

MANUFACTURING TECHNOLOGY, LEAN AND STRATEGIC FLEXIBLY THE SILVER BULLET FOR MALAYSIA LEAN MANUFACTURERS

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Abstract

The purpose of this paper is to conceptually propose the elements that constitute an ideal manufacturing strategy framework needed by Malaysian manufacturing sector. Malaysian manufacturing sector has so far underwent various challenges and exhibited fluctuating performance as reaction to these challenges. This paper is the product of an extensive literature review done on previous researches on the subject of manufacturing strategy and performance. In this review, the subject matter was comprehensively studied, and thoroughly discussed from the strategic perspective of Malaysian manufacturing sector. This paper manages to provide a fundamental framework, for expert in the area of manufacturing strategy and performance, emphasising on the complementary effect of multiple strategies on performance. The subject approach is relatively new in Malaysia, however based on previous studies and the critical impact of manufacturing towards the economic health of Malaysia, the sector is in dire need of suitable and favourable manufacturing strategy in order to continue to compete globally. Malaysian manufacturing sector is still lacking of a strategic approach on its national manufacturing direction and guideline, to serve as the launching pad for the sector's sustainable growth. This paper not only ventures into a new perspective of strategy-performance research, but it also explores the possibility of studying different complementing strategies impact on the performance of manufacturers.

Keywords: Manufacturing strategy, flexibility, lean, manufacturing technology, performance

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1.0 MALAYSIAN MANUFACTURING SECTOR

In Malaysia, the manufacturing sector is the second largest contributor to the GDP with share growing by 3.4% to RM193 billion and employing 2.2 million people, comprising 16.8% of the country total employment thus remains as the main sector for contributing toward the economic growth of Malaysia [55, 77,105]. These facts show how pertinent the manufacturing sector is to the overall economic health of Malaysia. This sector continues to propel the economy forward through synergistic relationships with others, such as trading, financial, transportation, and services sectors. Therefore, it is without any doubt that the manufacturing sector is one of the most important drivers of the growth of the

Malaysian economy, which, to date, employs more than one million workers nationwide [7].

By 2013, the Malaysian manufacturing sector contributed RM742.9 billion of gross output value (MPC, 2014). The largest industry sub-sector in Malaysia was electrical and electronics (32.9%), which amounted to RM236.8 billion of export revenue in 2014 alone. The last survey data collected by the Malaysia Department of Statistics in 2009 showed that there were 32,535 manufacturing facilities throughout the country with a gross output of RM817.7 billion. All these figures emphasize the significant contribution of the manufacturing sector toward the growth of the nation's economy, and how far it has developed over time, and how significant it has become as the pulse of the nation's economy.

2.0 MANUFACTURING STRATEGY

Manufacturing strategy is generally defined as the development of specific competitive strength based on the operation function and the use of manufacturing capabilities to achieve manufacturing goals [8]. One of the pioneer researchers in manufacturing strategy (MS), [146], defined MS as exploiting certain manufacturing functions as a competitive weapon. MS includes making decisions and plans affecting resources and policies directly relating to the sourcing, production and delivery of tangible products by positioning the company resources in a way that enhances its

competitive position in the marketplace [161]. Industries choose to follow operation strategies, such as lean manufacturing (LM), agile manufacturing and six sigma, to achieve a better competitive advantage, achieve productivity improvement and emerge as top players in their field [5,138, 168]. Therefore, it is without a doubt that the right manufacturing strategy is always an important driver in ensuring a company's higher performance. Researchers have chosen to define manufacturing strategy in accordance with the context of their approach. Below (Table 2.1) are some definitions of manufacturing strategy by several distinguished researchers in the field.

Table 1 Various definitions of manufacturing strategy

No	Author	Year	Definition
1.	Skinner	1969	The exploitation of certain manufacturing functions as a competitive weapon.
2.	Schmenner	1979	Plan that describes how to produce and distribute products.
3.	Hayes & Wheelwright	1985	As a pattern of decisions made by manufacturing organizations and the degree to which they support the business strategy.
4.	Swamidass & Newell	1987	The deployment and development of manufacturing capabilities in alignment with firm's goals and strategies, which, in turn, gives it a competitive advantage.
5.	Hayes & Pisano	1994	Stating specified competitive advantage that is required and how to achieve it.
6.	Swink & Way	1995	Decisions and planning concerning the firm's resources and policies that affect the functions in a firm in delivering products.
7.	Brown	1999	Drivers for continuous improvement in competitiveness that enable it to satisfy multiple requirements.

