

# การทบทวนงานวิจัยเพื่อพัฒนาแบบจำลอง ยุทธศาสตร์การผลิต\*

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## บทคัดย่อ

ยุทธศาสตร์การผลิต ถือว่า เป็นหนึ่งในยุทธศาสตร์ระดับฝ่ายที่มีสององค์ประกอบ ได้แก่ กระบวนการ (Process) และกิจกรรม (Content) โดยที่กระบวนการ หมายถึงขั้นตอนการกำหนดยุทธศาสตร์ การผลิตขององค์กรในขณะที่กิจกรรม จะหมายถึง กลยุทธ์ที่องค์กรตัดสินใจเลือกใช้เพื่อให้สามารถตอบสนองเป้าหมายหลักหรือตัวชี้บ่งชี้ระดับความสามารถในการแข่งขัน เช่น ระดับคุณภาพ การส่งมอบความยืดหยุ่นและดันทุนการผลิต/บริหารจัดการ การศึกษานี้มีวัตถุประสงค์เพื่อนำเสนอผลสรุปจากการทบทวนงานวิจัยที่ผ่านมาและนำเสนอสู่การพัฒนาแบบจำลองยุทธศาสตร์การผลิตที่ อธิบายขั้นตอนซึ่งประกอบด้วย การกำหนดหรือเลือกดัชนีบ่งชี้ระดับความได้เปรียบในการแข่งขัน (Order-qualifiers หรือ Order-winners) ที่เหมาะสม การเลือกดัชนิใจเลือกกิจกรรมที่สอดคล้อง และการประเมินผลที่สะท้อนให้เห็นว่าองค์กรสามารถบรรลุเป้าหมายหรือวัตถุประสงค์ที่ต้องการได้มากน้อยเพียงใด

คำสำคัญ : แบบจำลอง, ยุทธศาสตร์การผลิต, ตัวชี้บ่งชี้

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# CONCEPTUAL FRAMEWORK OF MANUFACTURING STRATEGY DEVELOPMENT: FINDINGS FROM LITERATURE REVIEW<sup>\*</sup>

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## Abstract

Manufacturing strategy, as a functional strategy, consists of two key components: process and content. Process refers to how strategy is made and addresses content issues of competitive priorities, which includes quality, delivery, flexibility, and cost aspects. Process means a pattern or procedure in which strategy is developed and implemented. The purpose of this study is to summarize the results of comprehensive literature review, which various researchers have investigated the influence of manufacturing strategy of a firm on performance measures. Conceptual framework (process) of manufacturing strategy development that includes the effect of manufacturing strategy on both manufacturing and business performance was proposed. This framework necessarily precludes the use of competitive priorities (order qualifiers and order-winners) as good estimators of manufacturing performance and hence the direct linking of these measures to business performances.

**Keywords :** Conceptual framework, manufacturing strategy, competitive priorities

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## INTRODUCTION

The manufacturing strategy consists of process and content that describes the way to produce and distribute the product. It is defined by APICS dictionary as “A collective pattern of decisions that acts upon the formulation and deployment of manufacturing resources.” To be most effective, the manufacturing strategy should act in support of the overall strategic directions of the business and provide for competitive advantages” (Cox and Blackstone 1998). Manufacturing strategy must describe the contribution that manufacturing makes to the cost, quality, availability and future objectives of the business. Process refers to how strategy is made and addresses content issues of competitive priorities, which includes quality, delivery, flexibility, and cost aspects. Process means a pattern or procedure in which strategy is developed and implemented (Dangayach and Deshmukh 2001a).

Wickham Skinner (1969, 1974) initiated the debate on how high levels of manufacturing performance can be developed within a manufacturing firm. One of the main recommendations that Skinner makes to practitioners is to basically avoid trying to “be all things to all people” in terms of manufacturing performance. In other words, Skinner is already aware that some “manufacturing activities” are inherently in a “trade-off” situation with some others. In short, Skinner recommends that since no company can be the best at all competitive priorities (costs, quality, reliability, flexibility, etc), companies should concentrate on a few, well-defined tasks.

