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## Fit manufacturing; integrated model of manufacturing strategies

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### Abstract

Manufacturing sector is an essential ingredient to accelerate economic growth of the country. Recent advancements in globalization and technology affect manufacturing systems. By applying manufacturing strategies, manufacturing sector is strategizing to enhance their business performance. Thus the integration of manufacturing strategies is vital to survive in current market competitive environment. In order to gain excellence in manufacturing activities, it is necessary for firms to implement Fit Manufacturing with Lean and Agile systems tend to achieve sustainable benefits. The goal of this paper is to present the main manufacturing strategies and then the Fit Manufacturing as an integration manufacturing strategy consisting Agile Manufacturing, Lean Manufacturing and Sustainability.

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## 1. Introduction

Mostly, manufacturing sector focused on the usage of two broader manufacturing systems which are Agile Manufacturing System and Lean Manufacturing System. However, stakeholders like customers, societies and policy makers consistently pressurizing manufacturing sector to incorporate the social and environmental factor within manufacturing process to protect society and environment from negative effect of the manufacturing process. However, the purpose of these all manufacturing systems is to enhance manufacturing effectiveness through increasing process effectiveness and reducing cost. More so, global competition has necessitated the formulation of both efficient and effective paradigms in response to the global economies for the purpose of improving the overall performance. Lean and Agile Manufacturing have gained wider acceptability in recent years' enterprises. Leanness primarily leads to elimination of the non-value added activities while Agility focuses mainly on leads to market responsiveness [2]. Thus, by applying these strategies manufacturing sector is strategizing to enhance their Business Performance. Thus the integration of these two manufacturing strategies are vital to survive in current market competitive environment.

It is also necessary to note that firms which implement Fit Manufacturing with Lean and Agile systems tend to enjoy sustainable benefits as well as manage to be excellent in all activities [1]. Overall, Fit Manufacturing which is known as a competitive paradigm empowers manufacturing organizations to support universal competitiveness. On top of that, it also acts as a necessary ingredient in all-round among firms in the manufacturing sector in Malaysia. According to Pham and Thomas [4], Fit Manufacturing framework assists manufacturing firms in becoming economically sustainable, and meeting global market competition. However, there is minimum effort made for analyzing the implementation of Fit Manufacturing in their business operations, thus it is crucial to conduct this research in order to improve manufacturers' business performance.

## 2. Lean Manufacturing (Leanness)

According to Naylor et al. [5] "Leanness means developing a value stream to eliminate all waste, including time and to ensure a level schedule". Sharma [6] revealed that Lean Manufacturing is considered as a requirement for manufacturing systems that has been conceptualized by Toyota. According to Kumar, Kumar [7], the Lean Manufacturing System is classified as a strategy while Sundar, Balaji [8] posit that Lean Manufacturing is a waste reduction method. Likewise, El-Tawy and Gallear [9] revealed that Leanness is essentially concerned with reducing waste, as Leanness exists to improve information on participation and encourage the standardization of work and continuous improvement.

Lean concept, focuses on elimination of non-value-added activities. The challenges of effective competition in the business environment has made lean crucial capability of a manufacturing organization which is able to achieve strategic objectives such as productivity, profitability and survival via improvement in the overall performance [2].

## 3. Agile Manufacturing (Agility)

Agile Manufacturing is intended to enhance the competitiveness of firms. Manufacturing processes based on Agile Manufacturing are characterized by customer supplier integrated process, involving product design, manufacturing, marketing and support services [10].

According to Sherehiy [11], Agility is regarded as a new model which utilizes both management and production. Dubey and Gunasekaran [12] demonstrate that Agile Manufacturing is considered as an operational strategy that organizations have utilized to reduce environmental risks, resulting in a global economic slowdown. Gunasekaran [13] notes that Agile Manufacturing is considered similar to sustainability due to its development in a competitive environment, variable modification and quick, efficient response in developing markets. Agility was depicted as "the ability to timely and cost-efficiently design and produce goods of customer-driven quality, in order to deliver them within a window of commercial opportunity, coping with volume uncertainty" [14].