2.1 Manufacturing Strategy – The Beginnings, Evolutions and Progression

Professor Skinner was the first to use the term "operation strategy" through his renowned article published in the Harvard Business Review in 1969. He postulated that there were four types of manufacturing strategies:

- i. Cost-based strategy – this approach uses a prediction by economic theory, where the optimum firm will operate at a scale where organization and technology will produce at the lowest average cost.
- ii. Quality-based strategy – has the best quality for a given design.
- iii. Flexibility-based strategy – be the most flexible in terms of schedule, product change, and product release.
- iv. Speed-based strategy – offer the best customer service.

Using this framework, much later on, [132] commented that cost-based strategy, as defined above, is more suitable for firms that practice mass production and where quality is not a major concern. As for flexible manufacturing, this strategy influences a firm's ability to fluctuate as necessary in terms of product, design, product mix, product material, and sequence, in order to meet various requirements by customers [34].

After Skinner's typology, other renowned strategists, [112], came up with a different character typology of manufacturing strategies. They explained four types of manufacturing strategy as distinct characters according to the general strategic orientation of firms implementing them, as explained below:

- i. Defenders – companies with a limited product line that focuses on improving the efficiency of their existing operation. The cost orientation makes them unlikely to innovate in new areas.
- ii. Prospectors – companies with fairly broad product lines that focus on and market

product innovation, emphasizing creativity over efficiency.

- iii. Analyzers – companies that operate in at least two different product-market areas, one stable, the other variable. In the stable areas, efficiency is emphasized and in the variable areas, innovation is emphasized.
- iv. Reactors – companies that lack a consistent strategy-structure-culture relationship. Often ineffective when facing environmental challenges and tend to adopt a piecemeal strategic approach.

This approach continues to be used by manufacturing strategy researchers to this very day, since dividing competition into these categories not only enables strategic managers to focus on monitoring a certain strategic orientation, but also helps develop scenarios for future industry development [176]. This work was then followed by [127] in which he introduced his four generic strategies. Porter's generic business strategies are generally summed up as follows:

- i. Cost leadership strategy- aims to achieve overall cost leadership in the industry, which considers assets used, employee productivity, and discretionary expenses. For example: cost reduction from experience, tight cost and overhead control, cost minimization primary and supporting activities on firm's value chain, such as research, manufacturing, service, sale forces, and advertising [43, 73, 124, 127].
- ii. Differentiation strategy - offers unique products and services in various forms, such as prestige and brand image, technology leadership, engineering design, rapid product innovation, features, customer service, and dealer network [43, 71, 127].
- iii. Focus strategy - can be categorized into cost and differentiation focus. It chooses a narrow competitive scope within an industry for the selection of a specific market group in order to provide better service. The cost focus is to create a cost advantage within a particular market, while the differentiation focus aims to differentiate the target market. The firm is able to utilize technology, research capability, managerial creativity, and talented workforce to serve unique market segment differentiation [71, 127].
- iv. Integrated strategy - overall low cost and differentiation strategy enables a firm to

provide two types of value and lower prices for unique value to customers, such as automated and flexible manufacturing systems, and extended value chain by information technology [43, 127].

Over the years this typology has received numerous empirical supported evidences [27, 32, 110, 151, 171, 170]. Porter then followed his earlier work with the identification of the famous five forces to explain the forces of competitiveness.

The competitor model is summarized as follows:

- i. Rivalry among existing organizations – originate from the desire of the firm to gain competitive advantage.
- ii. Supplier of key inputs – reliant on suppliers, which cause firms to develop stable, long-term relationships with suppliers as a result of strategic alliances.
- iii. Customers – customers having a strong influence in certain markets with preference toward competitive markets.
- iv. Potential new entrants – new entrants bring extra capacity, typically adopt strategies of aggressive competition to build market share at the expense of existing firms.
- v. Substitute – occur when customers can replace one product with another from organizations in different industries.

