

Strategic capacity management: meeting technological demands and performance criteria

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Abstract

Although manufacturing determines mostly the current performance of companies, few companies deal systematically with the issues related to strategic capacity management. Besides decisions on outsourcing and acquisition of resources, this involves triggering process innovation, process development and improving performance by adapting organisational structures. *Action research* in companies reveals the importance of capacity management at a strategic level as well as the implementation at tactical and operational levels.

The methods as proposed in this paper provide industrial companies with tools for implementing their manufacturing strategy. Through matching product configurations with product–market strategies and product development, they point to areas of improvement by deploying performance evaluations and the determination of performance requirements. These improvements lead to decisions on investments for resources, resource utilisation and development of processes, including initiation of manufacturing technologies.

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1. Introduction

The market and competition drives industrial companies to improve the way they run their overall operations. This concerns the total primary process of these companies, innovation and product development as well as the manufacturing operation. For the manufacturing operation it involves issues such as: (i) How to manage capacity from a strategic point of view; (ii) When to develop new processes; (iii) Which processes to develop; (iv) Which capacities of processes to deploy in operation; (v) To acquire these processes, to develop processes or to decide for outsourcing; (vi) How to manage the value chain and how to link resources for achieving optimal performance.

When companies fail to initiate timely development of new processes, the non-availability of these processes might result in higher overall costs and increased lead-times. *Action research* in two companies in particular revealed that the actual manufacturing costs might exceed up to 30% of original estimates and the overrun on lead-time might amount to 50%. This applies especially to companies who do develop and manufacture their products on customer demands.

1.1. Background

In the current literature one finds only a few references for strategic capacity management. Mostly, the literature and the presented models concentrate on tactical and operational utilisation of resources for enhancing performance and pay less attention to linking resources to achieve objectives or to the portfolio of resources. Avella [1] remarks that most companies have maintained efficiency as the main objective of their production departments. Since Skinner's publication in 1969 many more have recognised that manufacturing can be a fundamental cornerstone for achieving a competitive advantage. When an industrial company wants to achieve strategic objectives it should connect the *manufacturing system* to its environment.

The performance of manufacturing depends strongly on the effective and efficient utilisation of resources to fulfil its role within the total operations of companies. To implement effective strategic capacity management, methods have been developed to support decision-making on a strategic basis for the utilisation of resources, consisting of process mapping, an evaluation framework and a master plan for technology acquisition, process development and resource management. This way long-term production planning is enabled as well as support during the development and engineering processes. The methods combine both technological demands and performance criteria.

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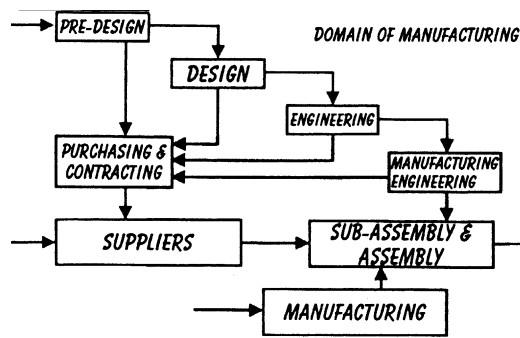


Fig. 1. Total primary process.

During case studies, fragments of these methods have been implemented. These case studies result from initiatives by industrial companies and show that the implementation of a proper manufacturing strategy depends on three major issues: (i) concentration on competencies and the implementation of an outsourcing policy; (ii) process development to enhance manufacturing technology; (iii) organisational structures to meet demands on business performance.

These issues as such require adequate attention of management; the interrelation and connection to an adequate product–market strategy challenges decision-making by manufacturing managers.

1.2. Manufacturing as part of the primary process

The management of industrial companies faces these challenges when defining their strategy, while only a few methods are available for managing capacity at a strategic level and for the initiation of process development (e.g. manufacturing technologies or improvements). Capacity refers to the deployment of units of resources in this context. Manufacturing is part of the total primary process of companies as depicted in Fig. 1. Driven by a study into sequential and simultaneous approaches to engineering, Riedel and Pawar [2] highlight that the concepts of design and manufacturing are not linked in literature and that the interaction of product design and manufacturing strategy is under-researched. Spring and Dalrymple [3] came to the same conclusion when examining two cases of product customisation, manufacturing issues got little attention during design and engineering. The case study resulting from our own *action research* demonstrates the importance of this link between product development and engineering.

1.3. Case study vision systems

The company produced dedicated vision systems for specific applications for a wide variety of customers having their own requirements. The total lead-times for specific orders (product development and manufacturing) amounted to 5 years. Manufacturing costs accounted for 65–70% of the

sales per order, lot-sizes for orders varied between a few systems to sometimes 30 pieces of equipment.

The Manufacturing Department encountered more problems to produce within budget and schedule for specific orders. Investigations (focusing on competencies, outsourcing strategy, manufacturing technologies and organisational structure) showed that most problems were caused by not taking manufacturing aspects into account during product development. Typically, an old design concept included one main sensor per system for receiving signals, a new concept introduced a hundred-fold of smaller sensors. The consequences for manufacturing were not considered. This resulted in a relatively high cost-price and above all manufacturing lead-times increased by a factor 3.

Also, the Manufacturing Department did not succeed in following a strategy. First of all, because of the lead-times of product development they could not set out an adequate strategy. During product development the Engineering Department determined mostly manufacturing aspects without considering the consequences, as shown above. Secondly, the Manufacturing Department did not translate objectives into programs for improvement and did not anticipate changes for the business. This was mainly due to having insights only at a total level of load on capacity, which did not trigger decisions on capacity investments, process technology improvement and structures to meet performance requirements.

2. Manufacturing strategy

Since manufacturing is part of the total process, the strategy is also. Fig. 2 represents this thought, showing the breakdown of the overall strategy in its components: marketing strategy, product development strategy and manufacturing strategy. Although each strategy will generate more details, these strategies should have a strong common link. The case shows that particularly the execution of strategies diverges during execution, thus reducing the total efficacy from strategy formulation and implementation.

Manufacturing management is confronted with increasing overall performance and reducing costs. The issues relate to the set-up of the primary process and control mechanisms, leading to increased competitiveness in today's global market. Key issues for capacity management in industrial



Fig. 2. Components of strategy.

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