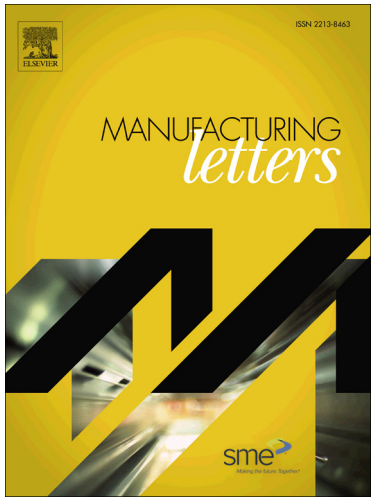

Letters

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PII: S2213-8463(17)30005-6
DOI: http://dx.doi.org/10.1016/j.mfglet.2017.03.001
Reference: MFGLET 88

To appear in: *Manufacturing Letters*

Received Date: 5 October 2016
Revised Date: 24 January 2017
Accepted Date: 5 March 2017

Please cite this article as: M.E. Brosas, M.A. Kilantang, N.B. Li, L. Ocampo, M.A. Promentilla, K.D. Yu, Novel approach for manufacturing supply chain risk analysis using fuzzy supply inoperability input-output model, *Manufacturing Letters* (2017), doi: http://dx.doi.org/10.1016/j.mfglet.2017.03.001

Novel approach for manufacturing supply chain risk analysis using fuzzy supply inoperability input-output model

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Abstract

Aside from becoming more complex and dynamic, manufacturing supply chains must be capable in adapting to disruptive events caused by natural and man-made disasters. Risk analysis is an aid in developing mitigation policies to achieve a resilient manufacturing supply chain. However, the uncertainty and vagueness of information along the supply chain pose a challenge to risk analysis. Previous approaches on the analysis of supply chain risks have been proposed but have drawbacks that may provide counterintuitive results. Thus, this study attempts to develop a methodological approach based on supply-driven input-output analysis with fuzzy parameters in order to address supply chain risk analysis. The motivation behind the adoption of such approach lies in the strength of I-O analysis in addressing interdependent systems and its ability to address uncertainty of information shared among members. The proposed approach was applied to an herbal manufacturing supply chain to illustrate the methodology.

Keywords: supply chain, risk analysis, fuzzy set theory, input-output model, inoperability

1. Introduction

Due to the current highly competitive environment, individual firms no longer compete as individual entities, but rather as supply chains to supply chains (Lambert & Cooper, 2000). The goal of any supply chain, in particular manufacturing supply chain, is to improve operational efficiency, effectiveness, profitability and competitive advantage of its members and partners (Min & Zhou, 2002). In order to achieve this goal, several issues must be addressed especially on managing manufacturing supply chain risks. Negative impacts can occur in a manufacturing supply chain due to the existence of risk events which can cause unanticipated changes in material flows along the supply chain. Such risks include international terrorism (Sheffi, 2002), economic crises and wars (Lim, 2010), and natural calamities such as fires, earthquakes and typhoons (Wiengarten et al., 2015) among others.

Several works have addressed supply chain risks using different approaches (Aqlan and Lam, 2016; Sarkar & Mohapatra, 2009; Blos and Miyagi, 2015). Despite of the increase of works focusing on this topic for the last two decades, there is still an inadequate use of quantitative models (Kirilmaz & Erol, 2016) in systematically assessing and analysing risks. Due to the complex behaviour of the manufacturing supply chain such as the interactions among its members, its interdependent components must not be analysed simultaneously, not individually. Haimes and Jiang (2001) and Santos and Haimes (2004) made an excellent