Porter's model carefully indicates how the hurdle of gaining competitive advantage depends on the performance of competitors and that when competition is weak, it is relatively easy to gain competitive advantage and vice versa [175]. From an extensive review of the literature, it is easily concluded that within the manufacturing strategy framework, the models of [112, 126, 127] are the most popular frameworks in terms of classifying the various ways in which firms compete [110, 121].

However, while Porter's generic strategies model has been amply supported empirically [74, 91, 93, 173], it has also received criticism due to its limitations and simplicity [113]. Over the years the classical strategic typology introduced by Porter began to receive criticism as it was said to be too generic and deemed inadequate to be used by firms as a competitive weapon nowadays. Table 2.2 is a summary of the arguments and criticisms concerning Porter's Theory of Generic Strategies.

Table 2 Arguments concerning Porter's Theory of generic strategies

Criticism	Author (Year)
1. Number of strategies are not limited to these strategies only : i. Cost leadership ii. Differentiation iii. Supply chain iv. Training	Allen, Helms, Takeda & White (2007)
2. Dichotomous nature: Generic strategies are not dichotomous in usage, as a number of businesses that adopt both cost leadership and differentiation strategies have not ended up being stuck in the middle (as suggested by Porter). In fact they are some of the world's most successful firms.	Murray (1988)
3. Theoretical shortcomings : Generic strategies are too general Strategic approach is too simplified.	Christman, Hofer & Boulton (1988); Hill (1988); Miller (1992) Day & Wensley (1988); Matthur (1992); Morrison & Roth (1992); Spender (1993)
4. Fit with reality: Generic strategies do not fit empirical reality. Generic strategies model is based on an invalid epistemological approach. Generic strategies do not consider the evolution of the competitive environment.	Gurau (2007); Dawes & Sharp (1996) Aktouf, Chenoufi & Holford (2005) Downes (1997)
5. Limited applicability : Generic strategies are not applicable for small firms. Generic strategies are not applicable for fragmented markets. Generic strategies are not applicable for retailers. Generic strategies are not alternative solutions, but can profitably coexist in the strategic approach of a firm.	Lee, Lim, Tan & Wee (2001) Borch & Brastad (2003); Pitelis & Taylor (1996) Botten & McManus (1999); Gupta (1995) Kaya, Alpkay & Aytakin (2003); Kotha & Swamidass (2000); Wagner & Digma (1997); Miller & Dess (1993); Miller (1992); Wright, Kroll, Tu & Helms (1991); Murray (1988); Wright (1987); Miller & Friesen (1986)
6. Alternative theoretical approaches: The strategic analysis should apply a resource-based approach. The strategic process is flexible and emergent, being based on trial and error. Generic strategies do not consider the necessity for collaborative strategies.	Juga (1999); Kay (1993) Botten & McManus (1999) Brandenburger & Nalebuff (1995); Moore (1996)

Source: Adapted from Gurau (2007)

Over the years, manufacturing strategy studies have received wide attention from both academicians and industrialists. The emergence of various challenges from the business environment has drawn more attention to this topic. However the traditional typology has also evolved with more researchers going for content classification of manufacturing strategy. [34] reviewed and classified more than 30 years of research performed on manufacturing strategy to capture its overall constitution. Starting from the earliest work by Skinner in 1969, until the year 2000, 260 published research papers were reviewed and classified according to the methodology used and contribution to the total area of manufacturing strategy. The outcome was a complete summary of

the manufacturing strategy body of work, which indicated that manufacturing strategy is actually an issue approached through three different priorities:

- i. Manufacturing strategy as manufacturing capabilities – [143, 144] started this route by dividing manufacturing strategy into five different priorities: cost, flexibility, quality, delivery dependability, and delivery speed. An approach seconded by [59,119, 147].
- ii. Manufacturing strategy as strategic choice – [143] proposed plant, equipment, production planning, and production design, etc., as the key choice areas in manufacturing strategy. This approach was further elaborated upon by [70,177] with the

addition of structural and infrastructural issues.

- iii. Best practices – this approach has received more attention in recent research. [177] coined the concept, which was later adopted and developed by [136].

