A Supplier Perspective on Rapid New Product Volume Ramp-Up Manufacturing Strategy

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Abstract—**This paper highlights that weak production volume ramp up capability can be a major impediment for a supplier to thrive in a tightly linked overseas Japanese collaborative manufacturing supply network. An exploratory multiple-case longitudinal research methodology was adopted in this study involving two large Japanese MNCs and their respective supply networks consist of ten factories in four countries. The preliminary findings suggest that a supplier attaining rapid ramp up capabilities can enhance the predictability of initial production output during new product volume ramp up. Thus the new supplier gains immediate customer trust on the ability to deliver the committed product/services and consequently leads to increase in future business opportunities.**

Keywords—**Japanese Supply Network, Volume Ramp-up, Manufacturing Strategy**

I. INTRODUCTION

Due to major relocation of Japanese manufacturing firms out of Japan in the past decade, the unique Japanese *Keiretsu* supply network system has evolved into an overseas collaborative manufacturing supply network involving local suppliers [1], [2], [3]. The relocation creates a need for firms to restructure and re-design their manufacturing supply network to enhance network responsiveness and visibility [4]. This in turn offers new business opportunities for expansion and growth to new local suppliers with potential to enter into the network.

However, unlike the traditional *arm's-length* approach, the tightly linked collaborative structure of manufacturing supply networks raises the entry barrier for new suppliers to penetrate into the existing network [5]. Moreover, some Multinational Corporations (MNCs) even face problems of existing over-sized supply networks and lead to the justification to reduce their network members. Often these MNC's subsidiaries are also deterred by *supplier switching cost* and *risk* associated with replacing an existing critical supplier, such as quality problems and delivery delay, rather than exploiting the merits of a lower cost, innovative product/services and spatial proximity that a potential new supplier can offer. The decision becomes even more complex when considering a new product to be transferred to a potential new supplier or manufacturing service provider. The main concern is that the change may incur added cost and uncertainty especially on new supplier's ability to cope with unpredictable engineering changes during *volume ramp up* (*time-to-volume*) that can affect delivery schedules.

Apart from having a competitive product and/or services for a potential new supplier to joint into a network, the short product life cycle and fast changing technology in the high-tech electronic environment require agile capabilities. Manufacturing supply chain responsiveness is under a critical test, in particularly when focal firms launch new products that specifically to replace an existing product line. Product manufacturability and engineering changes are often the major challenges that cause production rescheduling and delivery delay.

The timing chosen for switching a supplier or manufacturing service provider is often implemented during a change of a new product model. This is because activities on the process of transferring a new product from R&D to a customised part supplier and/or manufacturing service providers is often costly and time consuming and needed to be minimised. The total time required for transferring a new product until volume production can be greater than 15% of the total time of a product life. The increasingly shorter timing window allocated for product transfer and volume ramp up is often due to changes in marketing commitment to launch a product at a specific time.

Early research focus on Vendor Selection System (VSS) to minimize switching cost and risk by assessing the physical production facility, production system, quality system of a targeted potential new supplier [6], [7]. Literature reviews show that two major area of research focus on manufacturing performance and infrastructural resources criteria for new supplier assessments [6]. However, little has been focus on the capability of a potential new entrant to deliver rapid production volume ramp up. This study explore on the implications of critical part suppliers and contract manufacturing service providers to develop *operational capabilities* to lower entry barrier in a collaborative manufacturing supply network through acquiring rapid new product volume ramp up capability.

A. The Importance of Volume Ramp Up

Time-to-market has been perceived as a critical competitive advantage [8], [9], allowing

manufacturing firms to: (i) achieve a fast pay-back of investments in new product development and production facilities and (ii) gain a market leading position by rapidly deploying newly acquired technology into new products (hence, differentiated product) ahead of competitors. However, both shorter time-to-revenues and the ability to maintain market-leading position depend critically on *time-to-volume*. Since in the high-tech short product lifecycles industries, new product prices typically fall rapidly, achieving high product volume early has especially high financial payoff [10]. Thus, the capability of a manufacturing firm to effectively and rapidly ramp up a new products with shorter manufacturing lead times becomes vital.