Some other researchers have proposed alternative ways in which high levels of manufacturing performance can be developed. The cumulative capabilities models (Ferdows et al, 1986, De Meyer et al, 1989, Ferdows and De Meyer, 1990) propose a less-restrictive way in which manufacturing capabilities can be developed. The underlying idea is that of predetermined, sequential improvements that can lead to lasting, high performance along a number of manufacturing areas. On the other hand, the rigid-flexibility model (Collins and Schmenner, 1993; Collins et al, 1998) also offers a less-restrictive way in which high manufacturing performance can be achieved. However, contrary to the cumulative models, this model does not impose a predetermined and fixed sequence for the development of manufacturing capabilities. Instead, the rigid-flexibility model argues that flexibility in manufacturing, and thereby responsiveness to market requirements, is achieved through simplicity in process and discipline in procedures.

The result of comprehensively review literature leads to understand how the manufacturing function (manufacturing strategy) should be performed in terms of its impact on business performance measures. It is implicit that by achieving high levels of performance in terms of quality, reliability, flexibility, costs, etc, the manufacturing function can help a business stay competitive in the market. It could also be said that ideally all manufacturing priorities, improvement programmes should reflect in tangible characteristics of the products/services that is being delivered to customers. Thus, as will be discussed in the next sections, these tangible characteristics of the product (quality, reliability, flexibility, costs/price, etc) should inevitably be used when assessing the impact of the manufacturing function on business performance measures.

This paper consists of four sections. In section 2, previous studies that have investigated the impact of the process of manufacturing strategy development on business performance are reviewed. Conceptual framework of manufacturing strategy development was proposed and explained in section 3. Section 4 describes the conclusions of this study.

## MANUFACTURING STRATEGY AND BUSINESS PERFORMANCE

Hayes and Wheelwright (1984) argue that the manufacturing strategic role goes through at least four stages of development:

- Stage 1: Minimize manufacturing's negative potential, "internally neutral".
- Stage 2: Achieve parity ("neutrality") with competitors, "externally neutral".
- Stage 3: Provide credible support to the business strategy, "internally supportive".
- Stage 4: Pursue a manufacturing-based competitive advantage, "externally supportive".

These researchers suggest that the third stage is the one that authors such as Skinner seem to imply when describing the concept of manufacturing strategy. In the third stage, the firms expect their manufacturing organization to provide credible and significant support to its overall competitive strategy. Firms that reach stage four however, base their competitive strategy significantly on their manufacturing function. These firms anticipate the potential of new manufacturing practices and technologies. These firms also develop long-range business plans in which manufacturing plays a major part in securing the company's strategic objectives. As can be seen, going from stage one through stage four, the manufacturing function of companies can develop from being just required not to make things worse than they are, to a stage in which it can become a source of competitive advantage and long-term stability and prosperity in the firms' plans. Consistent with this, in the next paragraphs, some studies that explore the associations between aspects of manufacturing strategy and business/firm performance will be discussed and analysed. While the literature that examines link between manufacturing strategy and business performance is vast, we have selected a number of papers on the basis that they help to illustrate the main topic of discussion.

Swamidass and Newell (1987) investigate the impact of environmental uncertainty on manufacturing strategy content and process, and manufacturing strategy's influence on business performance. Manufacturing flexibility is used as a representative of manufacturing content for the study. A composite measure using perceptual items is utilized to measure manufacturing flexibility performance. Statistical analyses indicate that higher environmental uncertainty is linked to higher flexibility, and that higher flexibility is associated with better economic performance. Seemingly, under the influence of uncertain environments, manufacturing flexibility can be the source of competitive edge and hence support the economic performance of the business/firm.

Cleveland et al (1989) propose a theory of production competence. Production competence is a function of business strategy and production process, and as such, it can only be measured by the manufacturer's strengths and weaknesses relative to the priorities of the business plan. The participants are asked to rate their performance relative to the standards in their industry along various manufacturing dimensions and business performance. A competence index that combines the relative strength/weakness in each performance area with the importance of that performance area in the business strategy is derived. Statistical analyses show that the relationship between an overall performance measure and the competence index is highly significant, indicating that production competence explains much of the variance in business performance in these cases.

