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Manufacturing strategy – a neglected success factor for improving competitiveness

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Abstract

In the past decades, the requirements for manufacturing have increased significantly. The major reasons are shorter product and market life cycles, a significantly increased model range but smaller batch sizes and highest technological requirements. In order to distinguish oneself from other companies and to improve the own competitiveness in this challenging market, an effective manufacturing strategy is crucial. Therefore, the manufacturing strategy has to be coordinated with other functional strategies and depends on enterprise individual contents. In result, the manufacturing strategy determines the certain use of specific resources and capabilities in manufacturing, which can enable the development and expansion of competitive advantages. However, existing approaches for developing a manufacturing strategy do not allow a sufficient response to the described market situation. In fact, relevant resources and capabilities which lead to a better performance in manufacturing and a higher competitiveness cannot be identified or just with a time lag. To meet the changing market conditions, the manufacturing strategy has to be developed with a new process. Therefore, an approach for developing a manufacturing strategy is presented. This paper points out how manufacturing can enable a decisive differentiation from competitors. In this new process, the development of the manufacturing strategy is seen as an integral part of the enterprise strategy. In summary, the approach allows a unique strategic position that enhances the competitiveness through specific resources and capabilities in manufacturing.

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1. Introduction

The environment of manufacturing companies has changed dramatically over the past decades. Significant changes can be seen in the change from a seller' to a buyers' market, increasing globalization, the declining market development in many sectors and the growing environmental awareness of customers. Hence, manufacturing companies were facing a constant increase in complexity in recent years. Smaller batch sizes because of customized products, shorter product life cycles and a constantly growing international competition are just some consequences, which result from the changes. [1 - 4]

As a consequence, the requirements on manufacturing are increasing in order to react adequately to the prevailing market situation. Consequences for the manufacturing are that shorter product life cycles with a significantly increased model range

but smaller batch sizes and highest technological requirements have to be managed effectively. Therefore, product and manufacturing process innovations have to be finished faster in order to guarantee the adequate renewal of the service range. Moreover, increasing quality, time and cost targets have to be achieved so as to counteract the intensified competition. [4 - 6]

Nowadays, it is no longer sufficient to control and adapt the manufacturing by short-term targets in effectiveness. [5, 7, 8] Moreover, the manufacturing gains more and more on relevance for the competitiveness of the enterprise and its long-term strategic decisions for itself. The manufacturing is a strategic competitive factor through which companies can differentiate themselves from the competitors. [1, 3, 9] In order to meet the specific needs of the strategic manufacturing management, a process to develop manufacturing strategy is

crucial. This publication points out that currently no adequate process of development and implementation for manufacturing strategy exists.

2. Demands on manufacturing strategy

In the scientific literature, there are many different definitions of manufacturing strategy. The evaluation of the different definitions shows that those do not differ fundamentally. [9, 10] Therefore, manufacturing strategy specifies which resources and capabilities need to be established or maintained in the area of fabrication so that those contribute to the enterprise competitiveness. [8, 11, 12]

From those definitions can be derived the following basic requirements for manufacturing strategy:

Requirement 1: The manufacturing strategy must be phrased in a way that the manufacturing contributes to the competitiveness of the enterprise.

Requirement 2: The manufacturing strategy has to be coordinated with other functional strategies.

Requirement 3: Enterprise-specific contents and sub-strategies have to be taken into consideration for the implementation of the manufacturing strategy.

Requirement 4: The manufacturing strategy must be phrased that for its content enterprise-specific resources and capabilities are established or maintained in order to increase the efficiency of the manufacturing and, consequently, improve the competitiveness of the enterprise.

Each of the described requirements is explained below:

Requirement 1: The manufacturing strategy provides a contribution to the competitiveness of the enterprise by the integration into the corporate strategy and its influence on the overall objective of the enterprise. As shown in Fig. 1, the manufacturing strategy has to be seen as a functional strategy. [1, 9, 10] The corporate strategy includes the general direction of impact of the enterprise. The functional strategy serves as a strategic orientation within the functional divisions. [1, 10]

Requirement 2: As a functional strategy, the manufacturing strategy has to be coordinated with other functional strategies. [9, 10, 1] The need of coordination with different functional strategies is identified by several authors. Foschiani emphasizes the functional strategies in R&D, human resource, procurement, finance and marketing. [1] On the contrary, Samson only emphasizes the coordination between the marketing and finance strategy. [7]

Requirement 3: During the implementation of the manufacturing strategy, the integrated enterprise-specific contents have to be divided into partial sub-strategies. This process is shown in Fig. 1. The extensive literature review of Freibichler shows that different contents should be considered in manufacturing strategy. [10] The most commonly named contents are the strategies in technology, location, depth of manufacturing and capacity.