Based on this classification work, 97%, which is 200 out of the total 206 reviewed, approach manufacturing strategy from the three platforms above. The approach above is called a content approach of manufacturing strategy, with the second approach being the process approach. The latter includes elements such as design, development, and implementation of manufacturing strategy. In a comparison of the two approaches, the content approach has received more attention from researchers due to its large scope since it covers a larger paradigm on maturing strategy as a whole. However, the process approach is also gaining more attention since it focuses on strategy deployment throughout the company [172].

In the context of this paper, the content approach has been chosen as the framework for the whole discussion for the reason that it facilitates a wider and more complete strategic outlook of a firm that chooses to compete through manufacturing. Manufacturing practices have a significant impact on manufacturing performance [37, 81, 82, 90]. Various scholars have reported positive relationship between manufacturing practices and performance [6, 51, 52, 53, 54], and that manufacturing practices adapted or adopted by manufacturers are context specific [13,39]. This line of work has received continuing attention and there is evidence that some practices are widely adoptable, whilst others are only effective in specific contexts [154].

There is also a growing view that manufacturers must view manufacturing strategy as bundles or packages and not just single and individual practices [33,140]. It is important to understand which practices are necessarily complementary, and which are not, which practices are universal and which are contingent [172]. The context of best practices is becoming an increasing source of interest due to the failure of many practices to materialize into benefits [39, 140, 172]. Many best practice debates ignore the issues of why practices are successful and instead concentrate on which best practices will provide a competitive edge [85]. Much of the fundamental understanding underpinning practices is often ignored. Evidence through empirical validation has indicated that best practices are not chosen in a systematic manner nor are they measured properly. There did not appear to be any investigation of the context of best practice. This could be the reason why so many 'best practices' resulted in failure to transfer into an effective implementation. The adoption of best practices is not sufficient to emulate the success of top manufacturers since practices have to be adapted to the environment in which the company is operating [30, 179, 182, 57]. However, the

crucial argument is that companies that have adopted best practices achieve high performance in operational areas [171, 24]. Contingent to that, it has been suggested that by implementing these practices at the operational level, the performance of the overall organization will also be improved [39, 135]. Various manufacturing practices have been discussed in a broad spectrum of the literature. However, manufacturing practice research on the strategic content relating to the importance of content choices and integration of implementation has only recently began to be integrate with another important concern of manufacturing strategy [22, 23, 24, 85].

3.0 IMPORTANCE OF MANUFACTURING STRATEGIES TO MALAYSIAN MANUFACTURERS

The link of manufacturing strategies to performance has been discussed by various scholars. The manufacturing strategy determines how manufacturing resources and capabilities are deployed based on the process, content and implementation [23,177]. With the progress made from the seminal work of [69,145, 177]. Skinner (1985), the conventional manufacturing strategy paradigm has been changing and evolving. Core manufacturing concepts, such as manufacturing practices, capabilities and world class manufacturing process, have been challenged and improved. Scholars have suggested that while the conventional manufacturing paradigm is still useful [48], there is a lack of (1) cohesive theory based effort by researchers [95], (2) insufficient survey based empirical work [23], and (3) proper integration with the concept and theories developed in other disciplines [23]. Therefore, while the conventional strategies can still be of use, manufacturers continue to find and explore other paradigms of manufacturing strategies that are best suited to them. Malaysian manufacturers have undergone the same journey and experience. [169] in his study on Malaysian manufacturing industries tried to determine the elements that represent competitive advantage. Their study showed that in order to maintain competitive advantage, four major components – the ability to respond as an organization, the ability to compete at a low cost, having and effective supply chain management and the ability to differentiate and innovate product – are needed. An earlier study by [183] tried to determine the best manufacturing practices among Malaysian electrical and electronic firms. This research suggested that the implementation of world class practices was satisfactory in the areas of management commitment, internal and external customer service policies and supplier relationship and development programs. The research of other scholars on the manufacturing strategies of

Malaysian manufacturers was less comprehensive and more focused on singular or individual paradigms, such as supplier selection and strategies on manufacturing performance [118], purchasing strategies and manufacturing performance [166], instead of the complementarity approach taken by this study.

