

Designing a product-service supply chain performance evaluation model in the home appliance industry using factor analysis and fuzzy neural networks

Case study: home appliance companies in Iran

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Abstract: The aim of this study is to propose a comprehensive performance evaluation model with emphasis on service performance metrics in the service-product supply chain rather than the production supply chain in the home appliance industry and using neural-fuzzy networks for performance evaluation. The present study is typically a descriptive-exploratory research with survey approach in which, data analysis has been conducted using quantitative method and exploratory and confirmatory factor analysis. For the purpose of this study, a sample of 58 home appliance companies has been selected and Smart-PLS, SPSS and Matlab software have been used for data analysis. Findings indicated 10 main constructs and 29 performance criteria obtained for evaluating the performance of service supply chain and fuzzy neural networks of several home appliance companies.

Introduction: Based on predictions, services are a key component of the growth of the global economy in future (Arnold et al. 2011). According to Jane and Kumar (2012), services play a critical role in a supply chain. Also, according to Wang et al. (2015), a "product" or "service" must exist in each supply chain which is produced by the upstream sectors and delivered to downstream. Recently due to increasing customer expectations, companies' competition has been replaced by the supply chains competition and as a result, competition has been increased in the simultaneous supply of products and services. This has led to challenges in integrating companies and in coordinating the materials, information and financial flow that were previously overlooked. Accordingly, a new managerial philosophy has been developed known as Product-Service Supply Chain (PSSC) (Stanley & Wisner, 2002). This study seeks to develop a performance evaluation model for the product-service supply chain in the home appliance industry, which is finally solved using Adaptive Neuro-Fuzzy Inference System (ANFIS).

Design/Approach: In this paper, performance evaluation constructs and criteria of service supply chain are identified by reviewing the literature and exploratory and confirmatory factor analysis and then, the performance evaluation of service supply chains in Iran's home appliance industry has been performed using these constructs, criteria and ANFIS.

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Findings and Discussion: Based on the findings, ten main extracted constructs can be suggested for the performance evaluation of the supply chain. They include "Operational Performance (OP)", "Strategic Performance (SP)", "Financial Performance (FP)", "Performance of Information and Communication Technology (PICT)", "Return Performance" (REP), "Risk Performance (RIP)", "Logistic Performance (LP)", "Market Performance (MP)", "Internal Structure Performance (PIS)" and "Growth and Innovation Performance (PGI)", among which, the Strategic Performance (SP) and Return Performance (REP) are the most important and the least important constructs, respectively.

Conclusions

Based on the findings, the following practical recommendations are suggested to the companies:

- Enhancing the demand forecasts performance and utilizing more appropriate methods and software to improve forecasts in demand and order management areas.
- Improving the return management status by increased attention and more investment in return management processes.
- Effective investment in service development management to enhance the R&D services performance.
- Utilizing risk management approaches and methods to identify and take preventive actions on the risks in the companies' service supply chain.

Keywords: Product-service supply chain, Performance evaluation, Fuzzy neural network, Factor analysis, Home appliance industry

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