Kim and Arnold (1993) analyse whether a firm performs better if its manufacturing function supports the competitive priorities as defined by business strategy. Manufacturing competence is defined by the degree of consistency between the importance given to a capability and the firm's strength with regards to that particular capability. The participants in the study are asked to rate the importance given to a number of manufacturing performance measures, as well as the perceived strength relative to their primary competitors in the same industry along those dimensions. The authors propose a new model of manufacturing competence that differs from

another model studied by several authors. Results show that in general, the new model proves to be a better predictor for the business performance variables of return on assets and profit ratio than the old model. It is concluded that the new model represents better manufacturing competence, where only strategically important capabilities are considered.

Ward et al (1995) suggest that environmental uncertainty affects competitive priorities, and that competitive priorities affect business performance. Several competitive priorities are measured by the emphasis that the subjects place on activities related to these areas. Business performance is measured by perceptual items regarding the change in performance over a period of time in terms of profit before tax. Results show that the pre-specified model fits better for high performers than for low performers, which the authors say is consistent with the literature. Ostensibly, environment appears to have a tangible impact on strategic choices in operations. It also appears that the link between environment and operations strategy helps determine firm performance.

Williams et al (1995) study how the business strategy (in terms of level of differentiation) is related to companies' emphasis on factors inherent to both market and technology orientation, and how market/technology orientation in companies is linked to performance in terms of return on sales. In order to measure technology and market orientation, the subjects rate the emphasis they place on activities/areas/decisions that are identified with each of the two orientations compared to other business units in their industry. Results show that one variable belonging to manufacturing technology orientation ("innovative manufacturing process") and three variables related to manufacturing market orientation ("capacity slack", "product quality" and "variety of final products offered") are significantly associated to business level of differentiation. Also, "quality assurance programs" (an item that belongs to the manufacturing technology orientation) and "product quality" prove to be significantly associated to ROS. Ostensibly, their results indicate that firms seeking a differentiation strategy reflect this emphasis on innovative manufacturing processes, product quality and variety of product offerings, while decreasing their levels of capacity slack maintained. Empirical support for existing theory on the relationship between manufacturing strategy and business performance is also found.

Forker et al (1996) explore which quality performance areas are related to business performance. The respondents rate their performance relative to their major competitors along a number of quality performance dimensions. Business performance was evaluated using a number of performance indices. Results show the positive and significant association between quality performance areas and business performance, and conclude that quality remains the foundation of competitive advantage, even if a firm's attention has drifted to speed-to-market and other concerns.

Fynes et al (2000) analyse whether quality practices enhance some manufacturing performance areas, and if quality performance and time-to-market performance are positively and significantly linked to business performance. Quality performance is composed by perceptual items that measure the superiority/inferiority in performance along several quality-related areas. Time-to-market performance is measured by the speed of new product development in the companies. Cost performance is defined as the unit cost of product. Results show that quality practices are indeed associated to quality performance, product cost performance and time-to-market performance. Time-to-market and quality performance measures are also positively and significantly associated to business performance. The authors comment that quality improvement practices may not only influence quality performance, but other measures of manufacturing performance too. Quality may no longer be an "order-winner", but it is still an "order-qualifier".

Ward and Duray (2000) study whether a positive and significant relationship between emphasis on manufacturing capabilities and business performance prevails amongst high performance manufacturers. The subjects are asked to rate the importance they place on activities regarding the manufacturing capabilities of flexibility, quality, delivery and cost. Business performance is measured by perceptual items that rate their performance relative to their major competitors in terms of market share and sales growth. The sample is divided into high and low

performance groups. Analysis of the group of high performers reveals that one of the elements of manufacturing strategy (quality) shows a significant and positive association to business performance. This study conclude that their study supports an emerging paradigm in manufacturing strategy literature that suggests a tight constellation of environmental factors and strategies that lead to superior capabilities and performance.

Rho et al (2001) empirically test the importance of consistency between manufacturing strategies and practices in achieving better business performance. The subjects are asked to rate the emphasis they place on various manufacturing performance areas. They are also required to rate the level of implementation of practices related to the performance areas they emphasise (JIT, TPM, SPC, activity based costing, amongst others). An absolute value of the difference between each strategic orientation variable and its respective practice variable was defined as the gap variable. The sample is divided into groups of high and low performers in terms of profit-to-sales ratio and inventory turnovers. Some results reveal that all the gaps except for "delivery" show statistical and significant difference between the two groups in terms of profit-to-sales ratio. Apparently, the higher the congruence between the strategic orientation and manufacturing practices a company has, the higher its profit-to-sales ratio. Thus, the study summarise that ostensibly, the gap variable indicating inconsistency between manufacturing strategy and implementation practices plays an important role when discriminating the superior from the inferior performance groups.