Beyond the importance of a robust manufacturing sector to economic health, there are three primary reasons why Malaysia needs to focus on manufacturing strategy.

1. Other countries, such as the US [50], the UK [165] and even Malta [102] have strategies to support their manufacturers, and, by lacking similar strategies, Malaysia is forcing the manufacturers to compete at a disadvantage.
2. Systemic market failures mean that through the absence of manufacturing policies, Malaysian manufacturers will underperform in terms of innovation, productivity, job growth, and trade performance.
3. If the country loses the complex, high-value-added manufacturing sector, it is unlikely to get it back, even if the ringgit declines dramatically.

3.1 Lean as a Strategic Option for Malaysian Manufacturers

In building the ground work for manufacturing strategies choice of Malaysian manufacturers, a closer inspection on the surrounding environment of the sector was done. It was duly noted that Malaysian manufacturers face, among others, rivalry among competitors, speed of change as well as instability of demand. Everything seems to indicate that markets for industrial output will continue with the specific needs of customers, such as quicker and more regular deliveries [42,85,105]. In such circumstances, manufacturers have no other choice but to shield themselves with strategic operation priorities in their production. At the operation level, two different blocks to strategic approaches have been identified – differentiation and cost priority. Manufacturers that emphasize the latter give priority to the efficient management of cost through reduction of operating cost, or reduction of investment and inventory [10, 85, 105, 177]. However, companies that emphasize on differentiation will see quality of operation such as error free product, quality, delivery and flexibility as priority [10, 42, 96, 177]. However, it seems impossible for manufacturers to satisfy all these priorities without a certain trade off to make it work. A trade off means that increasing one chosen capability might decrease the other [128, 144, 148]. Currently, manufacturers prefer to focus on a few priorities at any given moment, and, once satisfied, move on to others without losing the developed, accumulated priorities [45, 105]. This approach is the basis of such practice that shapes the system of advanced manufacturing such as lean manufacturing. Lean manufacturing has received notable approval

among researchers, as being able to improve productivity through a reduction of waste [28, 29], added value to product [158], and basically improving the majority of operational keys, such as the reduction of lead time, better inventory level as well as unit cost [28, 178], which, in turn, allow improvement against competitors. Regardless of whether the manufacturers make highly differentiated products with a few models or use repetitive configurations, or vary in terms of the industry in which they operate, lean has proven to be superior and beneficial [67, 162]. Lean strategic approach is based on the assessment of lean as a strategy to improve performance [2] showing that organizations achieve higher performance through the management of their manufacturing strategy. Such an outlook indicates that the complementary aspect between strategy and performance is crucial when pursuing long-term benefit [15, 97, 99, 157]. It has been recognized that a strategic approach is necessary in explaining how the practice of lean helps improve performance [14, 163, 167]. These aforementioned scholars summed up the claim that lean as a strategy can bring significant competitive advantage when it is exploited in the long-term for the development of specific capabilities of the organization. Previous lean research focusing on the Malaysian manufacturing sector hardly ever associated the implementation of this strategy in relation to the hostility and dynamism faced by these manufacturers. However, [132] did suggest that based on their research on local E&E producers, this group of Malaysian manufacturers preferred manufacturing techniques that promoted production efficiency while reducing production cost, a concept that sustained the core of lean manufacturing.

3.2 Manufacturing Technology as a Strategic Option for Malaysian Manufacturers

Another strategy available to Malaysian manufacturers is through the adoption of manufacturing technology. Manufacturing technology can be strategically used to achieve a sustainable competitive edge and enables manufacturers to acquire a superior performance position [89, 104]. The strategic implementation of manufacturing technology allows manufacturers to respond to demand uncertainty and increases their competitive advantage [60, 62]. Strategic technology choice enables the company to not only focus on the implementation of the technology but also on how effective the investment is toward the performance of the manufacturers. From a strategic perspective, manufacturing technology acts as a tool used by firms to adapt and react to the increasingly volatile and complex business environment [122, 153]. [120] reported that two out of six strategic characteristics of the most successful companies are the willingness and ability to acquire technology and take technology risks. These

strategic advantages are crucial factors that have been noticed and adopted successfully by Japanese manufacturers [122]. The acquisition of appropriate technology is very important to enable a competitive advantage to be gained [25, 61, 130].

