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A tentative comprehensive manufacturing strategy framework adapted to the requirements in SME

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Abstract:

It is well-known that small and medium sized manufacturing enterprises (SMMEs) lack resources to work actively with their manufacturing strategies. Previous frameworks and tools have shown to work fairly well, but they are too complicated for the SMMEs. This paper presents a suggestion for an easy to use tool.

Keywords: Manufacturing, manufacturing strategies, SMME, analytical framework

Background

Manufacturing strategy has been around for many years, but the more modern era started with the famous article by Skinner (1969). Many authors have described how companies can use manufacturing strategies to gain competitive advantages. These descriptions have been wrapped up in various kinds of frameworks together with descriptions of the formulation procedure. Some of these frameworks have been empirically tested (e.g. Säfsten & Winroth, 2002), however with varying results. The main criticism has been that it is more of a consultancy tool than an easy-to-use tool for the companies themselves. This is even truer when it comes to SMMEs, who suffer from limited resources, both financial and personnel. This paper presents the present status of a Swedish project aiming at developing such a tool. The work is interactive and a tool is under development and will soon be tested at the participating companies.

Methodology

This research is being carried out as a collaborative research, where the researchers visit the participating companies regularly and the companies carry out work in their own operations. The project started by a series of semi-structured interviews with the management groups, in order to identify the maturity regarding manufacturing strategies. The work then continued with meetings, discussing how companies could work with their manufacturing strategies and the starting point was the Operations Strategy matrix, as described by Slack and Lewis (2011), since it was regarded as easy to comprehend. During the meetings, new tasks for the companies and the ideas by the researchers are discussed. The present status is that the companies have come differently far in their development work and two of the four companies now are acting as test objects for the researchers' ideas on development of the analytical framework.

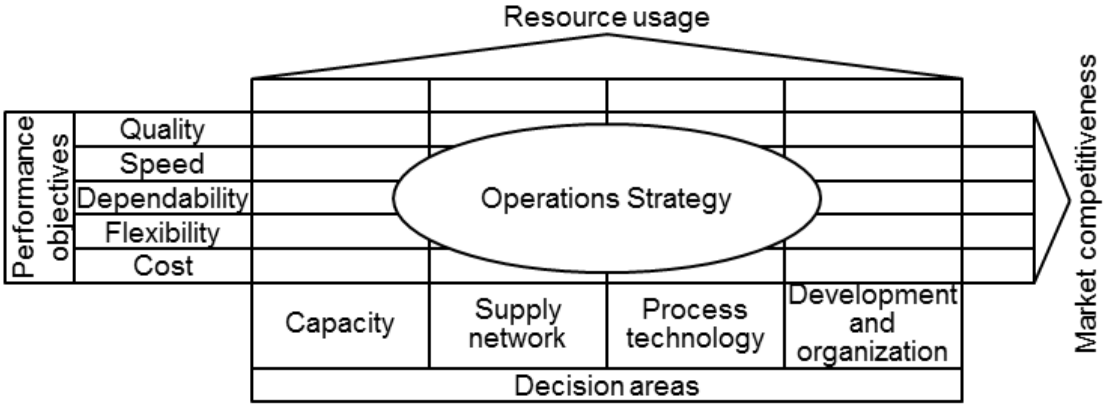
Frameworks for manufacturing strategies in literature

Manufacturing strategy frameworks

The prescriptive view is often predominant within manufacturing strategy literature (e.g. Rytter et. al., 2007). Research on manufacturing strategy in SMMEs revealed that prescriptive manufacturing strategy frameworks (Skinner, 1969, Wheelwright, 1978; Fine & Hax, 1985; Hill, 1989; Miltenburg, 1995; Kim & Arnold, 1996). These frameworks may be too complex to use for SMMEs due to limited resources, lack of time and domination of emergent approaches (e.g. Jennings & Beaver, 1997; Säfsten & Winroth, 2002; Bellamy, 2009). Existing prescriptive manufacturing strategy frameworks are hierarchical and seem to focus on the procedure, e.g. steps to be taken and not on management and organization, e.g. operationalization (Platts et al., 1996). Some frameworks are more descriptive, but seem to be too complex due to many stages and worksheets to describe their frameworks (Platts & Gregory, 1990; Mills et al., 1995; Baines et al., 2005). These frameworks may need a facilitator to understand the process. Also from a more quantitative perspective there are manufacturing strategy frameworks which need a facilitator (Karacapilidis et al., 2006; Jia & Bai, 2011). There are not many frameworks developed for SMMEs (Barad & Gien, 2001; Jia & Bai, 2011), but frameworks have been tested recently in SMMEs (Riis & Johansen, 2001, 2003; Baines et al. 2005; Lim et al. 2006) with quite satisfying result.