Avella et al (2001) analyse whether the emphasis on certain manufacturing competitive priorities (or capabilities) and decisions or practices and their internal coherence can be the base for achieving sustainable or lasting advantages over competitors and generate superior business performance. Manufacturing performance dimensions are measured by the emphasis the subjects place on them. Value added per employee is used as the business performance indicator in this study. The sample is divided into three groups according to their business performance. Based on their analyses, the authors comment that it is not possible to identify competitive priorities and decisions typical of the firms with low, medium and high levels of performance. The authors then study whether higher business performance is associated with a higher level of correlation between manufacturing competitive priorities and decision/practices emphasised. Results show no relevant differences are observed regarding the relationship between the manufacturing competitive priorities and decision of the firms in terms of their business performance. This study suggests that other functions such as marketing or research and development may be the source of competitive advantage.

Sun and Hong (2002) examine the alignment between manufacturing and business strategies and its influence on business performance. The subjects inform whether a formal process for translating corporate goals into manufacturing strategy exists in their companies, and to what extent the manufacturing function influences the development of business strategy and goals in their respective companies. They also rate their perceived level of improvement along several manufacturing performance indicators. The sample is divided into groups according to the degree of top-down and bottom-up alignment regarding business strategy and manufacturing strategy. Based on their analysis, the authors conclude that only when manufacturing strategy and business strategy are in alignment, can manufacturing contribute to the improvement of business performance and can business objectives be achieved.

The studies on manufacturing strategy development have been carried out internationally including in Sweden (Horte et al. 1991), Erstwhile USSR (Ardishvili and Hill 1992), Belgium (Gelders et al. 1994), UK (Neely et al. 1994), Hungary (Chikan and Demeter 1995), Singapore (Ward et al. 1995), New Zealand (Corbett 1996), Japan (Hitomi 1997), Brazil (Rohr and Correa 1998), USA (Kim & Arnold 1993, Baines et al. 1999, Kathuria et al. 1999), and India (Chandra and Sastry 1998, Sharma and Upadhyay 1998, Nagbhushna and Shah 1999, Dangayach and Deshmukh 2000, Dangayach and Deshmukh 2001). However, there is no such study summaries those studies and develop the common conceptual framework of manufacturing strategy development.

## CONCEPTUAL FRAMEWORK OF MANUFACTURING STRATEGY DEVELOPMENT

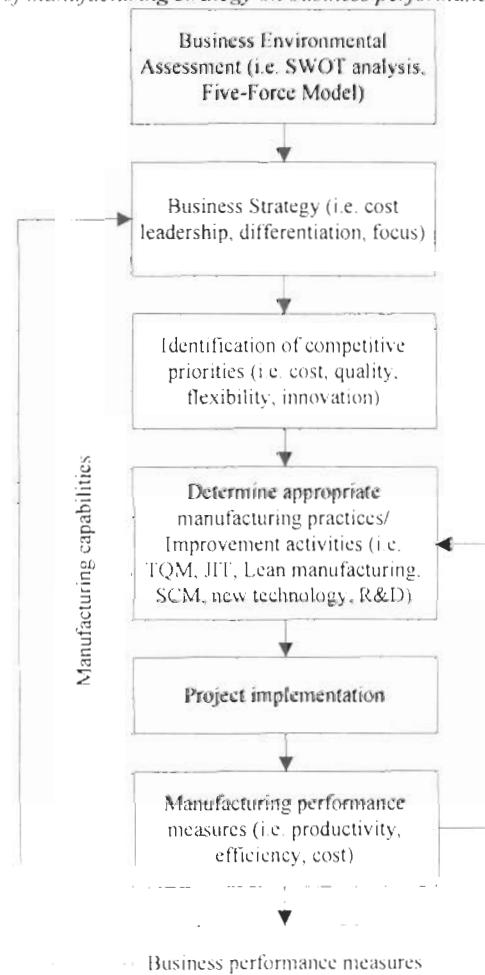
The importance that the manufacturing strategy has within the corporate/business perspective has been emphasized by a number of authors (Skinner, 1969, 1974; Hayes and Wheelwright, 1979, 1984; Fine and Hax, 1985, Hill, 1985, amongst others). Generally, in order to become an asset to a corporation/business, it is recommended that manufacturing adheres to the policies and directions created by the business/corporate strategy. Also, as Skinner (1969, 1974) comments, aside from costs, there are other several manufacturing-related dimensions that can become the source of competitive advantage. Consistent with this, Leong et al (1990) comment that capability may result from strategy formulation and implementation if the strategy is realized. Vickery (1991), when commenting on production competence, explains this point by offering a process model of manufacturing strategy:

The preceding paragraphs and illustration are helpful in order to understand better the studies that aim at analysing the relationship between manufacturing strategy and business performance. The result from examining of the model proposed by Vickery (1991) shows that the actual achievement along manufacturing dimensions is closer to business performance than other aspects of manufacturing strategy such as competitive priorities, strategic decision making and programs/practices implementation. This is consistent with what is generally found in the manufacturing strategy literature. That is, capabilities may result from a series of well-studied strategic decisions. As Skinner (1974) puts it, consistent policies and decision-making along elements such as size and capacity of the plant, production processes, wage systems, choice of equipment, production planning and control, etc, will result in an enhanced ability to compete.

Researchers	Methodology used to assess the impact of manufacturing strategy on business performance
Swamidass and Newell (1987)	Direct link of actual manufacturing performance measures to business and organizational performance measures
Cleveland et al (1989)	Measure the gap between actual performance and perceived strategic importance along several manufacturing performance areas, then link this gap directly to business performance measures
Kim and Arnold (1993)	Measure the gap between actual performance and perceived strategic importance along several manufacturing performance areas, then link this gap directly to business performance measures
Ward et al (1995)	Measure importance/emphasis that companies place on several manufacturing performance areas, then link these measures directly to business performance measures
Williams et al (1995)	Measure importance/emphasis that companies place on several manufacturing performance areas, then link these measures directly to business performance measures
Forker et al (1996)	Direct link of actual manufacturing performance measures to business performance measures
Fynes et al (2000)	Direct link of actual manufacturing performance measures to business and operational performance measures
Ward and Duray (2000)	Measure importance/emphasis that companies place on several manufacturing performance areas, then link these measures directly to business performance measures

	measures directly to business performance measures
Rho et al (2001)	Measure the gap between actual implementation levels and perceived strategic importance along several manufacturing performance areas, then link this gap directly to business performance measures
Avella et al (2001)	Measure importance/emphasis that companies place on several manufacturing performance areas, then link these measures directly to business performance measures
Dangayach and Deshmukh (2001)	Direct link of manufacturing strategy to corporate strategy, which leads the organization to enhance performance.
Sun and Hong (2002)	Direct link of actual manufacturing performance measures to business performance measures

**Table 1** Classification of manufacturing strategy studies according to the approach utilized to study the effect of manufacturing strategy on business performance.



**Figure 1** Conceptual framework of manufacturing strategy development  
- Adapted from Vickery (1991)

From the studies reviewed, at least three ways in which researchers understand how manufacturing strategy affects business performance could be identified. Some researchers directly link the competitive priorities to the business/corporate performance, and come to varying conclusions regarding the effectiveness of manufacturing strategy in terms of business performance. Other researchers directly link the actual performance achieved along some manufacturing dimensions to the business performance measures. Interestingly, some researchers study the degree to which competitive priorities are matched to actual levels of manufacturing performance or implementation of practices within companies, and how this "misfit" is related to business performance. Therefore, this study integrates all above previous studies and proposes the conceptual framework of manufacturing strategy implementation, which was adapted from Vickery (1991) at firm level as exhibits in Table I and Figure 1.

When evaluating business performance, it is observed that authors often utilize measures such as returns on sales, market share, return on investment, sales growth, and returns on assets, amongst others. It could be argued that these measures depend, to some extent, on the actual performance levels that are achieved along manufacturing-related variables. For instance, a measure such as return on investment (ROI) increases when production costs are reduced and/or total units sales increases. It could be said that total inventory levels could affect production costs. Total inventory levels have been associated with variables such as speed of manufacturing, quality of conformance, amongst other manufacturing capabilities. It is also evident that sales of goods/products come from the choice that the consumers make to buy such goods/products. In other words, it is reasonable to think that customers may be more inclined to buy products because they meet the characteristics (durability, features, price, etc.) that satisfy their needs/demands/possibilities.