As mentioned before, the adoption of manufacturing technology is not an easy task. The existing contingency factors, such as industry type and product lifecycle, are among the factors that could affect the success of adoption and the result [153]. There are even several industries that claim that the adoption of manufacturing technology is not beneficial for them [123]. However, contrary to this popular notion, the use of MT should significantly increase the competitive advantage of manufacturers [1]. Various studies have shown that investment in manufacturing technology is expected to contribute to the strategic performance of firms [160, 98]. Studies have also empirically proven that the adoption of manufacturing technology also helps increase the strategic flexibility within firms [35, 117, 60]. In studying manufacturing technology, most of the research focused on the impact of technology on performance [1, 152,160]. However, there is a lack of attention to a technology choosing guide to facilitate manufacturers to make smart choices in handling challenges from environmental factors. This proclamation is supported by various technology researchers such as [44, 142,153,]. The strategic approach to manufacturing technology enables these manufacturers to gauge such investment concerning the outcome of demand realization, optimal behavior capacity as well as the financial benefits of it all. Such an approach takes a long-term, comprehensive view of business and technology issues [49, 62, 133]. Strategic benefits, such as early market entrance, market leadership and the ability to customize products, and, ultimately, improved product flexibility within and outside of the plants, are extremely important for the growth and survival of manufacturers [49]. The relationship between manufacturing technology and performance from a strategic point is relatively complex [87]; however, the requirement for internal consistency within the manufacturing organization asserts the importance of the strategic approach to achieve superior performance.

Ultimately, the implementation of such technology offers manufacturers the ability to produce at lower cost, while, at the same time, become operationally flexible to meet customer requirements, and, finally, meeting the potential of improving the overall business performance. In the context of strategic approaches, manufacturing technology is viewed as a tool that enables firms to increase their production capability to sustain long-term objectives. This capability deserves attention as it serves as an approach to deal with the uncertainty associated with the business environment as well as the risk of huge investment that is associated with the technology. While strategists have argued that the implementation of multiple strategies by

manufacturers would be problematic instead of beneficial [128, 147], manufacturing technology would instead reduce the need for tradeoff between strategies, especially between the cost and variety for manufacturers [87]. The ability to adopt multiple capabilities through the implementation of manufacturing technology has proven to be crucial when dealing with stiff competition and unexpected changes in the business environment [58, 87, 36]. In respect of the significant impact on performance of manufacturing technology, an ability of such has been proven to be the essence of the reasoning behind choosing the strategic perspective outlook of this strategy. As for Malaysia, the country's manufacturing demand for the latest technologies has been valued at RM20 billion every year [26, p. 45]. The need for such technologies has caused the industries to record a staggering amount of machinery and equipment imports. MIDA reported that imports for such equipment have increased from €7.9 billion in 2005 to €8.6 billion in 2008. The main sources for these items are from Japan, USA, China, and Germany [103]. The large amount of investment clearly indicates the crucial role of technology to manufacturers.

3.3 Flexibility as a Strategic Option for Malaysian Manufacturers

Due to the previous mentioned competition in the manufacturing sector [72] Malaysian manufacturers have realized the need to understand and implement flexibility from the strategic point of view. Strategic flexibility enables the manufacturers to better deal with the dynamic and changing environment and aids them in adopting a strong stance against the threats from competitors [72, 92, 134, 156]. Flexibility has started to occupy a centralized position in how manufacturing could be strategically developed to play an important part in acquiring competitor advantage [45, 64,150]. Flexibility has been widely defined by different researchers, proving it to be a multifaceted concept. [139] identified at least 50 different definitions of flexibility as of the multitude of facets provided by [64] and [45]. However, consolidation of these ideas firmly points to the importance of flexibility as a 'tool' or prerequisite to effectively respond to changing market needs [60, 11, 18] and how it enhances performance [38,72, 131]. Strategic flexibility has been viewed by various scholars namely [78,86,129] as a crucial factor for global companies in order to compete and survive in an open market, which is also a similar requirement and challenge for Malaysian manufacturers. Flexibility, while being important for increasing operation effectiveness, needs to be viewed from the long-term perspective, which is aiming to achieve the overall company goals. However study on strategic flexibility of Malaysian manufacturers is rare, and when done is more focused on certain areas such as supply chain [72].

