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Practices for Strategic Capacity Management in Malaysian Manufacturing Firms

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Abstract

While the notion of manufacturing capabilities is a long-standing notion in research on operations management, its actual implementation and management has been hardly researched. Five case studies in Malaysia offered the opportunity to examine the practice of manufacturing managers with regard to strategic capability management. The data collection and analysis was structured by using the notion of Strategic Capacity Management. Whereas traditionally literature has demonstrated the beneficial impact of an appropriate manufacturing strategy on the business strategy and performance, the study highlights the difficulty of managers to set the strategy, let alone implementing it. This is partly caused by the immense pressure of customers in these dominantly Make-To-Order environments for SMEs. Current concepts for manufacturing capabilities have insufficiently accounted this phenomenon and an outline of a research agenda is presented.

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Keywords: Make-To-Order, manufacturing capabilities, organisation, strategy, technology.

1. Introduction

The contribution to competitive advantage by manufacturing activities (also production and operations) has been a long-standing topic of discussion in academic literature, at least dating back to Skinner's seminal work (1969). Arguments for the contribution of manufacturing were based on economies of scale and later augmented by the recognition of trade-offs and innovation (Hayes & Wheelwright, 1984). Later, Ferdows & de Meyer (1990) added the individual companies might excel in one capability rather than all, even though their interrelationship might be cumulative in some

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respect (Größler & Grübner, 2006). Hence, the development of adequate manufacturing capabilities that match with strategic intents constitutes a core competence for manufacturing firms.

1.1. Research Objectives

While there is an extensive stream of academic research on manufacturing capabilities (e.g. Swink & Hegarty, 1998; Ward & Duray, 2000), one might question how these capabilities could be achieved in relation to the manufacturing strategy. For example, Hsafizadeh et al. (2000) identify a potential link with the organisational structure, Schroeder et al. (2002) show that superior performance of plants is related to internal learning, external learning from customers and suppliers, and proprietary processes and equipment, and Tracey et al. (1999) demonstrate the link with (advanced) manufacturing technology. Rather than treating all aspects of manufacturing capabilities in isolation, for practice all these need to be brought together, in what one could call "strategic capability management"; however, no writing seems to exist under this term. However, Dekkers (2002, 2003) and Orr (1999) mention a similar conceptual approach that covers all these aspects: Strategic Capacity Management. That raises the question whether that notion of Strategic Capacity Management encompasses sufficiently the matching of manufacturing capabilities with strategic intents.

From a productivity perspective, as presented by Tangen (2005), Strategic Capacity Management also needs to address both efficiency and effectiveness, i.e. meeting integral performance criteria. In that sense, a more expanded (and a more up-to-date) view on Strategic Capacity Management includes implications for strategic objectives, (production) technology, outsourcing and organisational structures (incl. skills of employees) as well as other factors than cost (e.g. lead-time, logistics and quality). To this perspective Riis et al. (2007, p. 944) add the proposition that the indirect strategic roles of manufacturing will become increasingly important.

1.2. Scope and Outline of Paper

This paper's aims are twofold. First, it investigates what should be considered part of "strategic capability management" and whether the concept of Strategic Capacity Management is sufficiently encompassing. Second, it seeks to find out what companies are practising with regard to strategic capability management and whether the constituent elements of Strategic Capacity Management could serve as tools for achieving strategic intents for manufacturing. The first step in that journey is a literature review, presented in the next section. That is followed by the framework for Strategic Capacity Management. The fourth section discusses the research methodology and Section 5 the results of the empirical research from manufacturing companies in the developing Malaysian economy. A section with discussion of findings and a concluding section complete the paper.

2. Literature Review

As the first step in this study, the literature review should address:

- Whether the concept of Strategic Capacity Management is the only available notion for strategic capability management in manufacturing firms.
- Whether its constituent elements: strategy, technology and organisational structures are sufficiently inclusive for strategic capability management.
- Whether its framework needs further extension.

2.1. Methodology for Literature Review

To that purpose, a systematic literature review has been followed (Cronin et al., 2008; Tranfield et al., 2003). By searching in three databases – ABI/INFORM, Google Scholar, Scopus – using keywords, the first 100 returns from each search were inspected on abstract and content; only articles published up until 2011 have been considered. As an outcome of the searches, a considerable amount of articles were retrieved addressing pricing strategies as well as operational planning and scheduling; these were discarded; please note that there was duplication in search results for different keywords. Totally, we did find 74 papers in journals that addressed in some way or another Strategic Capacity Management.