Despite the importance of production ramp up, it is a relatively unexplored topic [10,[11], lack of concept and framework [12], and the limited applicability of Intel's "copy exactly!" approach to fast volume ramp up [13]. Existing studies focus only on ramp up problems within the vertically integrated firms, despite the fact that leading high-tech manufacturing firms are aggressively deploying their outsourcing strategy, which extends the ramp-up problems to their manufacturing supply networks [5].

B. The Cost of Switching a Supplier

Porter defines *switching cost* as the costs that a customer has to sustain when changing a supplier, including costs due to the search for and analysis of alternative suppliers [14]. It includes identifying the need to change supplier, investigating and qualifying the sources, adding and educating the new supplier into the supply network system [15].

In high-volume technology intensive manufacturing firms, the initial preparation stage of switching to a new supplier may include cost of duplication of special manufacturing equipment, increase inventory to absorb sudden production disruptions, and personnel training cost to receive new product technology and manufacturing process. Moreover, managing multiple identical suppliers incur additional inventory cost, vendors management cost, documentation, communication and transportation cost. Thus, managers have to justify the change to a new supplier for both strategic, cost-benefit assessment and other intangible benefits.

II. METHODOLOGY

An exploratory multiple-case longitudinal research methodology [16],[17], was adopted involving two leading Japanese MNCs and their respective international manufacturing supply networks comprising ten factories in four countries. As the research on the process of ramp up is little covered in the literature [10], rich qualitative data resulting from the adopted case study methodology provides a deep introduction to the dynamics underlying the relationship between *why* and *how* ramp up events in a natural factory setting occur. To ensure robustness of the research findings, multiple case-based approaches coupled with longitudinal studies were adopted to pursue the in-depth contextual analysis and cross-case analysis of studying the ramp up process.

A series of semi structured interviews were conducted to explore '*why and how*' a focal firm: (i) collaborates with its suppliers; (ii) integrates its supply networks; and (iii) identifies criteria for collaboration/partnership performance. Direct observation, participant observation and reviews of internal documents were used to capture the details of the ramp up activities

III. RESULTS

Only two case studies are included in this paper for the purpose of discussion and are presented as follows:

A. Case 1: Company A

Company A is a leading Japanese large MNC having a worldwide brand name in consumer electronics, games and computer industries. Two subsidiaries that produced Flexible Printed Circuit (FPC) Board with their manufacturing supply networks were studied.

A new project for producing display modules for digital hand-phone using hybrid FPC and thin rigid PCB marked the initiation of product transfer. Once the product transfer was completed and production volume ramp-up had begun, the problems of customized part supplier delivery volume and quality quickly become the major issue. Rapid engineering change orders to alter and improve on existing product design, and also a sudden up surge in volume demand were the main reasons causing the supplier to be unable to perform its function as expected.

The pressure to rapidly ramp up on production volume was also caused by the short lifecycles of digital hand-phone products which had a typical life cycle of about six months for the Japanese market. The newly relocated supplier could not respond to those changes causing further additional quality problems as a result of production capacity limitation and inexperienced personnel. Even though the supplier had experience in manufacturing the previous model of product in Japan, the responsiveness of this new plant was not sufficient to cope with the transition. Backlog built up and the MNC finally decided to look for alternative source of supply while the existing supplier pledged to improve its ramp up capability for next coming new model.

B. Case 2: Company B

Company B is a local Electronics Manufacturing Service (EMS) provider within an extended supply network of a large Japanese MNC. Its subsidiaries are located in Singapore, Indonesia, Malaysia and China. This EMS provider assembled parts and modules of electronic products for the consumer electronics and computer industries.

The company utilized a special team for new product reception and develops new product transfer process. The team supervised the entire product and manufacturing process technology transfer, personnel training, new production facilities and production line setup, pilot production, manufacturing process refinement activities, initial product qualification, volume ramp up and volume production. A typical ramp up process is shown in figure 1.

Data was collected from ten ramp up cases utilizing direct observation and/or document reviews in the optical storage industry. Cross case analysis of the data enables each ramp up activity to be categorized and labeled into group of activities. The process activity profile illustrates ramp up activity intensity in terms of man-hours relative to the time window within each activity.

