) Establishment | Management of Operational Small Amount Fund | Planning of Processing Raw and Production Water | Water Distribution Process | Marketing |
| Assesment      | Checking and Monitoring | Drafting | Forming Work Plan and Company Budget (RKAP) | Request for Goods | Implementation of Raw Water Treatment | Monitoring and Evaluation of Networking | Customer Support |
| Decree and Presence Management | Reporting and Recommendation for Operational | Financial Report Presentation | Searching for New Raw Water Plant | Onsite and Item Reconciliation | Evaluation and Monitoring of Production Systems | Procurement of Distribution Equipment | Control of Service Connection |
| Payroll        | Implementation       | Flow Control | Partnership | Mutation of Goods between Branches | Supply of Lab Aids and Chemical Raw Materials | Service Connection Maintenance |
| Workshop       | Activity Control and Surveillance | Budget Control | Co-operation | Delivery of Repair / Replacement Goods | Installation of Facilities and Infrastructure |
| Maintenance    | Strategy Development | Drinking Water Safety Plan | Submission of Broken Water Meter | Damage Prevention, Avoidance Assets Maintenance |
| Achiave and Control | Reporting Management | Implementation of Water Quality Advocates |
Table 1 Functional Decomposition

In the process of measuring the success, it is compulsory to describe the baseline of business architecture, which has function to identify relevant targets and the product or service strategy within organizational and business environment based on the business principles, business goals and strategic drivers. By having functional decomposition, the manager can have easily understand to analyse the gaps between the baseline and target to select the relevant architecture viewpoints that will enable the architect to demonstrate how the stakeholder concerns are addressed respectively by selecting the relevant tools and techniques to be used in association with the selected viewpoints. In this case, this study present the breakdown of previous value chain identified to have clear overview of the service offered by the water company, which can support the future plan in the distribution phase 1, 2 and 3.

4. Conclusion

In general, there is no fixed practice or method for evaluation of EA implementational though enterprises are looking for evaluable EA in order cope with their current problems and answering the future needs. Thus, this study validate the result through discussion and acceptance of relevant operational manager in the company. Since EA involves heterogeneous stakeholder groups such as application owners, business developers, software developers, system analysis, enterprise architect and the others may create complexity requirements within company, an appropriate evaluation documentation of the enterprise artefacts are vital, which can be executed during years of routine process of improvement.

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