- The **technology strategy** determines future development activities for the product and manufacturing process technology as to generate competitive advantages. Depending on the novelty of the product and process technology, different implementation approaches have to be considered.
- The **location strategy** determines the number, the size and the position of each individual site as well as their technological focus.
- The **strategy for the depth of manufacturing** defines the position in the overall value chain. Important contents are Make-or-Buy decisions as well as the relationship to the suppliers.
- The **capacity strategy** determines the capacitive performance of the manufacturing. Important decisions have to be made for the forecasts for future demand and planned capacity. [13, 12, 1]

Requirement 4: The improvement of efficiency in manufacturing can be realized by creating and maintaining enterprise-specific resources and capabilities, which lead to a competitive advantage and differentiate the enterprise from others. In terms of manufacturing, resources and capabilities can be physical (e.g. machines, equipment, information technology) or intangible assets (e.g. patents or licenses) as well as the enterprise existing (core) competencies and organizational processes. Thus, the resources and capabilities take into account competition influencing structures for coordination and organization of employees and the application of knowledge and other practical skills. General targets in quality, costs, time and flexibility are directly affected by existing resources and capabilities, which are part of the different contents of the manufacturing strategy. (Fig. 1) Therefore, competitive advantages can be created with a smart combination of these resources and capabilities in order to react more efficiently to the aforementioned market changes and increasing demands on manufacturing than other companies. [14 - 18] Since resources and capabilities are highly enterprise-specific and not available free on the market, they cannot be copied from competitors easily in short or middle-term. Therefore, the enterprise gets a sustainable competitive advantage. [4, 8, 9, 16, 19]

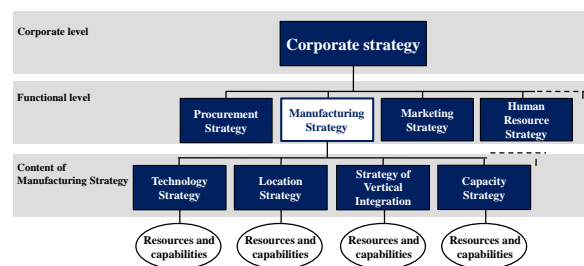


Fig. 1. Classification of manufacturing strategy

3. Approaches for developing manufacturing strategy

Based on a comprehensive analysis of Dangayach et al. [20], more than 300 peer-reviewed articles and specialized books were analyzed on manufacturing strategy. It was concluded that a process for the development and implementation of manufacturing strategy is described by only a few authors. In almost every approach (except one, from Miltenburg [22]), the manufacturing strategy is developed from the corporate strategy.

Thus, two different approaches for developing manufacturing strategy are described in the scientific literature. One approach describes the development of the manufacturing strategy derived from the corporate strategy. (e.g. [1, 21]) The other approach describes the development of the strategy from the functional divisions. (e.g. [22]) Both approaches are described in more detail below.

Approach 1: Development of the manufacturing strategy from the corporate strategy

In this approach, the manufacturing strategy is developed from the corporate strategy. The initial step of this approach is the analysis of the corporate strategy, from which the manufacturing strategy is derived. [1, 21] The manufacturing focuses on the fulfillment and achievement of targets of the corporate strategy or other functional divisions. [10, 21, 23, 24, 25] Examples for this approach are the specification of the manufacturing depth or the investment or disinvestment due to financial considerations. [23] Thus, the manufacturing strategy is a reactive functional strategy, often with the single focus on efficiency-oriented objectives, i.e. reducing the negative effects within the manufacturing. If manufacturing strategy contains only instruments for efficiency increase and cost reduction, there are not enough resources and capabilities left for an adequate competitive reaction to increasing requirements on the manufacturing and the prevailing market situation. [1, 9]

Approach 2: Development of the manufacturing strategy from the functional divisions

The development of the manufacturing strategy from the functional divisions is based on a detailed analysis within the manufacturing. For this, the starting position of manufacturing is identified and on basis of external analysis, relevant fields of action and contents are derived. The focus of this analysis is set on enterprise-specific contents of manufacturing strategy as well as related resources and capabilities, which have to be developed and preserved in order to react adequately to changing market requirements. (cp. the approach of [22])

4. Need of action

According to the described general requirements, which are shown in Fig 2, neither approach 1 nor approach 2 fulfills the requirements.

