國　立　清　華　大　學

碩　士　論　文

整合層次分析法與整數規劃實現大量客製化之智慧供應商評選

Integrated Analytic Hierarchy Process and Integer Programming Approach for Intelligent Supplier Selection Enabling Mass Customization

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摘要

在工業裝備製造領域，隨著產品規格的多樣化，大多數產品和製程都必須客製化，因而大大影響了產品生命週期的時間和成本。基於上述原因，良好的供應鏈管理將可以有效控制生產的製造時間和成本，從而增加企業利潤。良好的供應鏈管理最重要的任務是追蹤動態的、大量的客製產品訂單，即時選擇最合適的零組件供應商，以及管理向供應商所派出的訂單。本研究合作的產學方公司為一家客製化變壓器製造商。該公司目前主要通過主觀判斷（經驗法則）的方式來選擇其零組件供應商並進行派單。本研究將建立一個智能供應商選擇和派單系統，使用層次分析法（AHP）建立每個預定義標準的優先向量權重，然後將這些權重導入多目標整數規劃（MOIP）模型中以構建最合適的派單策略。每次派單完成後，由績效評估系統對所選擇之供應商的績效進行評估，將其表現量化並導入 MOIP 模型做為未來供應商選擇的其中一項依據。最後，本研究也將對此智能供應商選擇和派單系統中的參數進行敏感度分析，以了解這些參數值的改變對於模型結果的影響。本研究所開發之系統可以有效減少採購人員主觀因素對供應鏈管理和後續廠內生產效率的影響，為企業在選擇供應商時提供一個客觀準則。

關鍵字: 客制化設備製造、智能供應商選擇和派單系統、層次分析法（AHP）、多目標整數規劃（MOIP）、績效評估系統

Abstract

In the field of industrial equipment manufacturing, with the diversification of product specifications, most products and productions must be customized, which affects the time and cost of the production lifecycle. For the above reason, having good supply chain management can effectively control the manufacturing time and cost of the production, thereby increasing profits. The most important task of a good supply chain management is to track dynamic and massive customized product orders, select the most suitable component suppliers in real time, and then manage the order dispatched to the suppliers. The collaborating research company in this research is a customized transformer manufacturer. Currently, the way they select component suppliers and dispatching orders is mainly through the subjective judgment (rule of thumb). This research will establish an intelligent supplier selection and order dispatching system, using the Analytic Hierarchy Process (AHP) to establish the priority vector weights of each pre-defined criterion, and these weights is then imported into a multi-objective integer programming (MOIP) model to construct the most suitable order dispatching strategy. After each order dispatch, the performance of the selected supplier is then evaluated by a performance evaluation system, which generates a score for the selected supplier and will be imported into the MOIP model for future supplier selection. Finally, this study will conduct two sensitivity analyses on the parameters in the proposed intelligent supplier selection and order dispatching system to find out the impact of changes in these parameters to the outcome of the proposed model. The proposed system can reduce the impact of the subjective factors of the purchasing personnel on the supply chain management and subsequent in-plant production efficiency, and offers an objective rule for selecting suppliers.

Keywords: Customized equipment manufacturing, intelligent supplier selection and order dispatching system, Analytic Hierarchy Process (AHP), multi-objective integer programming (MOIP), performance evaluation system