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Managing raw material in supply chains



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ABSTRACT

In this paper, we explore how firms can manage their raw material sourcing better by developing appropriate sourcing relationships with their raw material suppliers. We detail three empirical case studies of firms explaining their different raw material sourcing strategies: (a) firms can adopt a hands-off approach to raw material management, (b) firms can supply raw material directly to their suppliers, and this may be beneficial for some agents in the supply chain, and (c) firms can bring their component suppliers together, and the resulting cooperation *between* suppliers can be beneficial for supply chain. We then analytically model the three raw material scenarios encountered in our empirical work, examine the resulting profits along the supply chain, and extend the results to a competitive buyer scenario. Overall, our results show that active management of raw material sourcing can add value to supply chains.

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1. Introduction

As businesses focus more and more on cost reduction and fast response, policies on supplier relationships and sourcing are fast becoming an effective tool for creating value for customers. Such policies include decisions on purchasing, quality, and process improvement that buyers may execute in the form of contracts between themselves and the suppliers. Our focus is on a critical component of sourcing – the raw material (RM). We believe that with increased focus on core business activities, and the outsourcing of non-core activities, firms have slowly distanced themselves from some of the sources of value in their sourcing-like managing upstream RM. For example, in some contexts, like that of an automotive firm, a large number of direct suppliers of the firm may be buying their RM from the same RM suppliers. In this scenario, building close relationships with these RM suppliers may be valuable for the automotive firm.

In this paper, we explore how managers can create more value from better managing their upstream sourcing via (i) empirical studies, and (ii) analytical models. Our results show that a firm's active management of RM sourcing can result in a more efficient supply chain.

The paper is organized as follows: First, we review the extant literature and establish our motivation for this study. Second, we describe our empirical work comprising case studies of three firms in three countries. Third, we model three RM sourcing scenarios analytically, anchor them to empirical findings, and then analyze

the interactions between a buyer, its suppliers, and its RM supplier. We then extend the models to the scenario of a competitive buyer. We conclude with a discussion of how firms can develop better RM sourcing, the generalizability of our results, and future research opportunities.

2. Literature and motivation

Our work is related primarily to the literature in the area of sourcing and buyer-supplier relationships. Many empirical and modeling studies span this literature, and among these, we can discern two interesting thoughts of creating value. The first assertion is that firms must operate in a lean fashion, and move away from the complexity that surrounds them: such focus is beneficial since it helps in improving efficiency (Masten, 1984). The second assertion is that managing the complexity in itself could be valuable (Fiol & Lyles, 1985; Helper & Sako, 1995; Nishiguchi, 1994). Our paper is anchored in the latter stream of research – we focus on the complex RM sourcing of a buyer and how managing this sourcing can be valuable.

Suppliers of a firm can provide valuable information to a firm (Gulati, 1999) and intangible relationship-specific investments in a firm's supply network can result in productivity gains in the supply chain (Dyer, 1996). From a buyer perspective, investments in supply chain relationships drive long term costs down (Nishiguchi, 1994), and affect new product development routines (Clark & Fujimoto, 1991; Kim, 2000). Such investments are usually focused at reducing the future uncertainty of costs, technology and information (Bensaou & Venkatraman, 1995) and component complexity (Bensaou & Anderson, 1999).

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Managing upstream sourcing can help create value in three ways. First, better RM sourcing can help decrease the manufacturing complexity related to sourced components (Masten, 1984; Novak & Eppinger, 2001; Parimigiani, 2007; Walker & Weber, 1987). Second, focus on RM sourcing can help with new product development. When OEM designers have more information about the RM, they are able to better predict the problems in new product development cycle, and thereby develop more robust products (Clark & Fujimoto, 1991; Takeishi, 2002; Wynstra, Von Corswant, & Wetzels, 2010). Finally, better RM sourcing can help reduce costs of sourcing by cost control at the design stage of components (Ahmadjian & Lincoln, 2001; Monteverde, 1995).

In the modeling studies on buyer–supplier relationships, game theoretic modeling is common, with a focus on buyer–supplier contracts. Most papers focus on the immediate suppliers of the firm, usually at the downstream end of the supply chain (Baiman, Fischer, & Rajan, 2000; Corbett, DeCroix, & Ha, 2005; Balachandran & Radhakrishnan, 2005; Lim, 2001) and for single or multiple periods (Tunca & Zenios, 2006). Xia and Gilbert (2007) focus on interaction between a manufacturer and a dealer for demand enhancing services, such as sales support. In this paper, in contrast, we model the upstream end of the supply chain and focus on the raw material sourcing. In this vein, our paper is closest in motivation to the work of Majumder and Srinivasan (2008), who focus on supply chain networks.

