IT Investment Evaluation Using Multi Objective Multi Criteria: Case Study on an Expedition Company

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Abstract—Information Technology (IT) is an essential part of a company. IT can enhance the company’s strategic position by helping them to take the next step in productivity and profitability. However, in many cases, there are failures in IT investment. IT investment only increases costs and does not provide any benefit for the company. IT investment must be aligned with the company’s strategy. Business needs for IT also has to be prioritized. Projects should be initiated and scheduled based on priorities and availability of IT resources. This paper describes a model based on Multi Objective Multi Criteria (MOMC) to help determining priorities in IT investment. The MOMC approach can reflect both tangible and intangible benefits, associate the investment to company strategies, and suggest important features on application portfolio selection. In addition, a case study of an expedition company is presented in which the model has been applied. This company determined the priority in selecting IT applications to be invested using MOMC model. Keywords — Information technology investment, MOMC, application portfolio

I. INTRODUCTION

One way to maximize IT investment is by considering how an IT project is initiated today. First, the need for the project is identified by a business unit or department. Then these business needs for IT supports are prioritized. Projects are initiated and scheduled based on priorities and availability of IT resources. This approach is focused on allocating IT resources, the resources which are insufficient to meet IT’s backlog of project work.

During the previous research (Fig. 1), a process of a strategic planning information system has been conducted for an expedition company. The process consisted of Porter Value System Analysis, SWOT
Analysis, TOWS Analysis, which generated a strategy for this company. This research conducted a selection both for the most needed application as well as most aligned to the strategy of the company using multi objective multi criteria (MOMC) methods. This method consisted of Balanced Scorecard (BSC) from four different viewpoints, Critical Success Factors (CSF), and Analytical Hierarchy Process (AHP). Fig. 1. IS/IT Strategic Model [10] II. THEORY A. Multi Objective Multi Criteria (MOMC) Corresponding with its name, this method finds the most optimal solution for a problem having multiple objectives [3]. This is the best decision making method by considering various objectives, costs and benefits in a company. Besides, this method allows a selection process for optimization to be conducted [7]. This MOMC method covers several research methodologies such as Balance Scorecard (BSC), Critical Success Factors (CSF), Delphi Method and Analytical Hierarchy Process (AHP). MOMC is a pretty much used variant of Cost Benefit Analysis [5][2]. This method is developed due to the reality that a company is holding a number of stakeholders having different views on the costs and benefits of many information technology aspects or elements [8] Every information technology project definitely has objectives to be met. It often has more than one objective as each stakeholder, as a decision maker, has different viewpoints towards that objective. Therefore each party has the right to give weight to the objective, for instance viewed from the priority side or the significant impact of the investment. Then the value that has been synchronized with the costs and benefits is multiplied by each weight to obtain the end result. TABLE 2 BSC – INTERNAL BUSINESS PERSPECTIVE B. Balanced Scored Card (BSC) • Improving the speed of delivery process closer to the This is a method which changes the concept and working delivery process using airfreight. steps of a company to be objective and measurable. If the • Addition of the numbers of railway carriages, car and truck company is going to do some improvement in something of the company. intangible, the result of the intangible measurement has to be • Improving the organization structure of the company integrated into the management system of the company [4]. In • Developing a wider marketing scale of the company this case, the ones categorized as intangible are the concept and • Improving the communication and information exchange working steps of a company. To be integrated into the management system of the company, the concept and working • systems among divisions in the company Improving the company competitiveness by providing more steps have to be analyzed using BSC method. The analysis • services compared to those of other companies using BSC method involves 4 perspectives: Improving the security, management, and inventory systems • Financial Perspective of the property at the company warehouse • Customer Perspective TABLE 3 BSC - INNOVATION PERSPECTIVE • Learning and Growth Perspective • Applying the checking system of the shipment content and • Internal Business Perspective the calculation of the shipment value to be able to determine the treatment for the shipment to minimize the company loss • Improving the efficiency process in the business activities of By analyzing the 4 perspectives, the Company Strategic the company using