2.2. Results from Literature Review

Table 1: Overview of search results by database.

Search term	ABI/INFORM	Google Scholar	Scopus
"Strategic capacity management"	11	9	19
"Strategy" AND "Capacity management"	1	16	
"Strategy" AND "Demand Management"	1	7	
"Strategy" AND "Capacity Planning"	4	19	
Total	**17**	**51**	**19**
Total without duplication	**15**	**42**	**17**

These selected papers, see Table 1, have been reviewed on their merits towards strategic manufacturing capabilities. During the review it also appeared that some of the finds addressed different domains, like service management and Supply Chain Management; these were discarded. Since the main components of Strategic Capacity Management are: strategy, technology and organisation all articles were classified to one of these or allocated as other. The overview resulting from this classification confirms that the three components of Strategic Capacity Management are strategy, technology and organisation.

In addition to the thematic treatment of the literature, those papers that have occurred multiple times during the keyword search have been looked at closer. Armistead & Clark (1994) propose a framework for capacity management in the context of service management based on utilisation of resources and service quality (please note that this paper was discarded because of its focus on the service industry). Also, Crandall & Markland (1996) investigate the service industry to find that more emphasis is required on strategies for resource utilisation. Kathuria & Igbaria (1997) investigate the importance of IT applications for manufacturing performance. Van Mieghem's (2003) considers the capacity portfolio. The most complete view is found in Dekkers (2002, 2003) and Orr (1999), who argue that Strategic Capacity Management requires balancing strategy, technology and organisation; a similar conceptual proposition is made by Sun & Riis (1994), albeit that they only focus on the implementation of advanced manufacturing technology. Hence, the investigation of the papers occurring multiple times confirms this notion to take Strategic Capacity Management as the starting point of the research.

2.3. Framework for Strategic Capacity Management

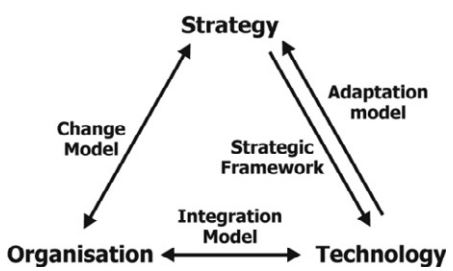

Figure 1: Strategic Capacity Management.

The connection between Sun & Riis (1994) and Dekkers (2002, 2003) is already described in Dekkers (2005, pp. 336-3337); that view is also consummate with Orr (1999). Sun & Ove Riis (1994) have generated a model that connects strategy through management with technology and organisation. Since, Strategic Capacity Management aims at managing resource utilization from a productivity perspective, management as concept is oblivious, and more emphasis should be given to the underlying models that govern effective management in this field (see Figure 1). The model of Sun & Riis relies on the following principles:

- organisation, technology and strategy are strongly linked to each other;
- organisation and technology should support the strategy;
- management is required to implement the changes;
- organisational and technological changes should be implemented synchronously (see also findings by Boer & During, 2001).

Dekkers (2005, p. 337) argues that four models are needed to describe the interaction between technology, organisation, and strategy (as shown in Figure 1):

- a strategic method for assessing manufacturing technologies;
- an adaptation model for strategy following the scan of technologies;
- an integration model for organisation and technology;
- a change model that interacts between the components: organisation and strategy.

With managing both steady-state processes and renewal processes, the conceptual notion of Strategic Capacity Management is also consummate with the notion of operational processes presented by Karlsson (2003) and Gadde et al. (2003), albeit that their arguments are related to industrial networks, and with arguments for strategic renewal by Agarwal & Helfat (2009).

3. Research Methodology

Since "strategic capability management" or Strategic Capacity Management itself has been hardly researched, the most appropriate research method seems the case study methodology. Following Yin's reasoning (1994), the primary unit of analysis is manufacturing (management) in industrial firms. Because of the construct of Strategic Capacity Management, consisting of separate components, guiding the data collection, the research has followed a structured path. Although, the research is exploratory, alternatives like qualitative interviews and grounded theory might be yielding less insight, certainly for the exploratory character of the research (Flyvbjerg, 2006). One reason for this is the availability of the predefined notion of Strategic Capacity Management; this position is consummate with Strauss' & Corbin's views (1998). Quantitative surveys could result in superficial inferences, according to Johnson & Onwuegbuzie (2004). Furthermore, the interest of this study is towards excavating the actual practises of manufacturing firms with regard to Strategic Capacity Management.

