Journal of Purchasing & Supply Management 15 (2009) 166–177

Contents lists available at ScienceDirect

Journal of Purchasing & Supply Management

journal homepage: www.elsevier.com/locate/pursup

Reducing the total cost of supply through risk-efficiency-based supplier selection in the EPC industry

Guido J.L. Micheli *, Enrico Cagno, Augusto Di Giulio

Department of Management, Economics & Industrial Engineering, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy

ARTICLE INFO

Article history:
Received 22 October 2008
Received in revised form
26 April 2009
Accepted 4 May 2009

Keywords:
Supplier selection
Supply risk
Total cost of ownership

ABSTRACT

While risk is becoming the decision driver for a proper supply performance, and supplier selection (SS) is used to mitigate the supply risk, the few existing SS approaches for optimization under uncertainty are typically prescriptive. This shortcome has been overcome through a risk-efficiency-based supplier selection (REBaSS) approach, which is an application of the total cost of ownership (TCO) approach and gives supplier-specific guidelines for immediate and later interventions, so that an average supply cost reduction may be expected, if compared with the traditional TCO. The purpose of the research is to assess the expected positive economic impact of REBaSS on the average total cost of supply in the EPC industry, where critical supplies are extremely frequent. REBaSS has been tested on 13 purchasing occasions within an EPC company, whose SS is currently based on TCO. The empirical test of REBaSS within its domain of application (i.e., procurement of critical supplies) shows a total positive benefit that amounts to 1 432 487€, i.e., 4.76% of the total TCOs of the selected sample. As a practical implication, not only does REBaSS allow to overcome the managerial and risk-related shortcomings of the traditional SS approaches (TCO included), it also – due to the fact that the average value of the critical supplies of an EPC company is about hundreds of million Euros – allows for the potential total economic benefit of the use of REBaSS, which can be estimated in the order of tens of million Euros. This confirms the validity – both managerial and economic – of REBaSS as a sound alternative to the traditional TCO, and encourages one to step into a different way of considering the supply risk within SS.

1. Introduction

The increasing complexity of products and services, characteristically shorter product lifecycles, globalization of trade, and the improvements in logistics, have generally made company survival depend more and more on their suppliers (De Boer et al., 2001). This increasing dependence on suppliers leads companies to be highly exposed to contingencies, so that supply risk management (SRM) is recognized to be necessary (Zsidisin et al., 2000; Wu et al., 2006), and supplier selection (SS) becomes one of the most important issues for purchasing managers (Hsu et al., 2006).

Such issues are even plainer in the engineering, procurement and construction (EPC) industry, and can be considered as an extreme case of the engineer-to-order (ETO) environment, i.e., an innovate-to-order (ITO) environment (Wadhwa and Rao, 2003). In fact, in this industry a high degree of complexity (also because of the intrinsically risky context of companies working by projects, see as an example Van der Vaart et al. (1996) and Chapman and Ward (2003)), together with an extremely high value associated with supplies (Cagno et al., 2004) have been observed. Thus, the importance of supply risk is plain in the EPC industry, and lack of proper management of this kind of risk can be detrimental to the success of a company.

Further, based on Tang (2006, who classifies 4 main ways to mitigate the overall supply chain risk: demand, product, information, and supply management) and on the parallelism between supply management & supply risk management and project management & project risk management (Project Management Institute, 1987, 2000, 2004), both SRM and supply management (SM – which includes SS as one of the most important issues; see Tang, 2006) can be used to mitigate the overall supply chain risk, as depicted in Fig. 1.

Nevertheless, considering SS as the crucial issue of SM, these two (partially overlapping, at least in terms of information gathering, see Dekker and Van den Abbeele, 2008) different approaches (SS vs. SRM) are used alternatively by EPC companies under resource constraints (Micheli et al., 2008a). This latest study shows that supply risk, as a main risk to be managed through SCRM, is dealt with either focusing more on SS or on SRM. This negative correlation implies that a SS approach must explicitly consider supply risk and allow for its management, particularly when a SRM process is not extensively in place. In fact, in spite of the evolution of the SRM process, the management

* Corresponding author. Tel.: +39 02 2399 4056; fax: +39 02 2399 4067.
E-mail addresses: Guido.Micheli@PoliMI.it (G.J.L. Micheli), Enrico.Cagno@PoliMI.it (E. Cagno), Augusto.DiGiulio@PoliMI.it (A. Di Giulio).