Bernstein and Kök (2009) explore cost reduction via process improvement in an assembly setting similar to that in this paper. Whipple and Russell (2007) discuss how collaborative transactions, event management, and process management can create value between distributors and retailers. Wynstra, Van Weele, and Axelsson (1999) discuss how value can be created in new product development process between OEMs, their first tier suppliers and second tier suppliers. Ellram and Billington (2001) document how an automaker facilitates the raw material supply to its machine shop contractor. This paper extends this research and explores how developing relationships with raw material suppliers can create value.

This work is motivated by our empirical investigation into the RM supply chain practices in the automotive industry. We worked with three OEMs in three different countries: DMV in Germany, TMV in India, and TDV in South Korea.¹ We spent many months onsite at each of these firms. In this paper, we first analyze these three case studies by exploring their RM sourcing strategies, and then analytically model the three RM sourcing scenarios to generate managerial insights.

A simple quote from a manager at DMV Germany exemplifies our motivation further. We asked “How much aluminum does DMV buy?”. The response was “We do not know. We don’t need this information since this is not our core competence”. Our studies of the sourcing of DMV (over many months) showed that the firm is the biggest buyer of aluminum in Germany, but it does not have a direct relationship with its RM suppliers for its aluminum sourcing (Fig. 1).

We found that the raw material information was not part of the decision making at OEM firms such as DMV. TMV and TDV had different approaches to raw material management: TMV had initiated direct RM buying for some of its suppliers, whereas TDV had gotten its component suppliers together and was taking a cooperative approach to managing its raw material supply chain. Can differential management of raw material supply chain be beneficial for firms? Our focus in this paper is to study this very real and inter-

esting problem, via three case studies, and also by using parsimonious analytical models, to explore conditions under which raw material supply chain management can be beneficial.

3. Three case studies on RM sourcing management

3.1. DMV’s strategy – Hands-off RM management

DMV is a European auto giant and is one of the world’s ten biggest car manufacturers. It has 14 plants worldwide, with six main plants in Germany. We studied DMV’s aluminum sourcing. DMV’s annual consumption of aluminum is close to 150,000 tons. The firm has thirty aluminum component suppliers (including its inhouse foundry) who are supplied by Germany’s three main aluminum suppliers. The sourcing network for aluminum for DMV is shown in Fig. 1B.

DMV’s aluminum suppliers, including the inhouse foundry, buy from all three of Germany’s major aluminum suppliers. DMV’s sourcing network of aluminum is dependent on the technology used by the suppliers for RM. In Germany, the aluminum component suppliers use molten aluminum as input, and a high volume of production is needed to ensure that the molten aluminum process is viable. More importantly, molten aluminum cannot be transported further than 200 kilometer without undesirable temperature drop; therefore, it is imperative for component suppliers to be physically located close to the RM suppliers. For DMV, most component suppliers, including the inhouse foundry, are within a 200 kilometer radius of the molten aluminum supplier plants. Production and all the associated processes of DMV aluminum supply are structured around this delivery model.

The suppliers of DMV make a 15% profit on the raw material and value addition of components supplied to it. DMV is a significant purchaser of aluminum within Germany, yet it does not have any direct relationships with its raw material suppliers for its total raw material consumption.

3.2. TMV’s strategy – Buying RM for suppliers

TMV is an Indian automotive firm. In the earlier years of its raw material supply chain management, TMV engaged in a hands-off RM management. However, it has now embarked on a policy of buying RM for many of its suppliers of steel and aluminum components. It now also purchases RM as a single buyer from the RM suppliers, and manages the logistics, physical supply, inventories of raw material and disposal or salvage of scrap/offcuts of steel generated in the manufacturing process at the component suppliers.

The transition from a hands-off to direct RM purchasing was complex (the firm still does not buy RM for all its suppliers). The firm aligned the RM suppliers, drew up longer-term contracts and developed processes for physical supply and tracking of raw material at the component suppliers. The input RM, and all the scrap and offcuts generated during the production process, needed to be tracked. Many of these activities were one-time investments to start the direct purchasing processes; however, additional work was needed every time a new component was developed.

There were implementation issues related to direct RM purchasing. In India, taxes are levied on direct transactions between any two parties. This creates some inefficiency in direct purchasing transactions. If TMV wants to directly buy RM, then the material transfer from the RM supplier to the component supplier needs to be executed in a way that is logistically inefficient – material has to be transferred to TMV’s ownership and then sent out for processing to the supplier. This logistical issue is local, and somewhat lowers the benefits that TMV can hope to accrue from direct RM supplies.

¹ Firm names are altered since we had to enter into confidentiality agreements with these firms, as we were researching areas in the raw material supply chain, and the variables of study, such as component level prices, are considered extremely confidential by firms.

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