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Smart Buyer: A Bayesian Network Modelling Approach for Measuring and Improving Procurement Performance in Organisations

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Abstract: Procurement, the act of buying goods or services from an external supplier, plays an important role in any organisation. To measure how well an organisation undertakes this activity, it needs to measure all associated Key Performance Indicators (KPIs). The current literature's major drawback in performing such a measurement is how to integrate the different KPIs, each of which captures a specific aspect of the organisation's performance. In this paper, we highlight this drawback and present our proposed Smart Buyer framework that is based on a Bayesian Network (BN) model capable of capturing and integrating the different KPIs. The measured procurement performance value can then be used by organisations to identify the areas in which they need to improve and develop plans to achieve this. Four scenarios are presented to show how the proposed BN model can be further used for analysis and decision making within organisations. Finally, a recent real-world procurement example is studied to demonstrate the applicability of the proposed Smart Buyer framework.

Keywords: *Procurement performance measurement, procurement management, Bayesian Network.*

1. Introduction and Motivation

Procurement as the enabler of acquiring goods and services is undoubtedly an inevitable part of any business. It is also an increasingly complex activity in relation to the features that it provides, thereby requiring the cooperation of different disciplines and departments to achieve its final goal successfully. The effective management of the supply chain in any organisation is the key to achieving a competitive advantage and procurement is one of the critical activities in building and shaping such an advantage (Gustin, Daughterty & Ellinger 1997). Aissaoui, Haouari and Hassini (2007) discuss the significance of procurement within firms by pointing to the steady increase in the outsourcing of goods and services due to globalization and the increasing share of outsourcing costs. Other researchers, such as Ellram and Carr (1994), Carr and Pearson (1999) and Abdollahi, Arvan and Razmi (2015) explain the importance and significance of procurement as not just being a support function or a buying function but as a key strategic tool which is vital for the success of a firm. Nair, Jayaram and Das (2015) referencing the work of Quinn (2005) state that the strategic impact of purchasing in terms of cost, quality, delivery, flexibility and innovation is increasingly evident, as the cost associated with procurement ranges from 30% to as high as 70% of the cost of goods sold in some industries. However, to ensure that procurement is given the importance it deserves in shaping the relationship between different parties of the supply chain, the key requirement is first to measure how it is currently being done and then, depending on this, to make plans for improvement. In other words, to ensure that procurement is given its due importance as a strategic activity, it first needs to be measured for how well it is being done across all the organisation's contributing departments to determine if this measurement matches with the organisation's strategic requirements. This is concurrent to the notion that you cannot improve what you cannot measure.

The literature's existing approaches that measure procurement do not consider the strategic notion of it overlapping different disciplines or departments (Easton, Murphy & Pearson 2002; Okinyi & Muturi 2016; Hovius 2016; Patrucco, Luzzini & Ronchi 2016). In other words, the current approaches measure the effectiveness of procurement by considering it as a stand-alone activity that is focussed on a single department. For example, researchers have improved procurement practices such as make-or-buy decisions (Puranam, Gulati & Bhattacharya 2013), supplier selection (Yadav & Sharma 2016) and supplier

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