1478-4092/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.pursup.2009.05.001

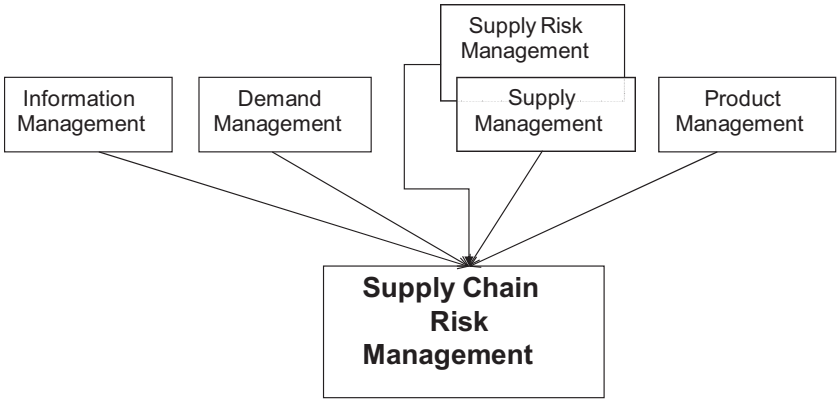

Fig. 1. Five ways to mitigate the overall supply chain risk (adapted from Tang, 2006).

of supply risk is still strongly related with risks arising from improper supplier selection (Smeltzer and Siferd, 1998; Giunipero and Eltantawy, 2004).

Therefore, a new SS approach (risk-efficiency-based supplier selection – REBaSS) as a way to mitigate the overall supply risk has been proposed (Micheli, 2008), which is as practical (Bhutta and Huq, 2002) as a total cost of ownership (TCO) approach (e.g., see Ellram, 1994; Degraeve and Roodhooft, 1999a, 1999b) and, at the same time, a real support for SS as a decision-making issue, rather than an additional constraint for the decision maker (Matos, 2007).

The paper is structured as follows. In Section 2, the issue of "supply risk" within both SS and SRM is discussed in an EPC context, and the transition from a TCO approach towards the need for a risk-efficiency-based supplier selection is presented; thereafter, the REBaSS approach is described, so that its managerial and practical implications are evidenced, as well as its expected positive economic impact on the total cost of supply. In Section 3 the purpose of the research is stated and in Section 4 the research methodology is reported. Section 5 of the paper includes the results and the discussion of the empirical research aimed at assessing the expected positive economic impact of the REBaSS approach on the average total cost of supply. Finally, a conclusion is drawn in Section 6.

2. Setting the problem

There is a plethora of supplier selection (SS) approaches – from simple scoring and matrix methods to more advanced mathematical programming approaches (e.g., Degraeve and Roodhooft, 2000), – proposed within the context of supply management and of supply chain risk management (Tang, 2006). All of these approaches have been proposed with the aim of taking preventive action against unforeseen events because risks cannot be completely eliminated (Fisher, 1997), as it has been recognized that SS helps to reduce the overall supply chain risk (Giunipero and Eltantawy, 2004) by reducing the supply risk.

2.1. From a generic one to an EPC-specific supply risk issue

As concerns supply risk, some insights must be provided.

Firstly, both operational (e.g., uncertain price, uncertain lead time, etc.) and disruption (e.g., earthquakes, currency evaluation, etc.) risks have to be considered within the concept of supply risk.

Secondly, a set of generic operational risk sources has been identified (Zsidisin et al., 2000; Zsidisin 2003a, 2003b; Zsidisin and Ellram, 2003), which can be grouped into three main categories (refer to Table 1): product-related, market-related, and supplier-related. These generic sources, within a specific context, originate the specific supply risks that have to be managed.

Table 1
Categories of Supply Risk sources.

Category	Supply risk sources
Product-related	Product design changes Quality
Market-related	Price increase Number of available suppliers Geographical concentration of suppliers
Supplier-related	Capacity constraints Cost reduction capabilities Lead time Environmental performance Financial health Failure to meet delivery requirements Inbound transportation Information systems compatibility and sophistication Inventory management Management vision Process technological changes Volume and mix requirement changes

Thirdly, due to (a) the fact that a supply risk arises within the context of a buyer–supplier relationship, (b) and the awareness that it is possible to reduce the supply risk propensity by forming alliances (Giunipero and Eltantawy, 2004; Smeltzer and Siferd, 1998), and referring to Das and Teng (1993, 1996), the supplier-related supply risks can originate both as relational risks (which relate to the possibility and the consequence that the partners in an inter-firm alliance do not commit themselves to joint efforts) and performance risks (which relate to the possibility and the consequence that the objectives of an inter-firm alliance are not successfully achieved), which can be properly managed, respectively through equity (which involve the transfer or creation of equity ownership) and non-equity alliances (which basically include the contractual arrangements).

In the specific case of the EPC industry, at least for the important acquisitions (i.e., critical supplies, in terms of value, quality, time, etc.) non-equity alliances can be observed to be mostly used to reduce the supply risk propensity, because of two main reasons: (1) the costs of opportunistic behaviour are generally perceived to be lesser than the costs of inadequate performance (so that equity alliances are not the preferred format, see Gulati, 1995; Das and Teng, 1996), and (2) the repeated change