3.4 Multiple Strategies in Performance Research

[107, 108] described how several practices tend to be adopted together because they are complementary or mutually supportive of each other. Other scholars [12, 16, 56,76] also noted that strategies and practices are more effective when a firm adopts them as a set instead of piecemeal or as standalone implementation. Based on these arguments, it is highly expected that several manufacturing strategies when implemented together will have greater impact on the performance. It is also very common in strategy studies to examine multiple strategies together. Previous scholars [9,88,110, 116, 187] noted that studies have shown that combined multiple strategic actions may either be consistent or complementary or better in terms of performance. This paper conceptually proposed the idea of multiple strategies to be put to the test in the context of Malaysian lean manufacturers.

4.0 DISCUSSION

The approach of this paper exhibits the importance of emphasizing the use of the multiple strategies in explaining the important concept of complementing strategies in strategy-performance research. In strategy studies, the emerging practices, which include the concept of 'fit', the concept of integrated strategy and the concept of complementary, would direct strategy researchers to look into finding the combination of effective strategies that add value to each other, and, hence, stimulate overall performance. Such an approach to the concept of manufacturing strategies is more reflective of the actual practice in the industry in which a mixture of different strategies is put to use as to enable manufacturers to be more dynamic in their operational and strategic foundation. Lean manufacturers in Malaysia have received much attention from scholars due to their ability to withstand various threats from the environment however limited research was conducted on their recipe for success in dealing with these threats, thus voluminous information is yet to be discovered. By attempting to investigate the concept behind their operation, it is hoped that a clearer picture of what constitute the optimal manufacturing strategy that should be implemented by Malaysian manufacturers in order to increase their performance. Lack of research in this particular area among could be the reason why a proper baseline and groundwork for a proper manufacturing strategy for Malaysia could not be fashioned so far. However the importance of the manufacturing sector to Malaysian economic health indicates the necessity of having a proper and systematic approach and strategy to provide the sector with a blue print on how to achieve optimal performance on the face of stiff completion globally.

The ever increasing global competition with customers demanding higher product quality, greater product selection, and superior customer service amid rising input costs have led many Malaysian manufacturing companies to adapt, adopt, develop and continue to search for various strategies in order to minimize wastage and defects, to improve product quality, and to sustain profitability and overall performance. The Asian economic crisis in 1997 caused a severe trade deficit in Malaysia, and, even after recovering from the hit, Malaysia faced tough competition from other ASEAN countries with similar manufacturing export specialization. The made up of the manufacturing sector, ranging from type of sub-industries as well as product produces by Malaysia are distinctly similar to those from the neighbouring Thailand and Indonesia. While these similarities enable manufacturers to source raw material and manufactured parts easily with competitive prices unfortunately the circumstances also provide ample amount of competition for end product customers. Due to a small internal market with a total population of only about 28 million, the local market is too small to be able to support the nation's economic growth on its own. Consequently, Malaysia's international trade has been playing a crucial role in the development of the nation and accounts for a significant portion of its GDP. The percentage of international trade to GDP in 1980 was at 113.0%, and reached a peak of 220.4% in 2000, before reducing to 167.2% in 2011 [164]. Among the major trading partners for Malaysia are China, Japan, the USA and Thailand.

Due to these factors, the formulation of manufacturing strategies for Malaysian manufacturing sectors cannot be crafted independently without reference to global economic, political, social and technological realities that are directly shaping and affecting manufacturing industries around the world. It is for this reason that Malaysia needed to come up with a proper approach towards constructing solid manufacturing strategy framework that constitutes critical elements which enable the sector to be propelled forwards.

5.0 CONCLUSION

In conclusion, Malaysian manufacturers which choose lean as their manufacturing strategy must also look at the possibility of other complementary strategies to strengthen the core of their operation. Based on the unique requirement and composition of Malaysian manufacturers themselves, manufacturing technology and strategic flexibility were identified as the other two strategies that coupled with lean, could enhance the performance of this sector. However this approach should be tested empirically in future studies in order to provide validation to this otherwise conceptual approach.

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