The easiest framework to use seems to be Slack and Lewis' (2011) operations strategy matrix, Figure 1, which is not a traditional prescriptive framework with well-defined steps. However, Slack and Lewis' matrix has been tested as a potential facilitator to introduce manufacturing strategy in SMMEs. The conclusion from the test is that it has potential, but needs to be refined (Löfving et al., 2012) to also include a customer and competitor perspective.

Figure 1. Operations Strategy matrix (Slack & Lewis, 2011)



However, Hayes and Wheelwright (1984) presented a list of eight decision areas that are more in detail covering the issues that a company needs to consider in order to perform well in their operations, Table 1.

Table 1. The decision areas and some of their main characteristics (Hayes & Wheelwright, 1984)

Decision area	**Characteristics**
Process technology	• flexibility, type of equipment, technology level, layout
Facilities	• location, size, focus
Capacity	• amount, acquisition time, type
Vertical integration	• amount, degree, relations
Quality management	• definition, responsibility, reporting
Human resources	• skill level, wage, training and promotion policies, employment security
Organization structure and control	• relationship between groups, decision
Production planning and control	• responsibility, rules and systems

Quality function deployment

Quality function deployment (QFD) originated in Japan in the 60's and 70's and originally proposed to be 'an overall concept that provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development and production' (Sullivan, 1986 in Chan & Wu, 2002). The main areas were product development, quality management, and customer needs analysis (Chan & Wu, 2002). In recent years, QFD has been applied to manufacturing strategies and Crowe and Cheng (1996) first introduced QFD as a tool for formulating manufacturing strategy to achieve alignment between manufacturing strategies and corporate strategies. The methodology comprises four stages, ranging from business strategy to action plans for manufacturing. Jugulum and Sefik (1998) realized that QFD could help companies in developing robust manufacturing strategies and that tools should be included in the classic steps of corporate strategy planning. Olhager and West (2002) used QFD for linking manufacturing flexibility to marketing requirements. Jalham and Abdelkader (2006) have modified Crowe and Cheng's (1996) methodology in companies in Jordan. The latest methodology for manufacturing strategy development use QFD as a transforming device to link competitive priorities and decision areas (Jia & Bai, 2011). The methodology focuses on quantifying manufacturing strategies using fuzzy logic. So far, there are only a few publications on strategic planning using QFD (Mazur, 1998) and there is only one manufacturing strategy model that is developed for SMMEs (Barad & Gien, 2001). The purpose with this model is to connect improvement actions in a company with its strategic and operating improvement needs. Dror and Barad (2006) and Barad and Dror (2008) have later extended the methodology to include supplementary matrices, but still focusing on the competitive priorities and improvement needs.

SMMEs

This research is carried out at SMMEs or more independent parts of larger companies, which are considered to act in a SMME similar manner. In an era characterized by increased globalization, SMEs play an important role in the national economy and represents an engine for economic growth (European Commission, 2004; European Commission, 2007; Dangayach & Deshmukh, 2001). The literature on SME is widely spread, and the terminology defining a SME is not uniform. Different aspects are included in different definitions of SME. A common denominator among the different definitions is size in terms of number of employees (Ghobadian & O´Reagan, 2000). The European Commission has provided a definition of SMEs involving headcount, turnover and/or total balance sheet, see table 2.

Table 2. The European Commission's definition of SME

(European Commission, 2003, 2005)

Enterprise category	Headcount	Turnover or	Balance sheet total
medium-sized	< 250	≤ € 50 million	≤ € 43 million
small	< 50	≤ € 10 million	≤ € 10 million
micro	< 10	≤ € 2 million	≤ € 2 million

The European Commission also includes independence in their definition. In order to be considered independent, not more than 25 percent of the company may be owned by another company (European Commission, 2005). However, a small unit within a large international company group could very well face the same problems as an independent company.