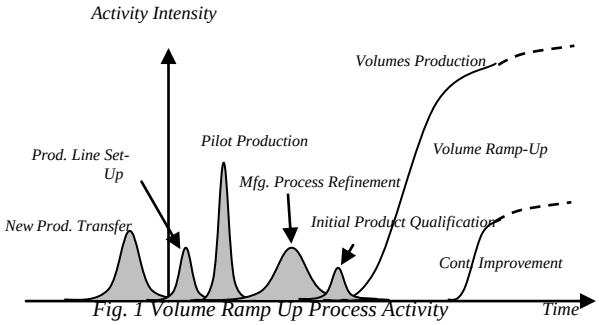

Fig. 1 Volume Ramp Up Process Activity

The Business Development Director of Company B commented that "Our "*commando" team* and the ramp up *process* have enabled us to enhance potential *new customer confident* on our ability to deliver production volume Just-In-Time". The team coordinated with the customer's final assembly plant, suppliers and R&D personnel at different stages during the entire ramp up process. Various mode of communication were utilized including physical personnel transfer until volume production stage.

Company B with its lower cost structure, location proximity with the MNC's subsidiary plant and rapid response to new product volume ramp up relative to its competitors has allowed the extension of its manufacturing capability from *module-based* to *box-build* manufacturing. The box-build business model offers "One-Stop" manufacturing services to its customers and enables its customers to further redesign a leaner and responsive overseas manufacturing supply chain.

IV. DISCUSSION

Case A presented that high initial volume demand concurrently with numerous engineering changes arises for a new product was a difficult challenge during initial ramp up. It was found that the personnel in-charge of company A for the project team took responsibility for both existing and new project activities and having no systematic ramp up process to guide manufacturing operational activities. The multi-tasking of the personnel caused conflict of job scopes and forced to prioritize between their daily and new product transfer activities. As the results, the initial production volume could not meet the delivery schedule and disrupt customer's final assembly production line.

On the other hands, company B was utilizing a dedicated team for new project transfer and reception from its customers. New project initiated was set to follow the ramp up process translated into action plans with activity, time schedules and person-in-charge clearly stated. A review of six years internal documents of company B shows that the ramp up process and its team structure have evolved from a simple single-departmental (i.e. the engineering process group) responsibility to a complex multi-departmental with inter-firm organisation structure. The team members include external suppliers, customer subsidiary manufacturing plant and R&D members. It was also observed that the ramp up process has also changed to coped with the increasingly shorter product lifecycle and to accommodate customer's qualification requirements.

Case A and case B represent extreme cases on the implications supplier's ramp up capability on manufacturing company business performance. As the optical storage industry has a short product life cycles, efforts were also made to revisit the case A and B after two years for longitudinal study purposes. Typically, a new model of CD R/W and/or DVD R/W would end its product life within nine months and replaced by new models having faster read and/or write speeds.

Case A shows that weak ramp up capability translates into additional manufacturing cost resulting from quality problems caused by reject and scraps, production downtime, re-scheduling production planning which have direct implications to customer's operational capability. Thus, it is argued that the ability to rapidly receive and volume ramp up initial production volume with minimum volume disruptions offer a time-based competitive advantage. The systematic ramp up process can reduce MNC's risk of engaging a new critical supplier apart from

competency in product technology and manufacturing resource capability.

V. CONCLUSION

The preliminary results suggest that a *systematic manufacturing ramp up process* deployed with a dedicated inter-firm structured team can enhance the *predictability* of initial production output during new product volume ramp up. Volume ramp up capability can be a critical factor in a *new supplier selection criteria* and offers competitive advantage to a potential new suppliers intend to penetrate into a tightly linked collaborative supply networks.

The outcomes from this research have important implications for practicing managers in understanding Japanese collaborative strategic choices in designing their global manufacturing supply networks. It may also offer a potential contribution to knowledge on new supplier selection criteria to reduce supplier switching cost and risk. However, the small sample size of this research and its focus in the optical storage industry is an obvious limitation. Future work could include other fast product lifecycle industries such as the fashion garment and biomedical sectors.

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