Furthermore, Agility refers to the successful exploration of competitiveness based on speed, flexibility, innovation proactivity, quality and portability via the integration of both recognizable resources and best practices in

a knowledge-rich production environment in order to provide customer-driven products and services suitable for the fast changing market environment [15]. Agility focuses on detecting and responding to uncertain changes of the market. In the current competitive business environment agile is a vital capability of a manufacturing organization that is able to gain strategic objectives such as competitiveness and profitability via improvement in the overall performance [2].

#### **4. Sustainability**

Sustainability techniques consist of various types of science, utilizing agricultural and health sciences and essential elements of knowledge during its implementation, in addition to propelling such knowledge through social activity [16]. Sustainability, which is a broad concept incorporating numerous environmental and social dimensions, has recently emerged as an important product evaluation criterion for consumers [17]. According to Chichilnisky [18], sustainability is considered as a method of determining the ranking of economic opportunities over time. Sustainability will determine a number of aspects, such as environmental, social and economic aspects [19]. The concept of sustainability was developed via the concern for economic sustainability, environmental sustainability and societal sustainability emanating from industrial activities. The three aspects of sustainability have effects on each other [20]. For instance, economic sustainability has been shown to affect both environmental sustainability as well as societal sustainability via the provision of capabilities to develop higher level of education and healthy environment for society. Sustainability is defined as the stability between market demand and production capacity. On this background, a continual and increasing demand on the production system is essential for economic sustainability of the company. It may be seen from a sustainable flow of both pay-out amount and pay-in amount. The role of production capacity in this case is the prompt fulfilment of demands. Otherwise, either shortage in capacity or overcapacity would give a negative sign to production efficiency [21]. According to Mostafa and Dumrak [22], the term sustainability can be used interchangeably with sustainable development and is referred to meeting the needs of the present generation without affecting the future generation negatively. Sustainability in manufacturing has focused on producing completely recyclable products eco-friendly or green production processes and completely disassemble product at the end of their functional life. Sustainable manufacturing can also be defined as the creation of manufactured products that uses non-polluting processes, natural resources and conserve energy and are economically sound and safe for employees, communities and consumers.

#### **5. Fit Manufacturing**

Although the term Fitness is used regularly in biological and evolutionary publications, its definition and use is unclear. This ambiguity has been transferred to those management and strategy papers that discuss the relevance and insights that fitness landscape theory could offer to management scholars. It seems that most authors assume there is a universally understood meaning of the term and therefore do not provide a working definition [23]. In 1864, Herbert Spencer was the first person who used the term fitness in the context of "survival of the fittest" alongside "natural selection" as suggested by Darwin in his *Origin of Species* four years beforehand [24]. Fisher [25] described fitness using an organism's reproduction rate, but he did not define fitness.

A study by Williams [26] revealed that Fit Manufacturing is a company-wide approach, supporting governances to oversee problems in the marketplace, such as customer suppositions in relation to production. Fit Manufacturing System as shown in Figure 1 is able to improve a firm's long-term strategic subsistence (sustainability) and functional competitiveness (Leanness and Agility) [26]. Fit Manufacturing can assist administrations through continuing Agility and Sustainability. Furthermore, Pham and Thomas [28] revealed that Fit Manufacturing comprises of a number of combined activities, such as manufacturing, marketing and product innovation strategies, which lead to the achievement of economic sustainability.

Vinodh, et al. [1] also stated that Fit Manufacturing is a competitive manufacturing model, which involves lean and Agile Manufacturing and its sustainable benefits. Fit Manufacturing system can be considered as an integrated approach which involves Lean Manufacturing, Agile Manufacturing and Sustainability [21]. According to Pham and Thomas [4], Fit Manufacturing framework assists manufacturing firms in becoming economically sustainable and meeting global market competition.

Generally, the researcher noticed that Fit Manufacturing or Fitness Production acts a new strategy, which involves three elements: Lean Manufacturing, Agile Manufacturing and sustainability. This strategy is not only considered Fit Manufacturing, but it also connects all sectors’ management in operations, marketing and sales through its competitive advantages in all firm activities.