A number of studies have pointed out specific characteristics of small and medium-sized manufacturing enterprises (see e.g. Löfving, 2010; Hudson et al., 2001). According to these studies, SMMEs are more flexible and closer to their markets than their customers, they rely on a small number of customers and they operate on limited markets, they have a high innovative potential and a reactive, fire-fighting mentality, and finally a flat and flexible organisation. Several of these characteristics can be assumed to affect the conditions for how to work with manufacturing strategies. Previous studies confirm that the specific characteristics of SMMEs have to be considered since the strategy management process in SMEs is unique and cannot be considered to be the same as in larger organisations (Jennings & Beaver, 1997). Only a few studies focus on manufacturing strategies in SMME (Barnes, 2002a; Barnes, 2002b). However, research on corporate strategies and the general strategy process in SMME is available (e.g. Jennings & Beaver, 1997; Ates & Bitici, 2009). A study including four SMMEs in UK indicates that managers carry out the activities within the strategy process, but they do not necessarily call it strategy formulation or strategy implementation (Ates & Bitici, 2009). Other studies confirm the reluctance to talk about strategy formulation and to document manufacturing strategy. In a survey carried out among SMMEs in Sweden, 84 percent claimed to have formulated manufacturing strategies, but only 48 percent of these had it in writing (Winroth, 2001). One problem, which might hinder SMMEs from implementing manufacturing strategies to a higher degree, is the existing frameworks for manufacturing strategy formulation (e.g. Hill, 2000; Miltenburg, 1995). The traditional top-down strategy process advocated in the manufacturing strategy literature was found to be inadequate in practice. A study among six SMMEs in UK indicates that a broader approach is needed, including the role of emergent actions and decisions from within manufacturing, together with impact from organizational culture, politics, and powerful individuals (Barnes 2002a; Barnes 2002b).

Case study

The outcome so far from the longitudinal work with the case companies indicate that the original OS-matrix, as suggested by Slack and Lewis (2011) does not go deep enough into the organization of the company, nor the competitive situation. The limitations are as follow:

- The companies would like to define their own decision criteria and competitive priorities, i.e. to provide them with names that feel more relevant to each company
- There may be both external competitive priorities as well as requirements that are put upon the companies from the top management within their company or company group as well as their owners
- The companies would like to know 'Are we performing well or do we need to improve?'
- The companies would also like to see clearly if there are any trade-off relationships, both negative and positive, between decisions criteria and competitive priorities

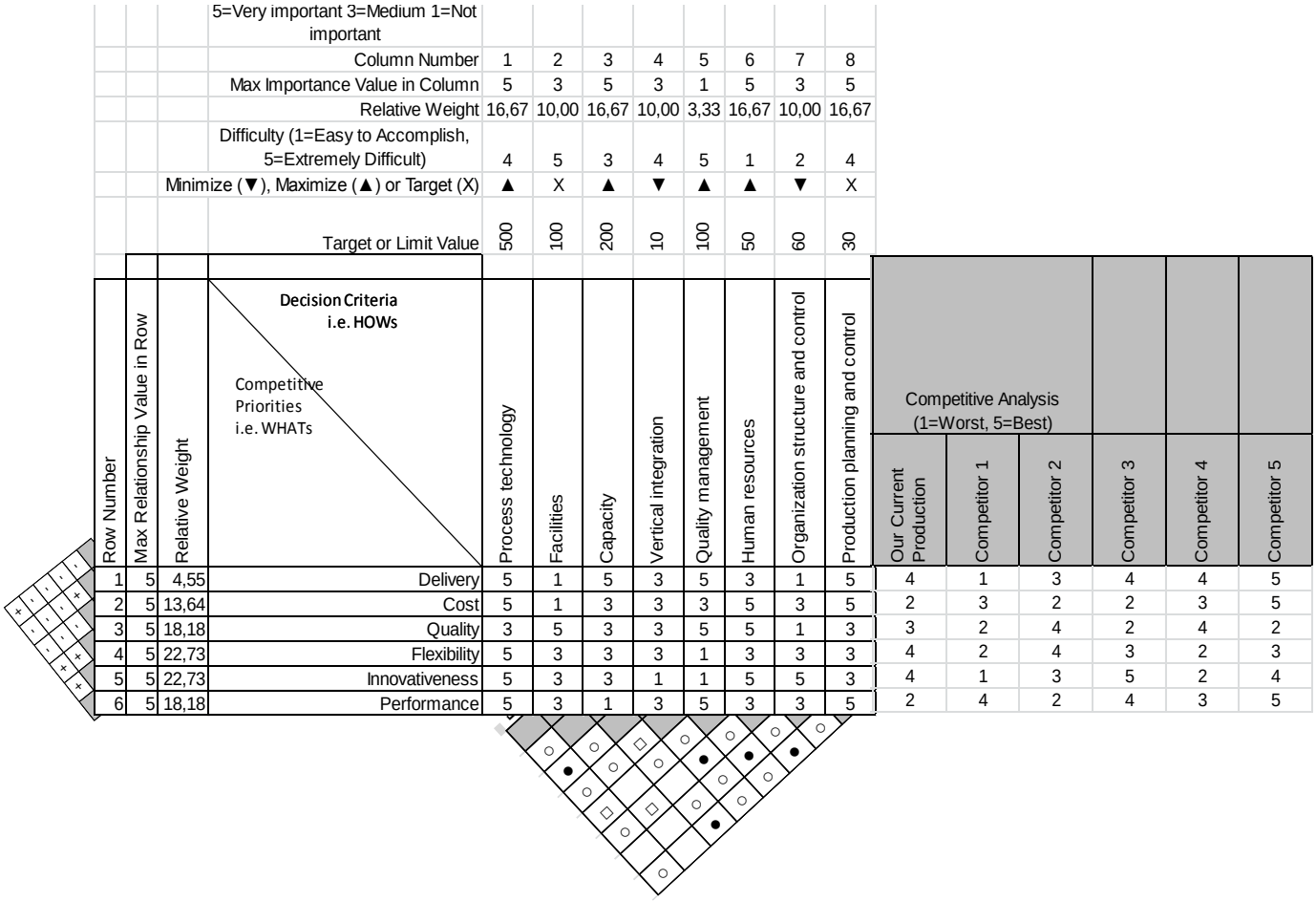
These questions have been taken into consideration when designing a first draft of a further developed analytical framework.