Requirements	Approach 1	Approach 2
1) Contribution to competitiveness	●	○
2) Coordination with functional strategies	●	●
3) Enterprise-specific contents of a manufacturing strategy	●	●
4) Development and sustainment of the resources and capabilities	○	●

● fully complied
 ● partially complied
 ○ not complied

Fig. 2. Comparison of existing approaches for derivation of manufacturing strategy

By developing the manufacturing strategy from the corporate strategy, there is a high risk that assumptions and objectives regarding the contents of manufacturing strategy are predetermined by the corporate strategy. As a result, a detailed analysis cannot be carried out to derive competition relevant resources and capabilities. Therefore, relevant resources and capabilities which lead to a better performance in manufacturing and a higher competitiveness are identified too late and, consequently, not included in the manufacturing strategy. In addition to that, there is a chance that not all relevant contents of manufacturing strategy are addressed. Hence, the manufacturing strategy only has a limited impact on the competitiveness of the enterprise.

The second approach for the development of manufacturing strategy, which is described in the scientific literature, only describes the necessary steps for the analysis of the starting position and the derivation of important actions within the manufacturing. A reference to the corporate strategy or the contribution to the competitiveness of the enterprise is not given. In addition, it is not shown how to coordinate the manufacturing strategy with the functional strategies. (cp. [22]) Thus, there is no process for developing manufacturing strategies described in the scientific literature, which meets the identified requirements.

In summary, decisions for manufacturing strategy cannot only be made by the corporate level of an enterprise and then passed down to the functional level. [26] In order to build up resources and capabilities for generating competitive advantages and positive impacts on the enterprise's success, manufacturing strategic decisions have to be made by the manufacturing itself. The start of the development of manufacturing strategy has to be in the functional divisions. With this, requirement 4 is fulfilled. As to fulfil requirement 3, the created and maintained resources and capabilities have to be derived from enterprise-specific contents. The relevant content as well as resources and capabilities have to be coordinated with other functional divisions (requirement 2) and the competitive strategy (requirement 3). Only then, it is reasonable to derive and implement manufacturing strategic objectives and manufacturing strategy.

5. Approach for developing manufacturing strategy

Based on the identified need for action and the described requirements, the external and internal situation of manufacturing must be analyzed in the first step of the development process for manufacturing strategy. Thereby, the external and internal environment should be analyzed in order to derive the appropriate content for the manufacturing strategy and the needed resources and capabilities. In order to ensure a contribution to the competitiveness of the enterprise based on the identified resources and capabilities, an analysis of the competitive position is necessary. Other functional strategies and the corporate strategy must agree the analyzed content as well as the resources and capabilities. After this step the strategic manufacturing objectives and the establishment of the manufacturing strategy can be determined. The final step is the implementation of the manufacturing strategy to realize the specified content and its resources and capabilities. The implementation must be continuously evaluated to ensure the appropriate implementation. This developed approach is illustrated in Fig. 3. In the following the individual steps are explained in more detail.



Fig. 3. Approach for developing manufacturing strategy

Step 1: External and internal analysis

For the **external analysis** external factors, i.e. influencing factors which act outside the enterprise, need to be analyzed. [1] For this purpose, Zäpfel categorized, as shown in Fig. 4,

the economic environment (overall economic development), the technological environment (technological development), the legislative and policy environment (political development) as well as the socio-cultural environment (social and economic development). [12]

Sector of environment	Possible influencing factors
Economic environment	<ul style="list-style-type: none"> • Development of the gross national product • Development of the capital markets • Expected cyclical fluctuations
Technological environment	<ul style="list-style-type: none"> • development tendency of product technologies • development tendency of production technologies • availability of potential substitution technologies
Legislative and political environment	<ul style="list-style-type: none"> • Development in the legislation • Importance and influence of trade unions • Development of the economic and regional policy
Socio-cultural environment	<ul style="list-style-type: none"> • Change from cultural standards • Change in recreational behavior and consumption • Change in the work attitude

Fig.4. Influencing factors [12]

The external analysis serves to identify and assess external factors of the enterprise and their future development at an early stage to determine proactively the strategic direction of manufacturing. This step is necessary in order to decide on the long-term development and expansion of resources and capabilities within manufacturing. [1, 27] If an enterprise is able to make more accurate expectations to the required usage of future resources and capabilities, competitive advantages can be generated. [28] Since decisions about establishing or sustaining resources and capabilities must be taken under uncertainty, the application of different forecasting methods is endorsed. ([29, 30]) Potential risks and future developments are more apparent and can thus be integrated in the strategy development. [12, 29]

The **internal analysis** focuses on the own strengths and weaknesses as well as, based on the external analysis, the potential opportunities and threats. [1, 32] The necessary contents of manufacturing strategy as well as the existing or the establishing resources and capabilities have to be analyzed. Previously, the technology strategy, location strategy, the strategy of vertical integration and the capacity strategy were outlined as an important content of manufacturing strategy. As a method for the internal analysis, the SWOT analysis, used as a central element in many strategy development processes, is especially suitable. [32, 33] There, also information from the external analysis is taken into account. In this case, existing internal strengths and weaknesses are edited the same way as future opportunities and risks, which can lead to a modified or new strategy alignment. It is necessary to know the weaknesses as well as the strengths of the own manufacturing. Only if these characteristics are known, weaknesses and risks can be mitigated or avoided and the strengths and opportunities can be obtained or expanded.