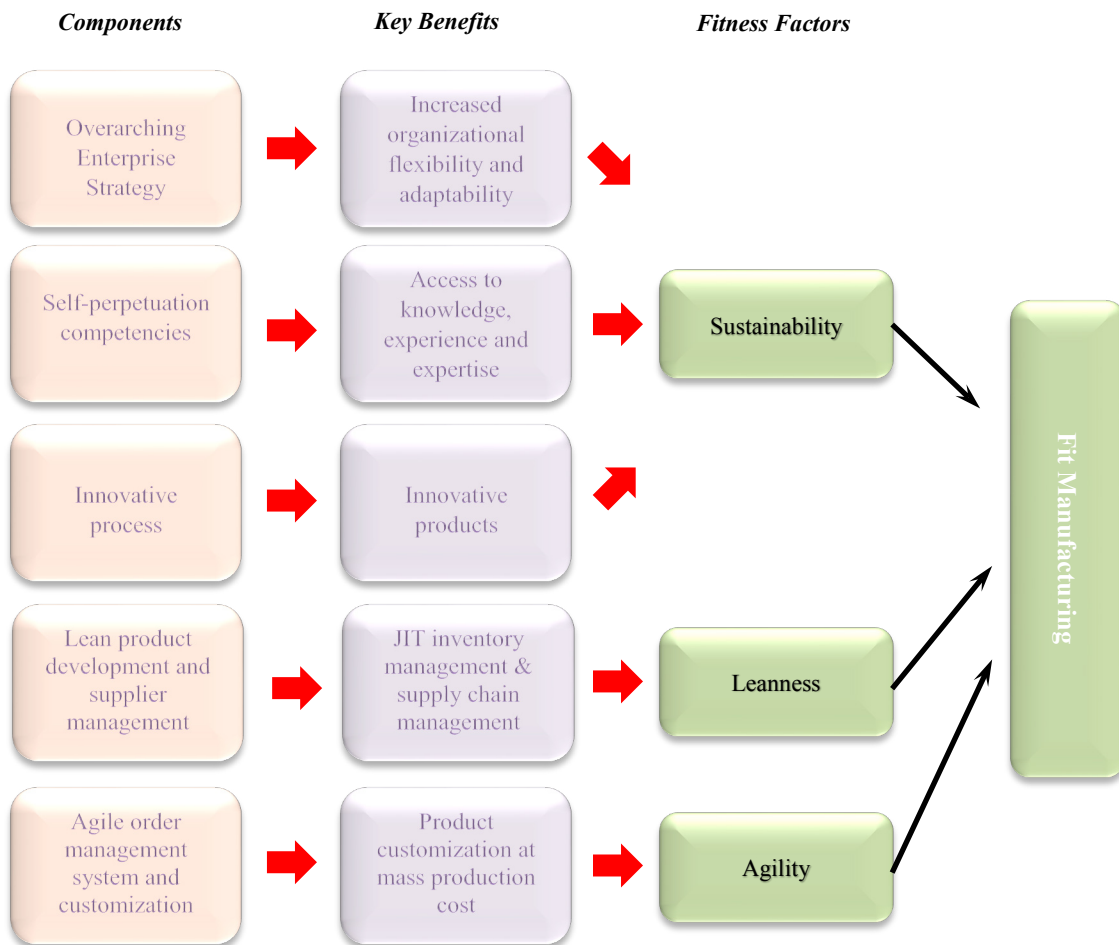


Fig. 1. Fit Manufacturing System.

“Fit” is aimed at providing a “total manufacturing” solution to the problems experienced in the present highly volatile and complex manufacturing environment. Extending the lean and Agile Manufacturing concepts, “Fit” combines key business fields such as design, manufacture, sales, finance and marketing to give a whole system approach to manufacturing. Unlike other strategic approaches, “Fit” does not only develop a company’s capacity to meet demands of customers and break into new markets, it pro-actively tries to find new markets whilst ensuring a company’s strategic and technological infrastructure is adjusted to meet new market sector requirement. In addition, “Fit” will help a company identify a customer’s requirements accurately, effectively and quickly, therefore leading to rapid and sustainable customer relationships [29].