the support of technology Planning will be generated [7]. • Developing the form of the business into a new one. as a C. Critical Success Factor (CSF) delivery boarding out service provider for other companies This method is a series of requirements, if owned by a • that have no carriages Developing the delivery form of the company not only using company, will ensure the success of the company. CSF of the railway but using airfreight as the fast delivery service of the company can be obtained by comparing the company strategy company with the result of the Balanced Scorecard analysis from various • Applying the route management system based on priorities, viewpoints. Then the CSF of the company for each view point will be obtained [7]. target address, numbers and sizes of the shipment. • Applying the forecasting system towards the everyday number D. Analytical Hierarchy Process (AHP) of customers who would like their property to be shipped. This method helps decision makers to select the best solution out of a number of choices and selection criteria [1]. In TABLE 4 BSC - CUSTOMER PERSPECTIVE assigning weights, some errors might happen, due to the lack of • Applying CRM using the support of technology consideration or some contradiction in assigning weights. Using After grouping the
strategy into four BSC perspectives had AHP method, the weight assignment to the criteria, can be been conducted, CSF analysis of the company of each strategy conducted with various consideration and calculation that can was conducted. With regard to the company strategy and minimize errors [7]. AHP is one of the current main company CSF, an IS analysis could be developed. This analysis mathematical models, used to give supports in decision making was needed to support the company strategy. The following theory [9]. The first stage in using AHP is to determine clear Table 5 is an example of CSF analysis on the financial criteria for the selection [6]. perspective. III. ANALYSIS USING BSC & CSF TABLE 5 CSF The strategy resulted from the previous analysis was Financial analyzed again using the BSC method. Each strategy was Objective Measure(s) Action (CSF) IS Need grouped into four BSC viewpoints, such as Financial ▪ Reduction ▪ Number ▪ Systematic, ▪ An inventory Perspective, Internal Business Perspective, Innovation of losses of orderly and control using Perspective, and Customer Perspective. due to cost damaged secure RFID to compensatio property shipment simplify the TABLE I BSC – FINANCIAL PERSPECTIVE n on the ▪ Number manageme shipment ▪ Reduction of losses due to cost compensation on the damaged of lost nt inventory and damaged and lost property of the customers and lost security ▪ Minimizing the operational cost by improving the use of property of process. carriages sharing system at the company the ▪ Position ▪ Improving the company competitiveness by surpassing the customers management for placing cost as minimal as possible the shipment at the AHP analysis was conducted using Expert Choice Program. warehouse The analysis process was started by determining the goal. In this and railway case the goal of the AHP was to determine the Implementation carriages Project Portfolio Priority. The next step was to determine the supported by alternatives. In this case the entire IT application portfolio was Mixed used as the alternatives. This process was followed by the Reality weighting process. Figure 2 is the result of the weighting System process of the criteria and sub-criteria. (MREAL) in The results of the weighting process shown in Figure 2, the form of showed that the most important criteria for the company was Warehouse Minimizing risks which had a point of 0.4. The least important Planning criteria was improving the financial advantage which had a • A Warehouse point of 0.107. security system using CCTV IV. APPLICATION PORTFOLIO IS and IT resulted from the CSF analysis were categorized into 4 parts at the application portfolio such as strategic, key operational, high potential, and support. The categorization depended on their contribution towards the success of the company business. The Application Portfolio resulted can be viewed at Table 6. V. MULTI OBJECTIVE MULTI CRITERIA The next process was using Delphi method to determine the Fig 2. Determining IT Priority criteria and sub-criteria. This method generated some criteria and sub-criteria as shown on Figure 2. The criteria and sub- The results of the IT implementation priority determination criteria were further analysed using AHP to determine the at the company can be viewed at Figure 3. priority of the company IT implementation process. TABLE 6 APPLICATION PORTFOLIO ▪ CCTV. STRATEGIC HIGH POTENTIAL ▪ MREAL for warehouse planning. ▪ The company official website as an online marketing ▪ Features on online order, location delivery checking media. and the shipment status checking at the company ▪ RFID for inventory control. official website ▪ Forecasting software. ▪ CRM software ▪ X-Ray Machine for inspecting the shipment’s content. ▪ Features on shipment route management based on the priority of the shipment delivery location, and the size of the shipment at the Company operational software ▪ GPS for location tracking towards delivery unit ▪ GPS for determining the best delivery route ▪ Shipment value column at the shipment table at the company operational software ▪ Features on the data maintenance of the partnering ▪ Features on the data maintenance of shipment, customers, and suppliers as well as receipts, loading companies at the Company operational software lists, travel documents and invoices writings at the ▪ Feature on data maintenance of customers at the Company operational software Company operational software ▪ The facility of crypto payment for the online order feature at the company official website KEY OPERATIONAL SUPPORT Fig 3. The results of IT Implementation Priority Determination TABLE 7 THE IT IMPLEMENTATION WEIGHTING
