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Manufacturing strategy–technology relationship among auto suppliers

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ABSTRACT

Each manufacturing plant has to develop its own path to success based on contingencies and on manufacturing practices links. On the basis of the latter, this paper tests the link between two of the most important manufacturing practices areas, manufacturing strategy (MS) and technology, without addressing causality or their combined effect on performance. This is done by selection fit, i.e. congruency adjustment. However, this paper goes beyond grouping both sets of practices in pairs, by using a more general selection view version, with practices from both sets related multidimensionally and subordinated by regression analysis to test for any congruent pattern. Regression results from a wide-ranging survey of auto supplier plants show that, in general, MS seems to have some kind of impact on technology, and that technology has some kind of influence on MS. In addition, a strong congruency between both practices areas is observed when using correlation. This suggests that when implementing or adjusting MS or technology, the other should also be considered; otherwise they may not operate effectively.

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1. Introduction

Each manufacturing plant must find its own unique path to success, based on contingent factors and the links between manufacturing practices. Previous studies on this topic still shed little light on the reasons why the application of the same manufacturing practices works well in some plants, but worse in others (Primrose, 1992; Olhager, 1993; Nassimbeni, 1996).

Thus, before the selection, adaptation (when required), implementation and interconnection of manufacturing practices, there should also be a strategic, well-conceived plan based on the particular situation of the company. Without it, the designed strategy will not have the desired effect: the achievement of success. All of the above should be linked to a planned path of continuous improvement. Hence plants should be dynamic, constantly drawing upon the best manufacturing practices for their possible inclusion as part of the manufacturing process. Such inclusion depends on both the context of the plant (contingency) and on the effect that the introduction of new practices will have by linking them to what the plant is already doing or is planning to do. This result in a synergy of processes designed to achieve a sustainable world-class competitive advantage by means of the continuous improvement of the manufacturing capacity (Schroeder and Flynn, 2001).

However, achieving a sustainable competitive advantage, by means of using manufacturing practices, is itself an evasive goal: world class plants may sometimes have relatively poor implementation levels of practices. In such cases, it may well be that the success of the plant will quickly diminish when the conditions change, as the solid foundation of a correctly connected network of practices is not supporting the whole. Likewise, there may be cases where plants have implemented a high level of practices and still be unsuccessful. In the latter case, the plants need to consider whether they have chosen the correct practices for their own circumstances and whether the practices are appropriately linked to the overall strategy and with one another (Schroeder and Flynn, 2001). On the other hand, the effective use of technological resources—amongst other things—is essential for achieving a sustainable competitive advantage and for increasing the effectiveness of the company. Therefore, taking into account the importance of MS and technology, as well as the proposition that the lack of success in some plants may be partially due to a

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faulty link between practices (Schroeder and Flynn, 2001), the present study examines the link between practices from manufacturing strategy (MS) and from technology from an international auto supplier sector survey. The need to investigate the interconnection between strategy and technology has also been stressed by Porter (1983, 1985).

Accordingly, the present paper is primarily centered on the following research question: are there any links between practices from manufacturing strategy and practices from technology? This is answered by way of exploratory and confirmatory research.

A review of the literature is made in Section 2. Research propositions are described in Section 3 along with their respective hypotheses. The research methodology of this work is explained in Section 4, describing the constructs and concepts used. Subsequently (Section 5), the results are discussed. Finally, in Section 6, some conclusions and final considerations are outlined, highlighting the implications and limitations of this study.

2. Literature review

In relation to the MS-technology relationships, some authors (Hofer and Schendel, 1978; Porter, 1983; Hayes, 1985; Maidique and Patch, 1988; Parthasarthy and Sethi, 1993; Parker, 2000) present a mainly static and unidirectional perspective. In this perspective, the causal relationship goes from technology to strategy and not vice versa (since the existing technical capabilities should guide the formulation of strategy). According to this perspective, competitiveness in a company's manufacturing technology is a springboard for the development of strategy (Parthasarthy and Sethi, 1993). Therefore, manufacturing strategy should reflect manufacturing capacities, including technological initiatives. This argument of complementarities implies that plants which try to achieve high effectiveness from technological practices should implement these in conjunction with the appropriate manufacturing strategy (e.g. Corbett and Van Wassenhove, 1993; Parthasarthy and Sethi, 1993). Technology is therefore a factor that limits strategy in two ways: (1) the existing technology determines the strategy that an organization can pursue (Itami and Numagami, 1992), and (2) the company, wanting to pursue a different strategy, should expand or change its technological base (Hofer and Schendel, 1978; Maidique and Patch, 1988; Parker, 2000; Porter, 1983).

