

# THE IMPACT OF AGILE MANUFACTURING REQUIREMENTS ON THE EVALUATION OF STRATEGIC PERFORMANCE

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## Abstract

To thrive in today's rapidly evolving and unpredictable business climate, manufacturers must be able to respond quickly and effectively to market demands for products while maintaining high-quality standards. This is where agile manufacturing comes in. As a result of achieving flexibility and technology for manufacturing processes, agile manufacturing is characterized by its ability to reflect with demand and quickly respond to that reflection. It can also be expressed as the unit economics' ability to work in an agile, turbulent, and unpredictable competitive environment by developing processes, people, and technology that enable a quick response to sudden shifts in customer preferences.

**Keywords:** Agile Manufacturing, benchmarking, Strategic Performance

## 1. INTRODUCTION

Agile manufacturing is a system that contributes to achieving the ability to survive and prosper in a competitive environment that is constantly changing and unpredictable from the defect of interacting quickly and effectively with markets; for the purpose of providing goods or services that meet the needs of the customer. Agile manufacturing is characterized by the ability to reflect with demand, and the rapid response to that reflection; as a result of achieving flexibility and technology for manufacturing processes, as well as can be expressed as the capacity of the unit Economic to work in an Agile, turbulent and unpredictable competitive environment through building processes, people and technology that allows achieving rapid response to unexpected changes to customer desires, taking into account cost control to reach their lowest limits and the highest level of quality and that Agile manufacturing requirements (simultaneous engineering, comprehensive production maintenance, benchmarking) have a major role in evaluating the strategic performance of economic units.

## 2. LITERATURE REVIEW

### 2.1. AGILE MANUFACTURING

There are several definitions of Agile manufacturing, the most important of which is the ability to visualize the right change and reposition processes in a flexible manner for the purpose of providing added and transparent value to products and customers (Gunasekaran & others, 2017:4), while (AlKhazraji & Others 2020:100) defined it as a method or technique implemented in economic units that have the ability to respond quickly to customer needs.

### 2.2. CHARACTERISTICS OF AGILE MANUFACTURING

In order to cover the changes in the internal and external environment from here, we find that there must be characteristics of Agile manufacturing, namely:

1) **Appropriateness:** It is one of the basic characteristics of Agile manufacturing, so the management of economic units should provide all that is appropriate for customers from the outputs and these outputs have an impact on decisions and be provided in a timely manner and that appropriateness is a concept synonymous with the concept of conformity with specifications, as it depends on the outputs that determine the inputs, that is, whenever the outputs are suitable for the customer (satisfying the customer), the customer's demand for the product or service increases, i.e. the customer's satisfaction with the product is an engine for production, so specifications and conditions must be searched for Which provides the conviction of the customer to acquire this product (commodity) (Gutierrez & others, 2019:5) Therefore, economic units must be flexible to suit changes and adapt to them, as human and material resources must be reorganized for the purpose of adapting to the changing environment and market changes, so there must be a good



deal with these resources and technology and the need to apply and develop knowledge and skills in order to empower workers and as a result of technological development and for the purpose of moving from traditional manufacturing methods. It was necessary to develop and train employees to increase their capabilities in order to walk in parallel with this technological development in order to reach customer-friendly outputs (Lakhal & Khalfallah, 2021:3).

2) **Reliability:** It is a property to maintain the ability of the unit to perform the current function at a certain time and under certain conditions, that is, it is the ability of machines and systems to perform their required functions satisfactorily under specific conditions during a certain period of time, and there are three factors affected by reliability and are related to the manufacturing system:

a- the number of units (components in the system), b- the time required for operation for the purpose of obtaining outputs, c- maintenance policy.

Reliability in a manufacturing system is usually treated as a performance indicator that provides information about the overall capacity of the system, 2020: 1 (others & Prieto), and this requires an intelligent decision-making system capable of carrying out tasks performed by humans, so there must be a synchronous intelligent engineering design that can provide a support system quickly and has a response to any changes that these changes may be related to the design of the product or process or both (Lentferink & others, 2022:1398)

3) **Virtual strategy:** It is the integration of complementary core competencies distributed among a number of carefully selected units, all of which have similar supply chains that focus on speed of access to the market and cost reduction for the purpose of meeting the desires of customers and are characterized by high quality and help economic units to increase flexibility and responsiveness and for the purpose of implementing the virtual strategy the unit must be virtual and have a temporary environment that can be easily changed depending on the product design and the design of processes and activities, i.e. it is able to re-engineer a process. Manufacturing its own quickly to meet the change in demand (Nylund & Shankar, 2012:21).