According to Kutbi [30], in his idea of new manufacturing strategy, ‘Fit’ itself has several meanings as an adjective, verb and noun. As an adjective, Fit means; (i) a thing of a suitable quality, standard, or type to meet the required purpose, (ii) to be in good health, especially because of regular physical exercise. Fit as a verb means; (i) to

be the right shape and size to meet a need, (ii) to put something into place and (iii) to be in agreement or harmony with something”.

Fit Manufacturing therefore supplies firms with a model that helps them to work towards the elusive goal of ‘staying healthy’ (fit) over a period of time. The initiative provides manufacturing firms with a framework through which they can allocate resources, strike a balance among the various types of manufacturing initiatives, respond to disruptive forces, develop suitable metrics to evaluate and reinforce the long-term overall fitness of the organization. The Fit System supports continuous improvement through innovation by introducing new, creative products to make the market more modern. Combining the different basics of production systems is vitally essential, as they are able to function together towards accomplishing better efficiency with competitiveness. According to Ebrahim [21], the production fitness is based on the three basic components (1) minimal manufacture wastes identify Leanness, (2) responsiveness towards modification identifies Agility and (3) demand-capacity major identifies sustainability which are presented in Figure 2.

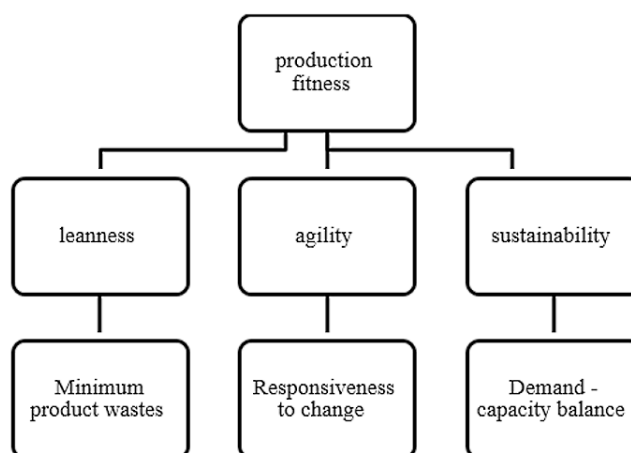


Fig. 2. Production Fitness Components.

Table 1 presents the Fit Manufacturing Components used in previous studies which have been extracted from the literature.

No	Source	Fit Manufacturing		
		Leanness	Agility	Sustainability
1	Pham, et al. [28]	×	×	×
2	Ebrahim [21]	×	×	×
3	Ebrahim, et al. [31]	×	×	×
4	Pham, et al. [29]	×	×	×
5	Sekar, et al. [32]	×	×	×
6	Kutbi [30]	×	×	×
7	Pham and Thomas [33]	×	×	×
8	Brousseau and Eldukhri [34]	×	×	×
9	Yusoff, et al. [35]	×	×	
10	Williams [26]	×	×	

It is clear from Table 1 that most of the researchers agree on the three components for Fit Manufacturing. It might be concluded that an enterprise that is fit, is agile, lean and sustainable too.

## 6. Conclusion

This paper presents the three main manufacturing strategies and finally scrutinized the Fit Manufacturing as a integration manufacturing strategy which contain three main Manufacturing systems namely; Agile Manufacturing, Lean Manufacturing and Sustainability. Fit Manufacturing therefore means the coordination of Agile Manufacturing, Lean Manufacturing and Sustainability. The continued existence of a manufacturing system is guaranteed by this integration which will help to manage the demands made on it. Although implementation of manufacturing strategies such as Lean Manufacturing, Agile Manufacturing and Sustainability has some barriers and differences which needs to be evaluated. Ensuing barriers on the other hand are cultural difference, poor leadership, backsliding or lack of perseverance and so on in the descending order. Manufacturing strategies implementation issues may vary between other sectors and those of the manufacturing sector. Furthermore, it may vary from country to country, work culture of the organization and between different geographic locations [36]. This shows the necessity of evaluation of the Manufacturing strategies in different countries.

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