

Integration of Web Services technology with business models within the total product design process for supplier selection

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Abstract

Supplier selection plays a vital role in the process of product development. The purpose of this research is to integrate the state of the art Web technologies with business theories to establish a Web-based distributed environment for supplier selection. A Web Services-oriented multi-possibility supplier selection system has been developed, which helps manufacturers to make decisions for selecting supplier more effectively and accurately. The business theories and analytic hierarchy process approach have been applied in combination with Web Services and J2EE Technology in the system. In this paper, a brief review of the current supplier selection issues are addressed first, followed by the presentation of the methodologies employed and description of the system structure and main features, an example is given in the end.

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1. Introduction

Nowadays, with the rapid development of technologies and turbulent market environment, organizations shift their conventional way of running business, from product-driven to demand-driven. Hence, manufacturing industry is challenged with the task of designing customized products in a timely and cost-efficient manner. Supplier selection has been stressed as one of the most crucial issues in the process of product design [1–3]. It is important for manufacturers to spend the least time to find the best suppliers in order to achieve competitive advantages [4].

The relationship between manufacturers and suppliers is influenced by the level of dependency of the one on the other and the degree of turbulence in the market [5]. In general, a manufacturer can have different types of relationships with suppliers for different purposes and must be able to match the optimal type of relationship to various product, market, and supplier conditions [1]. Traditionally, potential suppliers

are evaluated on several criteria such as technical capability, material selection, production technology, costs, product quality, service and geographical location [6]. Extensive research reveals that the selection of suppliers not only is a technical decision, but also need to consider several factors from business perspective [4,7]. As a business decision, an organization's vision, mission, priority and criteria must be taken into consideration. With regard to these issues, tangible criteria inevitably need to be counted, such as pricing structure, delivery capability, product quality, technology capability, service issues, etc. In addition, intangible factors also need to be taken into account, such as affects by the external changes. However, little has been done to integrate organization's development strategies with supplier selection criteria. In fact, research in integration of business theories into manufacture procedure has been far behind the development of each individual area of business and manufacture.

In order to fill in the gap, a Web Services-oriented multi-possibility supplier selection (WMPSS) system has been developed to help manufacturers to identify suitable suppliers for the components, materials and services required within the procedure of product design and manufacture. In the development of the WMPSS, the business models and the analytic hierarchy process (AHP) approach are integrated with

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the state of the art Web-related computing technologies including Web Services and J2EE.

2. Methodologies applied for developing the WMPSS system

2.1. Concept generation for the supplier selection system

Supplier selection is generally a lengthy evaluation process. In viewing the existing weaknesses in the process of supplier selection, to apply appropriate business theories into the supplier selection procedure would be an important issue for manufacturers to select the best suppliers under the changeable environments. It is crucial to investigate and analysis existing business concepts first before generating a solution to overcome the weaknesses.

Strategy is a major concern for manufacturers to meet the needs of markets within the global changing environment. Porter highlighted the importance and relevance of competitive strategies [8]. These strategies exploit opportunities and strengths, neutralize threats, and avoid weaknesses [9,10]. Johnson and Scholes defined that strategy is the direction and scope of an organization which achieves advantage for the organization through its configuration of resources within a changing environment to meet the needs of markets [11]. Although there are very broad generalizations in strategies, the strategies need to be tailored to meet a particular purpose. According to different market position and development directions, the manufacturers can position themselves in a number of ways within the industry; consequently, their products can be placed into different market positions with different strategies.

Bearing in mind, based on Porter's competitive theory, the authors allocated the competitive strategies into three types for

situations. An example of applying the matrices into supplier selection procedure is illustrated in Section 4.

2.2. Research methodology

The research carried out for this new supplier selection system is exploratory in nature, it is imperative to choose a proper research strategy in order to collect primary information regarding to supplier selection criteria in terms of various strategies in combination with product market positions. It will draw from these findings to deliver a working definition and characteristics list of disruptive innovation for use by this Web Services-oriented supplier selection system.

A survey method is required in order to implement this primary research. Oppenheim et al. mentioned that any survey could be seen as a set of logical steps that will enable surveyor to measure the needed variables. Once the survey method was selected, some data collection techniques could be used, such as personal interview, telephone interview, and mail questionnaire [13,14]. The closed questionnaire is applied in this research. The authors designed 12 ranking questions, which based on the tangible supplier selection criteria with the business level development strategies and potential product market positions. The assessments for each criterion have been explained in details to the respondents within the covering letter. The results are used to develop twelve initial CSPMP matrices (see Section 3.4.2). The following question is taken from the questionnaire, the respondents are asked their beliefs about the most important criterion for new product in the new market under the speed focus strategy.

Please rank each of the criteria listed below in order of importance for supplier selection. Name the most important, 9; the next, 8; and so on. If a criterion has no important at all, please leave blank.

Criteria: Quality, Cost, Technology, Production Capabilities, R&D, Delivery & Location, Performance & Services

Importance:

this supplier selection system, they are Unique focus strategy, Speed focus strategy, and Cost focus strategy. In pursuing competitive advantages, a manufacturer also has to choose its scope, whether it will target a particular segment or go for a broad market. These choices define four basic approaches to competitive advantages illustrated in Ansoff's alternative directions for strategy development [12]. Based on these issues, a set of competitive strategies with product market positions (CSMPM) matrices is proposed. The CSMPM matrices focus on the general supplier selection criteria incorporating with related business theories, which provide three essential strategies with four traditional product position directions. The detail descriptions are given in Section 3.4.2. The matrices would make a reliable and flexible comparison for manufacturers to select proper suppliers under various

In this research, 300 questionnaires are emailed to 60 SMEs. At the end, 95 questionnaires are returned, and with all the questions answered, there are no ineligible and unreachable questions in this research. The response rate is more than 30%. The Microsoft Excel is utilized to analyse the responses.

2.3. Evaluation method based on the analytic hierarchy process (AHP) approach

Many tangible and intangible factors exist in the supplier selection procedure. A measurement method is needed in order to evaluate potential suppliers. Several techniques exist for suppliers selection, such as liner-weighting models, Network models, Goal Programming, and artificial intelligence-based models [15,16]. Choy et al. developed an intelligent supplier

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