



Evaluation of new manufacturing technology implementation: an empirical study in the Thai automotive industry

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Abstract

This paper presents a study of implementation of new manufacturing technology (NMT) in the Thai automotive industry. Three research questions are explored: (1) what is the relationship between NMT used and organizational characteristics; (2) what are the benefits of NMT; and (3) what are the difficulties in implementing NMT. Descriptive statistical analysis and MANOVA with *post hoc tests* indicate that, among 15 NMTs, *CNC*, *CAD*, and *Pneumatic and hydraulic equipment* are the most frequently used, while *AS/RS*, *pick and place robots*, and *flexible manufacturing center* are the least used. The organizational characteristics, principal ownership, size of company and labor union memberships show a significant effect on implemented NMTs. It is also found that NMT improves performance significantly. The greatest improvements are reflected in *accuracy of product*, *work standardization*, and *company image*. Finally, the difficulties/problems in implementing NMT are revealed.

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1. Introduction

In the Thai automotive industry supply chain, customer companies expect varying product specifications, low cost production, higher manufacturing flexibility, and effective management practices. Without replacing conventional manufacturing technologies, companies may be unable to fulfill all customer needs and expectations. Thus, companies need to review their manufacturing processes strategically with a view to introducing a number of new manufacturing technologies (NMTs). Chen and Small (1994) suggested that management should be aware of new manufacturing technologies (NMTs) that can be implemented to improve not only operational benefits, but also marketing and strategic advantages. However, technology could not deliver all benefits alone. Management should also adapt management practices to ensure that implemented NMTs will be compatible with organizational characteristics.

Many previous studies reveal that size of a company (Gagnon and Toulouse, 1996; Germain, 1996) and principal ownership (Kotha and Swamidass, 1998; Sohal, 1994; Sohal et al., 1991), are related to management practices in implementation of NMT. As a result, the degree of NMT use is different. Recently, Schroder and Sohal (1999) investigated the relationship between organizational characteristics (size and principal ownership) and management practices leading to investment in NMT. Management practices used in their study include the nature of NMT investment required, generation of the NMT investment idea, the process of NMT proposal assessment, identification of expected benefits of NMT investment, and assessment of anticipated risks and difficulties in implementing NMT. Their study shows a number of significant differences in management practices based on company size and principal ownership.

For example, larger companies are more inclined to make larger investments in NMT. Australian owned companies are more likely to invest in local area networks while foreign owned companies are more likely to invest in wide area networks. They also concluded

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that much of the drive to invest in NMT is influenced by top management, irrespective of ownership and size of a company. The involvement of accounting and finance in assessment of NMT implementation in foreign owned companies is also higher than in Australian owned companies, and the inclusion of accounting and finance in NMT project teams is higher in smaller companies. So organizational characteristics are considered important factors determining investment in NMT.

We investigate these issues in the context of the Thai automotive industry. This industry has become one of the most important sectors in manufacturing in Thailand, contributing substantially to manufacturing employment and GDP. The Bank of Thailand reports that the dominant sector of economic activity in 2000 was non-agricultural, accounting for 88.8% of GDP and 43.32% of employment (Bank of Thailand, 2000). The Federation of Thai Industries reports that the total production of automobiles in 2000 was worth US\$ 1.6 billion, a 55.3% increase from 1998 (FTI, 2000). The three sectors of manufacturing, textiles and apparel, food, and automobiles, accounted for 35.02% of GDP and 27.79% of employment. UNIDO reports that during 1986–1994, the average annual growth rate of employment in the Thai automotive industry was 36.6% (Bank of Thailand, 2000). In 1994, 12.4% of the total manufacturing employment was in this sector, behind only textiles and apparel (45.4%), and food (12.8%).

Much of this strong performance has been aided by strong foreign involvement. Three principal ownership types can be distinguished in the Thai automotive industry: Thai owned; foreign owned; and joint venture companies. The industry has been dominated by Japanese and American automobile assemblers. Thailand is developing as a major offshore base for international automotive manufacturers, especially Japanese and American. Management practices (i.e., human resource management, leadership, and teamwork) that lead to investment in NMT may be different in different ownership types.

This industry has been designated as one of the major strategic industries in Thailand's drive towards modern competitive manufacturing (TDRI, 1999). The government wants Thailand to become the "Detroit of the East" (FTI, 2000), the most important center of automobile manufacture in Southeast Asia. The National Development Plan for the years 2001–2005 considers textiles and apparel, and the automotive industry as the top two industries for restructuring and development (FTI, 2000). Restructuring is to involve financial restructuring, human resource development, implementation of new manufacturing technologies and enhancement of technological capabilities. The renewed growth prospects of the automotive industry is encouraging a higher rate of technology transfer and employment, and leading Thai manufacturers to become more actively involved in

improving product quality and manufacturing flexibility. However, the regional competitive situation in automobile manufacture and export is precarious.

To achieve targeted growth, it is essential that Thai automotive manufacturers improve cost, quality, and flexibility vis-à-vis automotive manufacturers in other countries in the region. To respond to global customers and attract more foreign investment, the Thai automotive and supporting industries need to improve existing production systems and current management practices. International standards in quality management systems, such as QS-9000 and ISO/TS-16949, low cost production systems, and highly flexible manufacturing systems should enhance competitive advantage (Paul and Laosirihongthong, 1999; Jayaram et al., 1999). New manufacturing technology (NMT) could be used to enhance both product and volume-variety flexibility. However, the rate of implementation of NMT in the industry is still low, and more technological investment is needed (Laosirihongthong and Paul, 2000). To articulate policies for encouraging new investment in NMT, one needs to understand current technology use and performance achieved in the industry. It is also necessary to discover what organizational characteristics, such as size, ownership, and unionization, contribute to successful and beneficial NMT implementation.

This study is concerned with the relationship between technology use and organizational characteristics in the Thai automotive industry. The purpose of the study is to identify key technologies used in the Thai automotive industry and to examine the relationship with three organizational variables, size of a company (measured by number of employees); type of ownership (Thai owned, foreign owned, and joint venture), and existence of labor unions. In addition, this study also investigates the overall benefits and difficulties in implementing NMT. Inferential statistical analysis of empirical data from the Thai automotive industry was used to examine these issues.

The paper is organized as follows. First, the relevant literature is reviewed to identify a comprehensive set of NMTs used and organizational variables, which show a significant effect on the implementation of NMT. The relationship between NMT use and these organizational characteristics are then discussed, leading to the three research questions. The research methodology is described next, including the sample selection and data collection procedures. Then the results of the study are presented. Conclusions and recommendations are explained in the last section.

2. Literature review

To achieve the benefits of implemented NMT, companies have to understand the relationship between tech-

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