ORDER IT Aligning with the Company Strategy Increasing the Financial Excellence Criteria Maximizing the Company Efficiency and Effectiveness Minimizing Risks Total weights CCTV 0.043 0.040 0.028 0.034 0.034 The company official website as an online marketing media 0.043 0.073 0.059 0.036 0.048 RFID for inventory control 0.080 0.075 0.139 0.128 0.116 Forecasting Software 0.062 0.093 0.082 0.054 0.068 CRM Software 0.073 0.066 0.047 0.039 0.051 CX-Ray Machine for inspecting the shipment's content 0.027 0.021 0.111 0.060 features on shipment route management based on the priority of the shipment delivery location and the size of the shipment at the company operational software 0.094 0.117 0.091 0.062 0.083 GPS for location tracking towards delivery unit 0.044 0.029 0.037 0.057 0.045 GPS for determining the best delivery route 0.043 0.040 0.042 0.052 0.046 Shipment value column at the shipment table at the company operational software 0.026 0.022 0.020 0.018 0.021 Features on the data maintenance of shipment, customer, and supplier as well as receipts, loading lists, travel documents and invoices writings at the company operational software 0.122 0.141 0.155 0.133 0.138 MREAL for warehouse planning 0.069 0.075 0.105 0.130 0.106 Features on Online order, location delivery checking and the shipment status checking at the company official website 0.098 0.111 0.080 0.054 0.076 Feature on partnering companies data maintenance at the operational company software 0.034 0.029 0.028 0.022 0.027 Feature on customer data maintenance at the company operational software 0.060 0.037 0.033 0.024 0.035 the facility of crypto payment for the online order feature at the company official website 0.082 0.033 0.032 0.044 0.046 The results of the weighting process at Figure 3 and Table 7, showed that: • The 1st order is “Features on the data maintenance of shipment, customers, and suppliers as well as receipts, loading lists, travel documents and invoices writings at the integrated company operational software which can be accessed online”, as many as 0.138 • The 2nd order is “RFID for Inventory control”, as many as 0.116 • The 3rd order is “MREAL for warehouse planning”, as many as 0.106 • The 4th order is “features on shipment route management based on the priority of the shipment delivery location and the size of the shipment at the company operational software”, as many as 0.083 • The 5th order is “Features on Online order, location delivery checking and the shipment status checking at the official company website”. as many as 0.076 • The 6th order is “Software forecasting”, as many as 0.068 • The 7th order is “X-Ray Machine for checking the shipment’s content”, as many as 0.060 • The 8th order is “CRM Software”, as many as 0.051 • The 9th order is “The company official website as an online marketing media”, as many as 0.048 • The 10th order is “GPS for determining the best delivery route and the facility of crypto payment for the online order feature at the company official website”, as many as 0.046 • The 11th order is “The GPS for location tracking towards delivery unit”, as many as 0.045 • The 12th order is “Feature on customer data maintenance at the company operational software”, as many as 0.035 • The 13rd order is “CCTV”, as many as 0.034 • The 14th is “Feature on partnering companies data maintenance at the operational company software”, as many as 0.027 • The last order is the “Shipment value column at the shipment table at the company operational software”, as many as 0.027 VI. CONCLUSION • The Critical Success Factors owned by PT. X shows that PT. X is a company applying a modern system, structured, orderly and using the support of integrated modern technology. Thus the company is able to run the business process efficiently, orderly and secure • Currently the company most needed IT application, which is also the key operational of the company, is the development of “Features on the data maintenance of shipment, customers, and suppliers as well as receipts, loading lists, travel documents and invoices writings at the integrated company operational software which can be accessed online”. REFERENCES [1] Alexander, M. (2012). Decision-Making using The Analytic Hierarchy Process (AHP) and SAS/IM. SESUG 2012. [2] Espie, P., Ault, G. W., & McDonald, J. R. (2000). Multiple criteria decision making in distribution utility investment planning. Proceedings of International Conference on Electric Utility Deregulation and Restructuring and Power Technologies. Electric Utility Deregulation and Restructuring and Power Technologies (pp. 576 - 581). London: IEEE. [3] Gosh, A., & Dehuri, S. (2004). Evolutionary Algorithms for Multi- Criterion Optimization: A Survey.