Step 2: Analysis of the competitive position

Basically a competitive advantage is acquired as a result of a service offer which is superior over the offer of competitors.

Whether a competitive advantage is obtained by existing resources and capabilities or by resources and capabilities which have to be developed has to be seen in comparison to the competitors. Accordingly, the own resources and capabilities in the contents of manufacturing strategy must be compared with those of the competitors. Therefore the analysis of the competitive position serves as an alignment with the customer and competitive demands, and for the decision making on the resources and capabilities which should be established or extended. This step is performed after the 'external and internal analysis'. In this way the future developments which are relevant to the own enterprise are known i.e. opportunities and risks as well as the own strengths and weaknesses. As a consequence it is possible to describe target-oriented comparisons and necessary future resources and capabilities. [1, 10, 12]

Step 3: Coordination with other functional strategies and the corporate strategy

After the first two steps, the 'external and internal analysis' and the 'analysis of the competitive position', the existing strengths, weaknesses, opportunities and risks are known as well as the content to resources and capabilities of manufacturing which have to be developed. These prevalent conditions and content of manufacturing strategy can thus be communicated as a whole, so they can be aligned with other functional strategies and the corporate strategy. According to the determined contents of manufacturing strategy it is necessary to discuss, for example the following questions: With what product technologies and what manufacturing process technologies, what locations, what vertical integration and what capacity in the competition or the market, the enterprise intends to position itself. Depending on the strategy pursued by the enterprise to ensure competitiveness, the development or maintenance of the required resources and capabilities will be affected. In contrary, resources and capabilities which have to be taken into account in addition by the manufacturing can be pointed out by the preceding steps of the manufacturing strategy development. Hereby, the manufacturing influences the response to the aforementioned changes in market requirements whereby the enterprise's competitiveness can be improved.

Step 4: Definition of strategic manufacturing objectives

After the coordination of the other functional strategies and the corporate strategy the strategic objectives for manufacturing can be determined. These distinguish the demanded performance through manufacturing, which can be achieved by the development or sustainment of the resources and capabilities. These can be objectives in terms of quality, costs and time but also to realize specific customer requirements such as the use of ecological materials.

Step 5: Definition of the manufacturing strategy

After the definition of the strategic objectives of manufacturing, the manufacturing strategy must describe how these objectives can be achieved. Thereby, strengths need to be systematically expanded to the identify opportunities and to deal with risks. Weaknesses should be minimized or avoided. [33] With this approach, a promising conversion or restructuring of manufacturing can be achieved. Therefore the required content of the manufacturing strategy has to be

finally defined that should lead to a purposeful establishment or sustainment of necessary resources and capabilities. For this purpose an action program must be defined, which points out and describes the needed action activities. [1] In fact, the action program points out the measures that should lead to the establishment or sustainment of needed resources and capabilities.

Step 6: Implementation and review

In the final step of the development process, the implementation of the manufacturing strategy takes places in form of the proposed action program. This program describes the content-related definition of the needs for action and concretizes their chronological implementation. Thereby, an appropriate breaking down of objectives in the operational areas must be carried out. [12] To achieve long-term success of the implemented manufacturing strategy, a permanent evaluation and review of the strategic measures and the action program is necessary. Hereby, undesirable development as well as achieved progress can be become transparent in early phases. [1] Further, the initiated strategic measures to changing customer requirements and changes in the business environment can be adjusted in time. [33]

6. Summary and conclusion

This publication shows that the requirements have increased significantly for manufacturing in the recent years. Since manufacturing enterprises can outperform competitors with manufacturing, the appropriate strategic focus of the manufacturing becomes increasingly more important. Because of this, general requirements for a manufacturing strategy are derived and described in detail. To meet these general requirements, an approach to develop manufacturing strategy is described. This allows the development of manufacturing strategy, which contributes to the competitiveness of the enterprise. For this purpose, the coordination with other functional strategies and the integration into the corporate strategy are necessary. In addition to this, the contents of manufacturing strategy should be described in different sub-strategies with the purpose of the establishment and maintenance of resources and capabilities. Hence, manufacturing enterprises are able to respond to increased market demands more efficiently than competitors which results in competitive advantages.

Further research needs are seen in the detailed description of the steps to develop manufacturing strategy. In particular, the steps for internal and external analysis are very different from the general strategy development processes. Within these steps, the specific environment and information of manufacturing have to be considered.

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