Data have been collected from Malaysian manufacturing firms on their actual practices for Strategic

Table 2: Overview of cases

Company	A	B	C	D	E
Employees	120	2500+	110	220	1200+
Product	Electronic components for automobile industry. Make to order.	Electronic components for communications, computer, networking, medical and consumer electronics industries. High volume, make to order.	Customer supplied Engineering parts (heat treatment only). Engineered to order.	Plastic parts for household electrical appliances. About 90% of sales from 4 customers. 20 Injection moulding machines.	Assembly of durable consumer goods mainly for local market. A combination of make to order and forecasted demand.
Challenges	• Inconsistent quality from main supplier • Rigid organizational structure	• Quality problems from component suppliers	• High variety • Unpredictable demand • Quick turnaround	• Too dependent on a few major customers	• High number of repairs at the end of the production line • Too dependent on local market
Interviewees	1.General Manager 2.Manufacturing Manager	1.Senior Manager (manufacturing)	1. Managing Director 2. Production Executive	1. General Manager (Manufacturing) 2. Production Planning Manager 3. Quality Manager	1. Section Manager 2. Production Supervisor 1 3. Production Supervisor 2

Capacity Management. According to Mahadevan (2001), the manufacturing sector in Malaysia is experiencing substantial growth and consists of 2nd tier suppliers to a wide variety of industries. The cases from which data have been collected are depicted in Table 2; also interviewees are listed in the table. Given the structure of the Malaysian manufacturing sector, the case studies should be considered as typical (Flyvbjerg, 2006, p. 229). Furthermore, triangulation took place by factory visits, secondary data and consistency checks; for the latter, responses to the unstructured interviews were compared with components of the concept of Strategic Capacity Management, interviewees were asked to illustrate their responses and questioning proceeded until a complete and consistent picture emerged. Cases that did not fulfil this requirement were omitted from the study. Hence, a complete data set was obtained from all the cases considered in this study (see overview in Table 3).

4. Results

The first component of Strategic Capacity Management to analyse is the information obtained about the strategy for manufacturing. Quite unanimously, all the companies, except the OEM, expressed their dependence on their customer by arm's length contracts where often constraints are imposed. Mostly that concerns costs and delivery schedules, irrespective of the reality of the suppliers. Because of the pressure exerted by customers, the ones responsible for manufacturing are more geared towards resolving problems associated with current orders rather than setting out a manufacturing strategy.

Table 3: Summary of data.

	Topic	A	B	C	D	E
Strategy	Investment in locations and units			Investment in new technology to cater for growing demand in new market.	Injection moulding machines not up-to-date in terms of CIM. No plan to invest in new technology, customer	New plant for finished goods. Two small plants set up in Indonesia and China for final assembly.
	Manufacturing strategy	Main customers OEMs; keep demanding for value engineering and cost reduction, not easy to achieve.	High volume production.	Continuous technological improvements to meet customer needs.	Main customers demanding more cost reduction and better quality. To keep business with main customers, some specific parts produced at loss.	Short lead-time for product development leads to 'rushed' mass production. Looking for strategic partner to compete in global market.
	Outsourcing	Main parts outsourced to local and foreign suppliers.	Inconsistent quality level from main suppliers.	No parts suppliers. Only suppliers for maintenance and consumables.	Major mould maintenance outsourced.	Sub-assemblies and parts outsourced to local vendors. No vendor development programmes as most vendors considered as 'matured vendors'. However, some key vendor parts still causing interruptions.
	Trade-off performance criteria	Main customer's new component: initial requirements from one division while mass production orders from other div. (variability).	Poor quality parts from suppliers lead to customer complaints.	Customer requirements /specifications not clearly stated or have errors. Causes defects in production.	Customer specifications clearly spelled out most of the time; main customers multinationals with established quality and management system. Mould breakdowns lead to downtime.	No mould modifications are made after pilot production stage due to high cost. Therefore any fitting problems caused by mould design not resolved permanently.
Organ.	Order Entry Points	Organisational structure does not promote common goals – marketing and sales not involving production during order acquisition stage.	Recent restructuring was done to change from functional production to line production.	Family-owned business with multi-tasking MD who is key and only decision-maker in most matters related to production capacity and sales.	Experienced staff in planning, production and quality assurance departments seem to lead to good coordination among departments.	Centralized planning unit makes all decisions related to volume and model of production.
Tech.	Technology scan and decision-making			Efforts made to upgrade technology used in production facilities.		Investment in new technology made to manufacture new products.
Planning and scheduling	Demand strategy	No alignment between process capacity and order intake –master planner imposes schedule, without constraints of production process.		Short production lead time by customers. Delivery of parts from customer decided by customers.		Customer demand is high for selected models only.
	Resource utilisation			Scheduling problem arise whenever customers deliver parts, without any adherence to original schedule.		Ca. 60% utilisation, considerable repairs at end production line. JIT implemented. Core subassemblies in bulk, day ahead of production.
	Supply (chain) management	Main part from European supplier lead-time of 3 months and arrives with quality problems				New parts are co-developed with suppliers.