### 2.3. AGILE MANUFACTURING REQUIREMENTS

It is all the administrative and manufacturing techniques and policies that are introduced to agile manufacturing to reach Agile manufacturing with the requirements on which it is built in a way that enables the economic unit to reduce manufacturing costs, increase market share, meet customer needs, introduce new products, get rid of activities that do not add value and increase manufacturing competitiveness, and the most important of these techniques are (simultaneous engineering, Comprehensive Productive Maintenance, Benchmarking)

### 2.4. THE ROLE OF AGILE MANUFACTURING REQUIREMENTS IN ENHANCING STRATEGIC PERFORMANCE

The transition of economic units from the requirements and pillars of traditional manufacturing to an Agile manufacturing environment in the light of the developments and changes that occur in foreign markets aims to meet and achieve two main objectives, the first of which is to build the ability to provide products that meet the needs and desires of customers in a timely manner and at acceptable prices, and the second is cost management through contemporary systems and techniques in order to provide information that suits the needs of management, Hence, we seek to provide answers to the following questions:

First, does simultaneous engineering contribute to enhancing strategic performance?

Second: Does comprehensive production maintenance contribute to enhancing strategic performance?

Third: Does benchmarking contribute to enhancing strategic performance?

#### 2.4.1. THE ROLE OF CONCURRENT ENGINEERING IN ENHANCING STRATEGIC PERFORMANCE

Many studies indicate that product costs are determined at the design stage, and therefore any wrong estimate at this stage leads to inappropriate decisions, so the cost estimate should be based on scientific foundations and not be random because this has an impact on making decisions about the competitive position of the unit (Suwanda & Al-Ashaab, 2020: 409), and that estimating the cost under concurrent engineering early in the design phase leads to the best performance of the product as well as Reaching the target cost (Hoffmann & Others, 2022:1), and the role achieved by simultaneous engineering in enhancing the strategic performance of the economic unit can be shown through the reflection it achieves on the perspectives of the balanced scorecard and through the following:



**1) Concurrent engineering and financial perspective :** The goal of concurrent engineering is to provide an opportunity to reduce costs throughout the product life cycle by making adjustments early in the design stage, and this has a positive impact on making appropriate decisions and procedures that help reduce costs, which in turn leads to increased sales as a result of the customer's demand for these cost-reducing products (Kusar, 2021:5) Rihar&).

**2) Simultaneous engineering and customer perspective:** Simultaneous engineering enhances strategic performance by meeting the needs and desires of customers to be at an acceptable level of quality by reducing internal and external defects, and also works to improve products and processes to achieve customer satisfaction in the economic unit. Studies that have been employed in the American industrial environment indicate that simultaneous engineering achieves many goals related to cost reduction as well as enhancing all aspects related to meeting the needs of the customer (Dahmas&Others, 2019:6).

**3) Simultaneous engineering and internal process perspective:** The developments and changes that can occur in the design, manufacturing and marketing processes should suit the changes in the needs, desires and requirements of customers and this requires that there be flexibility in the internal operations of the economic unit for the purpose of meeting the rapid response, that simultaneous engineering has a role in achieving flexibility to respond to changes by providing design alternatives commensurate with the nature of the internal processes on which the economic unit is based. Therefore, we find that simultaneous engineering aims to build a database to facilitate the exchange of information internally and externally, and this leads to an increase in the percentage of productivity exploitation as a result of the increase in production achieved (Feng, & Xiang) (2021: 156).

