Lateral Collaboration in Semiconductor Industry Supply Networks: A Procurement Perspective

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ABSTRACT

The interactive emphasis of vertical and horizontal collaboration in the semiconductor industry supply chain (SSC) support the buyer(s) performing procurement activities with supplier(s) through joint planning and decision-making, information sharing, resource sharing and incentive alignment. The paper proposes a framework to explore the resource sharing conditions under which enterprises are motivated to collaborate and the conditions in which such collaboration would be successful. A lateral collaboration scheme is proposed, which can be operated by the e-market intermediary to motivate buyers and suppliers to collaborate under competition. The results of this study demonstrate that the proposed collaboration mechanism yields an effective infrastructure for each member of the supply chain that supports efficient exchange of information and resources among all members. It is expected that the proposed scheme would enable the optimal capacity decision among competing suppliers for minimum expected total cost of the supply chain by appropriate selection of ordering quantity and penalty cost as imposed by the e-market intermediary. It is argued that the managerial decision-making in procurement perspective contribute to the matching between supply and demand for gaining mutual benefits.

Keywords: Information Sharing, Lateral Collaboration, Resource Sharing, Semiconductor Industry Supply Chain

1. INTRODUCTION

In an environment of globalization and sustained demand growth, the semiconductor industries have recognized that in order to sustain their customer base and to seize revenue opportunities, they must be able to manage successive technological innovations effectively (Cao, & Zhang, 2011; Fabbe-Costes, Roussat, & Colin, 2011). This can be approached by introducing high margin innovative products at the right moment through optimal use of the scarce resources and realigning the members of the supply chains to adjust to this trend (Ku, Gurumurthy, & Kao, 2007). The objective of the future semiconductor industries would be...

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determine how the supply chain members collaboratively deal with the resource and capacity sharing due to rapid evolution and change of technology (Wu, Erkoc, & Karabuk, 2005).

The common logistical arrangement in the semiconductor industry supply chain (SSC) operations is characterized by outsourcing the final assembly of consumer electronics modules to first-tier suppliers. This arrangement is responsible for assembling and delivering the modules in sequential manner. This supply chain arrangement can be improved when semiconductor manufacturers work collaboratively with its extended supply chain to bring about enhanced synchronization throughout the supply (Coleman, Lyons, & Kehoe, 2004). It is believed that the supply chain collaboration can be achieved through synchronization of operational functions through accurate and real-time information sharing (Flynn, Hu, & Zhao, 2010).

The general relationships between the members of fabless supply chain are depicted in Figure 1. As the customer demands are placed at finished goods level, manufacturing requirements are communicated to final test, assembly, wafer probe, and to the foundries. Efficient means of communication are necessary to ensure the success of the processes, which can be achieved through e-marketplaces participation of the supply chain partners.

The most common types of dependencies among the SSC members can be identified as technical dependency (for resource sharing), knowledge dependency (for product development), social dependency (for long-term relationship) and logistic dependency (for smooth workflows) (Kim, Park, Ryoo, & Park, 2010). The significance of this dependency is that as the enterprises invest in relationships over long periods of time, it becomes difficult and costly to dissolve existing relationships in favour of new ones (Cao, & Zhang 2011). Such collaboration initiative is attractive since it puts more emphasis on governance through relational means in addition to governance through contract means (Nyaga, Whipple, & Lynch, 2010).

Firms are building collaborative relationships, based on trust, with their supply chain partners in order to achieve efficiencies, flexibility, and sustainable competitive advantage (Cao, & Zhang, 2011; Panayides, & Lun 2009). Collaborative activities, such as information sharing, joint relationship effort, and dedicated

Figure 1. Relationship between members in a semiconductor SC (pull system)
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