That means they are having a reactive mode towards the manufacturing strategy. But that also implies they are less able to align the manufacturing strategy with the business strategy and hence not reap the full benefits from a long-term perspective. Besides, in three out of five cases, the business strategy was either undeveloped or driven by actual sales (or sales opportunities). However, these results should also be understood in terms of the composition of the Malaysian industry, where a large portion of the manufacturing acts as first- or second-tier suppliers towards foreign-owned corporations. Therefore, the dominant mode is Make-to-Order with one company moving between Engineer-to-Order and Make-to-Order (Case C). Nevertheless, not flexibility and responsiveness dominates the manufacturing strategy but the enforced reduction of costs. That even led one company to express that the pressure by one of the main customers (but not the biggest one) forced them effectively to subsidise

that products by benefits gained from other customers. In addition, two of these companies reported serious challenges for manufacturing by the performance of their suppliers falling below expectations; by one of them this was caused by the decision to outsource a part of their operations. Therefore, the companies had insufficient time to develop their manufacturing strategy, let alone its implementation.

For the second component of Strategic Capacity Management, the organisational structures, one of the companies reported an organisational change. The four other companies had mostly a functional structure consummate with the flexibility in products and responsiveness to orders (similar to Tier 3 in the construct for the hierarchy of flexibility dimensions by Koste & Maholtra [1999, p. 87]). However, all companies seemed to recognise that their control structures were not sufficiently adequate to manage the order processing. Shorter lead-times and higher variety were putting greater emphasis on matching production capacity with (forecasted) orders; only one company mentioned that the current horizon of planning (measured in months) allowed sufficient flexibility for optimising production. The company that had implemented an organisational change did introduce a production line with manufacturing cells feeding into it; before they had a functional structure, which had for long caused headaches in terms of coordination and order processing. In fact, it had been recognised late that this organisational structure was beneficial. While some of the companies were growing, the management style could be characterised as entrepreneurial (Phase 1 of Greiner [1998]). Hence, the five manufacturing organisations thrived on the flexibility and the entrepreneurial management style to respond to customer orders.

The questions about the third component of Strategic Capacity Management provoked mixed responses. As all companies relied on relatively high levels of investment in technology, capacity utilisation was considered as most important for capital expenditures. However, one company reported not only investing in new technology for current production processes but also had considered new product/market opportunities. Another case invested in both production equipment and facilities also related to the introduction of a new product. While another company viewed investments in production equipment as a capacity expansion; that was also visible since much of the equipment was of a different make. The other two companies had not really considered production technology recently but also did not seem to make any attempts to review their current manufacturing processes. Hence, it seemed that not for all companies manufacturing technology was deliberately part of the manufacturing strategy.

5. Discussion of Findings

As a first result, the study finds that setting out the manufacturing strategy is often pushed to the background by the domination of fulfilling orders and reducing cost; even though, the manufacturing managers understand that the alignment between business strategy and manufacturing strategy is beneficial. Literature has already outlined the merits of this alignment (e.g. Williams et al., 1995) but paid less attention to the factual priorities for manufacturing managers. According to Demeter (2003, p. 211), a strategic view on manufacturing also facilitates that the focus moves away from cost to quality, product development and time factor issues. In the set of case studies, almost the opposite was proven; while the customer intensely pressures for meeting quality standards (two out of five were having customers who were very particular about this point) and reducing costs, manufacturing managers can hardy pay attention to develop a strategic perspective. In that respect, Swamidass' & Newell's remarks about the constructive role of manufacturing managers (1987, p. 522) should be rephrased. Generally speaking, these managers in the case studies hardly have time to contribute to strategic decision-making (or in some instances not even any time). Hence, our first finding is that manufacturing managers in these Malaysian firms are not given sufficient opportunity to develop an appropriate manufacturing strategy, while definitely recognising its importance.