**4) Synchronous engineering and the perspective of innovation and growth:** Concurrent engineering focuses on the development of multi-skilled workers by achieving the improvement of individual capabilities to accomplish concurrent engineering, and that the skills, capabilities of employees, motivation and the ability of the internal information system have a major role in achieving cost savings by achieving time savings as a result of carrying out design, manufacturing and assembly processes simultaneously, as well as from conducting correction and revision operations on the design in real time. This contributes to achieving customer satisfaction as well as by reducing the time of operations to reach the market faster, and this increases the current revenue activity, which in turn leads to more profits (Hoffmann & Others, 2022:1), and therefore achieving speed by delivering the product to the customer at the time he desires, as well as saving time savings leads to shortening the life cycle of the product to a minimum. This makes simultaneous engineering an effective and efficient tool to achieve enhancing the strategic performance of the economic unit :1429), 2022 Bodies & Colors) .

#### 2.4.2. THE ROLE OF COMPREHENSIVE PRODUCTIVE MAINTENANCE IN ENHANCING STRATEGIC PERFORMANCE

The main objective that comprehensive productive maintenance seeks to achieve is that the machines and equipment are of high productivity and manufacturing quality for the purpose of achieving a reduction in maintenance costs, downtime and periodic maintenance, which will reflect positively on the competitiveness of the economic unit in light of market developments and changes (Pandey & Raut, 2016:1405). In enhancing the strategic performance of the economic unit through the reflection it achieves on the perspectives of the balanced scorecard and through the following:

**1) Comprehensive productive maintenance and financial perspective:** Comprehensive productive maintenance is a reflection on the financial perspective of the balanced scorecard. This role can be explained through the objectives that comprehensive productive maintenance seeks to achieve by achieving optimal utilization of operating times and reducing non-value-added times represented by downtime and stops to reach zero breakdowns (Bahreini & others, 2018:2).

**2) Comprehensive productive maintenance and customer perspective:** Comprehensive productive maintenance contributes to the development of plans and control procedures in order to achieve performance evaluation, which includes fault maintenance and equipment repair through early detection of malfunctions, reducing downtime for equipment repair, speed of management response, and setting standard specifications for maintenance work, and this improves operational processes that lead to product improvement and thus increase customer satisfaction. This leads to an increase in market share and thus an increase in sales (Olsson, 2020:581 & Ivina).

**3) Comprehensive productive maintenance and internal operations perspective:** Comprehensive productive maintenance contributes by carrying out early maintenance of equipment (preventive maintenance) and this helps to make improvements to the equipment before starting the

production process in a way that contributes to reducing maintenance to a minimum or eliminating it and this helps in providing reliability of equipment and flexible flow in production and that any modification or development contributes to improving operational processes. This leads to an increase in the percentage of production capacity utilization, which is a positive indicator of internal processes (Dong & others, 2020:2), and that comprehensive productive maintenance has a role in providing high-quality and defect-free products, and this leads to an increase in the desire of customers through regular maintenance of equipment and sudden maintenance of it, as well as maintaining a constant level of quality by eliminating sources of repeated quality defects in the product and for all operational processes, and this leads to an increase in actual production. (Pramod, 2020:2) Johnson & others).

**4) Comprehensive productive maintenance and the perspective of innovation and growth:** Comprehensive productive maintenance focuses on the development of multi-skilled workers by achieving an improvement in the individual capabilities of human resources and that the behavior of employees is affected by education and training programs, which are a very important factor for successful implementation. Comprehensive Productive Maintenance (Graisa, 2011:63), **training is defined as a continuous process that is constantly reviewed and adjusted to take into account changing conditions and new developments, and as long as comprehensive productive maintenance improves the performance of Machinery, reducing their malfunctions, improving working conditions and procedures, and encouraging the full participation of management and employees as well, they require continuous improvement and training commitments** ((Dadzie, 2019:97), and the comprehensive production maintenance as one of the requirements of Agile manufacturing, it seeks to achieve products in response to customer requests and be of high productivity, quality and low cost by involving all employees of the economic unit and that the management of comprehensive productive maintenance means the implementation of the four dimensions of performance, which are Cost, quality, flexibility and time, and neglecting maintenance leads to negative effects because of its important role in the production process, and this reflects negatively on the operations of the economic unit (financial, technical, as well as the requirements of the internal and external environment and safety) and this ultimately affects the enhancement of the strategic performance of the economic unit (Nurprihatin & others, 2019: 9).