Taking the opposite view, other researchers (Skinner, 1969; Stobaugh and Telesio, 1983; Dean and Snell, 1996) uphold that strategy should determine the selection of technology. According to this perspective, for an organization to be competitive, strategy must drive technological development (Porter, 1983). In this way, technological development can bring both a group of competitive weapons and a deeper technological base applicable to other products/markets to the plant (Itami and Numagami, 1992; Zahra and Covin, 1993). The accumulated resources of past products/markets may change into the driving forces behind the diversification strategy of the plant. The true sources of competitive advantage may be derived more from consolidating technologies with manufacturing skills in the core areas of competition than from generating products that the competition does not anticipate (see Chandler, 1962; Prahalad and Hamel, 1990). Thus, the most important plant decisions in manufacturing should be made to improve the chosen base of competitive advantage (Hayes et al., 1988; Garvin, 1993). Manufacturing technology can clearly be one of these, since it is a significant element in manufacturing (Leong et al., 1990; Marucheck et al., 1990). Hence, in order to use strategy effectively, technology should be considered through its lens.

However, the present study will go beyond the limitations of any single approach regarding the directions of the relationships between manufacturing strategy and technology that can be explored.

Thus, the research question of this paper could be nuanced as to how to identify the MS practices that affect technology practices and vice versa, and to explore the nature of these relationships.

Among the possible models to analyze these relationships, *selection fit*[1] has been chosen since it has proven to be the best way to examine how variables interact to explain each other's designs/implementations (Gerdin and Greve, 2004). Additionally, selection is the most common and simplest form of fit in the literature (Burns and Stalker, 1961; Morse, 1977; Drazin and Van de Ven, 1985; Galunic and Eisenhardt, 1994; Meilich, 2006). For this, exploratory and confirmatory research based on three relationships, namely a bidirectional and two unidirectional views of selection (also termed congruency) will be used. The adjustment premise that is assumed in selection is a congruency between both practice sets mutually influencing each other while operating in a plant (see Hannan and Freeman, 1977; Aldrich, 1979; McKelvey, 1982; Van de Ven and Drazin, 1985; Drazin and Van de Ven, 1985).

A closer look at the way the MS-technology relationships have been researched reveals that only nine studies from over 110 papers compiled in a book edited by Schroeder and Flynn (2001), whose two main High Performance Manufacturing (HPM) research foundations were contingency and *links between manufacturing practices*, directly dealt with linkages between practices (Flynn et al., 1992, 1994, 1995; Morita and Sakakibara, 1994a, 1994b; Morita and Flynn, 1997; Ahmad, 1998; Cua, 2000). Furthermore, Morita and Flynn's paper (1997) is the only study of these nine that is directly concerned with the relationship between MS and technology. However, it does not deal with this relationship in an exclusive or exhaustive way, since, on the one hand, it approaches the relationship of MS (considering only strategic adaptation) with other practices and, on the other hand, it only takes on board the concept of technological adaptation with its scales. The authors do conclude, however, that there is an important link between this technological concept and strategic adaptation.

Since the said book, only three works in this same line of HPM research have directly examined this important subject. In these papers there are findings that tend to confirm the importance of this relationship. Matsui (2002) studies the contribution of different practices (including MS) in the development of technology in three practices of process and product technology (effective implementation of processes, interfunctional design effort, simplicity of product design). Parts of his results constitute clear evidence that the participation of manufacturing practices (MS included) in the development of technology has a strong impact on the competitiveness of the production plant. McKone and Schroeder (2002) seek to determine the type of companies making use of process and product technology by taking the relationship within the context of the plant (they include strategic aspects) but without considering performance. Finally, a part of Ketokivi and Schroeder's (2004) study considers the strategic eventualities involved in the adoption and implementation of several manufacturing practices to achieve high performance. However, they include "design for manufacturability" as the only technological variable.

[1] Fit could be defined as the correlation between two or more factors that leads to a better result.

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