Suggestion for further developed analytical framework

The idea is to build further on the QFD-approach and highlight the linkages between competitive priorities and decision criteria, Figure 2. In the center we can see the OS-matrix (Slack & Lewis, 2011), with indications about how important each decision criterion is for achieving each competitive priority. The upper part describes the relative importance of the different decision criteria and the difficultness of accomplishing targets. To the bottom there is an attempt to show if decision criteria are linked to each other. To the left there is a description of the trade-off

relationships between different competitive priorities as well as their relative weight. To the right, finally, we can see the competitive situation, or how we perform relative our competitors.

Figure 2. The present status of the further developed framework.



			5=Very important 3=Medium 1=Not important														
			Column Number	1	2	3	4	5	6	7	8						
			Max Importance Value in Column	5	3	5	3	1	5	3	5						
			Relative Weight	16,67	10,00	16,67	10,00	3,33	16,67	10,00	16,67						
			Difficulty (1=Easy to Accomplish, 5=Extremely Difficult)	4	5	3	4	5	1	2	4						
			Minimize (▼), Maximize (▲) or Target (X)	▲	X	▲	▼	▲	▲	▼	X						
			Target or Limit Value	500	100	200	10	100	50	60	30						
Row Number	Max Relationship Value in Row	Relative Weight	Decision Criteria i.e. HOWs / Competitive Priorities i.e. WHATs	Process technology	Facilities	Capacity	Vertical integration	Quality management	Human resources	Organization structure and control	Production planning and control	Competitive Analysis (1=Worst, 5=Best) Our Current Production	Competitor 1	Competitor 2	Competitor 3	Competitor 4	Competitor 5
1	5	4,55	Delivery	5	1	5	3	5	3	1	5	4	1	3	4	4	5
2	5	13,64	Cost	5	1	3	3	3	5	3	5	2	3	2	2	3	5
3	5	18,18	Quality	3	5	3	3	5	5	1	3	3	2	4	2	4	2
4	5	22,73	Flexibility	5	3	3	3	1	3	3	3	4	2	4	3	2	3
5	5	22,73	Innovativeness	5	3	3	1	1	5	5	3	4	1	3	5	2	4
6	5	18,18	Performance	5	3	1	3	5	3	3	5	2	4	2	4	3	5

The companies in the study also ask for the ability to include much more information within each cell in the central OS-matrix. Thus, the further developed tool will give the possibility to click on each cell and get further into detail.

Further research

The project will now continue by further developing and testing the framework. Most of all, it has to be accompanied by detailed guidelines for how to use it.

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