#### 2.4.3. ROLE OF BENCHMARKING IN ENHANCING STRATEGIC PERFORMANCE

The comparison process is the process of measuring and comparing the current performance of the economic unit with the high-performance units to identify the strengths and weaknesses of the unit and then compare them with the strengths and weaknesses of those units in order to adopt applications for the purpose of enhancing performance (Hassan & others, 2019:530), and the role achieved by benchmarking in enhancing the strategic performance of the economic unit can be shown through the reflection it achieves on the indicators of the balanced scorecard and through the following:

- 1) **Benchmarking and financial perspective:** Benchmarking has a major role in enhancing the strategic performance of the economic unit and this is not achieved without providing the necessary information such as providing information about individuals in their various specialties for the purpose of preparing a team with different skills commensurate with the nature of the work as well as providing information about the product that achieves customer satisfaction and also other sufficient and appropriate information about the competing product for successful implementation and this leads to an increase in product sales compared to the competing product and this in turn leads to Increasing profits for the economic unit, which enhances its performance (& others, 2021:3 Mahdavi).
- 2) **Benchmarking and customer perspective:** The developments in the modern business environment have led to making the customer a basis in determining the specifications of the products he desires, which has become necessary to search for new products according to his desires and that the reference comparison is one of the tools that keep pace with the changes in the modern business environment and that the customer's demand for products that meet his desires will increase sales, and this in turn has a positive impact on the profits of the economic unit, 2019:1) & others Banbury) .
- 3) **Benchmarking and internal operations perspective:** The benchmarking does not address all problems, but it is a tool aimed at raising the level of performance of operations and

activities in order to achieve conformity to the requirements and needs of customers by enhancing performance and operations as well as enhancing functions and given the need to enhance the performance of the economic unit for the purpose of achieving competitive advantage, the economic unit should search for methods for the purpose of enhancing its performance and continuously and one of these methods is the reference comparison and when the unit follows the comparison this will lead to an increase in the number of units produced Thus, increasing the actual production achieved for the economic unit (Adesta& Others, 2018).

**Benchmarking and innovation and growth perspective: Training employees on new skills increases their understanding of how to perform new processes when benchmarking and this type of training helps to encourage innovation and growth and the structure must be more interactive and participatory starting from the top management down to the employees and this helps in the production of products of high value and the customer's demand for them is high and thus achieve customer satisfaction, which achieves revenue for the economic unit and this has a positive impact on profits Economic Unit 2021:156 (Feng, & Xiang).**


### 3. CONCLUSIONS AND DISCUSSIONS

Through the foregoing, it was found that the economic units are required to make improvements in their performance, whether they were successful or not. Whatever the circumstances and conditions surrounding the economic unit, they are required to enhance their performance, either in order to improve their current situation in the event that the economic unit is collapsing or on its way to collapse, or to maintain its current status and the continuation of success and excellence in the case of successful units, so that enhancing performance is one of the priorities of any economic unit, and neglecting it exposes it to disappearance from the market, and therefore the role played by the requirements of accelerated manufacturing in enhancing strategic performance cannot be achieved without considering the provision of the necessary accounting information from In order to prepare a successful strategy to promote products, as well as provide information about individuals with their various specializations in order to prepare a team that works with different skills that are appropriate to the nature of the work, as well as information must be provided about what the customer desires for the purpose of providing his requirements in the product to achieve his satisfaction, and also information must be available about the specifications that benefit Including in the product design activity and all this in order to ensure the successful implementation of the requirements of accelerated manufacturing.

### REFERENCES

- 1-Al-Khazraji, H., Khlil, S., & Alabacy, Z. (2020). Agile manufacturing assessment model using multi-grade evaluation. *Journal of Engineering*, 26(11), 100-109.
- 2- Adesta, E. Y., Prabowo, H. A., & Agusman, D. (2018). Evaluating 8 pillars of Total Productive Maintenance (TPM) implementation and their contribution to manufacturing performance. In *IOP conference series: materials science and engineering* (Vol. 290, No. 1, p. 012024). IOP Publishing
- 3-Alwan, S. A., & Jasim, A. L. (2022). The Role Of Simultaneous Four-Dimensional Engineering In Providing Sustainable Products/An Applied Study In The State Company For The Textile And Leather Industry/Factory No.(7). *Journal of Positive School Psychology*, 6(10), 1428-1436.
- 4-Bahreini, R., Doshmangir, L., & Imani, A. (2019). Influential factors on medical equipment maintenance management: In search of a framework. *Journal of Quality in Maintenance Engineering*, 25(1), 128-143
- 5-Dadzie, E. (2019). Total Productive Maintenance and effectiveness of Occupational Health and Safety Management Systems. *African Journal of Procurement, Logistics & Supply Chain Management*, 1(7), 90-123
- 6-Dahmas, S., Li, Z., & Liu, S. (2019). Solving the difficulties and challenges facing construction based on concurrent engineering in Yemen. *Sustainability*, 11(11), 3146