With respect to the organisational structure, flexibility and responsiveness are the key drivers for these firms. This is congruent with findings from Swamidass & Newell (1987, p. 521) for 35 U.S. manufacturing firms, more than three decades ago, albeit that the call for flexibility might be externalised upstream to the suppliers. The imposed flexibility and reduction of cost are managed for part by the focus of the companies on quality; this is consistent with Größler & Grübner's findings (2006, pp. 471–473), when they state that both capabilities (flexibility and cost) will be developed cumulatively under the condition of improvement programmes. However, the improvement programmes in the five case studies are more inclined towards short-term problem-resolving and -fixing rather than structural decisions as looked into by Größler & Grübner, like capacity expansion. Please note that exact development of manufacturing capabilities is still a matter of discussion, for

example, see Corbett & Claridge (2002) and Ferdows & De Meyer (1990) for alternative approaches. Furthermore, the two key drivers, flexibility and responsiveness, not only extend to the external orientation but also to the internal management styles. Nevertheless, there are signs that not only the work pressure but also the need for coordination triggers the need to consider their control and organisational structures (consummate with the design philosophy for organisational structures, see Dekkers [2002, 2003]). Therefore, our second finding is that the organisational structures of these companies reflect the imposed performance requirements, flexibility and responsiveness, that match more with functional structures; only when coordination has become unreasonably difficult, alternatives are considered.

Despite manufacturing technology being a cornerstone of Strategic Capacity Management, not all companies were actively considering their options. Contrastingly, only one of the companies had set out an adapted business strategy for reviewing new manufacturing technology and another company was operating relatively state-of-the-art production equipment. Congruent with Tracey et al. (1999), our third finding is that scanning and considering new manufacturing technology in conjunction with revising the business strategy is beneficial; however, our fourth finding indicates that not all of these Malaysian companies are taking an active stance towards the search for technology that might upgrade their production processes.

6. Concluding Remarks

The start of this paper set out to investigate whether the notion of Strategic Capacity Management, or strategic capability management, encompasses sufficiently the matching of manufacturing capabilities with strategic intents. By studying the practices in five Malaysian firms, the investigation shows that using this concept that integrates strategy, technology and organisation highlights (relevant) strategic issues. Particularly, this integration is mentioned by Vokurka & O'Leary-Kelly (2000, pp. 499-500), when they state in the context of manufacturing flexibility that a proper fit between environmental and internal strategic, organisational and technology variables can provide firms with a competitive advantage and improved performance. But it also shows that the integrative framework allows engaging with managers to identify (strategic) areas for improvement. Additionally, the research uncovered the challenges of manufacturing managers in these Malaysian companies.

The findings from the case studies indicate that the reality of manufacturing management does not match with the often-theoretical concepts available for it. For example, Voss (2003) discusses three paradigms for manufacturing strategy; these might be valid from a perspective on research in operations management but hardly considers the existing challenges for manufacturing management, certainly these of the Malaysian companies, who are often suppliers pressured for delivery and costs. In addition, that leads even to a situation where there is no time available for implementing a manufacturing strategy; according to Maruchek et al. (1990, p. 121) that represents even a bigger challenge for manufacturing manager. Because of competitive pressures on the short-term the development of longer-term perspective hardly gets any attention.

Therefore, the position of manufacturing managers in these Malaysian firms differs hardly from those observed by Skinner as base for his seminal work. This dilemma could be resolved by providing support for manufacturing management, the framework of Strategic Capacity Management being a case in point, by educating manufacturing managers or by better alignment of the business strategy and manufacturing strategy. In practice, the latter seems to be most challenging. However, it reveals a few other avenues for further research:

- The development of a framework for Strategic Capacity Management that allows managers to make a quick assessment of meeting strategic objectives (even in the absence of a fully developed business strategy).
- A more detailed investigation into the challenges that manufacturing managers are facing in realising the manufacturing strategy (and alignment with the business strategy).
- The position of manufacturing management in companies in developing countries being 1st and 2nd (and sometimes even 3rd) tier suppliers to conglomerate or large companies; these companies are often SMEs but not necessarily.

Only by understanding these mechanisms will we be as researchers able to truly support those manufacturing managers.

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