Taking this into consideration, it is argued that any study that aims to analyze the effect of manufacturing strategy on business performance should do it in terms of actual levels of performance along manufacturing-related dimensions. From the literature review, it is observed that some authors have evaluated the manufacturing strategy in terms of the importance that companies place on manufacturing-related dimensions. At the risk of speculating, it could be argued that there are at least two reasons why the authors of these papers use this approach: 1) the researchers of those previous studies believe that the emphasis/importance that companies place on manufacturing capabilities is a good estimator of actual levels of performance. 2) Those researchers believe that the manufacturing function within a company (through its competitive priorities) can have a significant impact on the well being of a business other than via its natural function, which is to manufacture products as effectively and efficiently as possible. However, as some researchers have commented, importance and/or emphasis are different from actual levels of performance and hence should not be treated as being equivalent (see for example the comments of Safizadeh et al, 2000; Boyer and Lewis, 2002, Ahmad and Schroeder, 2002).

## CONCLUSIONS

As can be observed in Figure 1, for the intentions of a company (competitive priorities) to become actual capabilities, some stages and decisions in the manufacturing strategy process (in terms of technology, facilities, programs, etc) have to be fulfilled. However, even if companies try to do all they can (priorities, practices, programmes, policies, etc) to achieve high levels of manufacturing performance, it could be that factors outside their control might influence the outcome of their efforts (see for example the comments of Wacker, 1996; Droege and Germain, 1998). Sarmiento and Byrne (2003) criticise that fact that the trade-off theory (Skinner, 1969, 1974) has been tested by some studies in which inconsistent and erroneous measures of manufacturing capabilities have been utilized, including the use of competitive priorities instead of actual levels of performance (capabilities). We believe that the same argument applies when it comes to evaluating the effect of manufacturing strategy on business performance.

In their study of manufacturing competence, Kim and Arnold (1993) suggest that if a capability is not important as a competitive priority, it does not matter whether a firm is good at it or not and hence it should not be studied in terms of its contributions to business performance. Though this view may seem to be consistent with the generally recommended top-down approach to manufacturing strategy, an objection could be made to this argument. As Leong et al (1990) write, capabilities may also result from unplanned patterns of activities rather than a strategic plan. They add that capabilities (planned or unplanned) may provide a company with a distinctive competence. Hence, it could be argued that if an existent capability is not studied because it is not as important as other capabilities, a part of the effect of the manufacturing function on business performance could be missing.

To further illustrate the main point of discussion, this will go back to the research carried out by Forker et al (1996). Aside from the results that have been already discussed, their study also shows that the variable "design quality" (measured by the assessment of the respondents' performance compared to their major competitors) is a superior contributor to some business performance measures. Nonetheless, in terms of perceived strategic importance, "design quality" only shows average value. These results clearly demonstrate that the importance that companies place on certain aspects of manufacturing performance might not match their real manufacturing performance outcomes. Sometimes, there is a gap between what is originally planned and what is actually achieved due to a number of factors. The key issue here is that, in such cases, it is clear that choosing perceived importance or actual manufacturing performance in order to analyse the effect of manufacturing strategy on business performance could potentially yield contrasting results. Also, the findings of Forker et al (1996) give support to what Leong et al (1990) propose, and go against the comments of Kim and Arnold (1993).

Whether the production/manufacturing competence or the direct use of manufacturing capabilities is the best approach to the study of manufacturing strategy effect on business performance is debatable. Nevertheless, here it is argued that at the very least, studies that aim at analysing the effect of manufacturing strategy on business performance should utilize measures of actual achieved performance (perceptual or raw indexes) of manufacturing capabilities. As was commented before, business performance measures (in terms of sales, production costs, etc.) depend to some extent upon the actual performance levels accomplished across several manufacturing dimensions. Hence, if the manufacturing strategy effect on business performance is to be studied, consistent measures of manufacturing capabilities and their link to business performance should be utilized. This approach necessarily precludes the use of competitive priorities as good estimators of manufacturing performance and hence the direct linking of this type of measure to business performance indicators. Further study should validate this proposed conceptual framework by using empirical data from a specific industry. Finally, the comparative study among industries and countries are recommended.

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