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- 7- Dong, W., Liu, S., Cao, Y., Javed, S. A., & Du, Y. (2020). Reliability modeling and optimal random preventive maintenance policy for parallel systems with damage self-healing. *Computers & Industrial Engineering*, 142, 106359.
  - 8-Gunasekaran, A., Yusuf, Y. Y., Adeleye, E. O., & Papadopoulos, T. (2017). Agile manufacturing practices: the role of big data and business analytics with multiple case studies. *International Journal of Production Research*, 56(1-2), 385-397.
  - 9- Graisa, M. (2011). An Investigation into the Need and Implementation of Total Productive Maintenance (TPM) in Libyan Cement Industry (PHD). Nottingham Trent University.
  - 10-Hoffmann, J., Deutsch, M., & Bertrand, R. (2022). Development of a concurrent engineering tutorial as part of the “ESA\_Lab@” initiative. In 4th Symposium on Space Educational Activities. Universitat Politècnica de Catalunya
  - 11-Hassan, M. G. B., Akanmu, M. D., Mohamed, A., Harun, N. H., & Nadzir, M. M. (2019, April). The role of benchmarking on sustainability performance in food and beverage companies of Malaysia. In 2019 IEEE Jordan international joint conference on electrical engineering and information technology (JEEIT) (pp. 530-537). IEEE
  - 12-Ivina, D., & Olsson, N. O. (2020, July). Lean construction principles and railway maintenance planning. In Proc. 28th Annual Conference of the International Group for Lean Construction (IGLC28), Berkeley, California, USA
  - 13-Johnson, J., & Pramod, V. K. (2020, December). Integration of Total Quality Management with Total Productive Maintenance to develop Maintenance Quality Function Deployment model and its implementation study in food industry. In IOP Conference Series: Materials Science and Engineering (Vol. 993, No. 1, p. 012022). IOP Publishing
  - 14-Khalfallah, M., & Lakhal, L. (2021). The impact of lean manufacturing practices on operational and financial performance: the mediating role of agile manufacturing. *International Journal of Quality & Reliability Management*, 38(1), 147-168.
  - 15-Lentferink, A., Noordzij, M. L., Burgler, A., Klaassen, R., Derks, Y., Oldenhuis, H., ... & van Gemert-Pijnen, L. (2022). On the receptivity of employees to just-in-time self-tracking and eCoaching for stress management: a mixed-methods approach. *Behaviour & information technology*, 41(7), 1398-1424
  - 16-Mahdavi, A., Berger, C., Amin, H., Ampatzi, E., Andersen, R. K., Azar, E., ... & Verbruggen, S. (2021). The role of occupants in buildings' energy performance gap: myth or reality?. *Sustainability*, 13(6), 3146.
  - 17-Nylund, H., Shankar, K., Koho, M., & Torvinen, S. (2012). Competitive and sustainable production systems and networks (KEKE).
  - 18-Pandey, D., & Raut, N. (2016). Implementing TPM by doing Root Cause Analysis of the Downtime losses. *International Journal of Advanced Research in Science, Engineering and Technology*, 3(2), 1399-1405
  - 19- Rihar, L., & Kušar, J. (2021). Implementing concurrent engineering and QFD method to achieve realization of sustainable project. *Sustainability*, 13(3), 1091.
  - 20-Rodríguez-Prieto, A., Primera, E., Callejas, M., & Camacho, A. M. (2020). Reliability-Based Evaluation of the Suitability of Polymers for Additive Manufacturing Intended for Extreme Operating Conditions. *Polymers*, 12(10), 2327.
  - 21-Sánchez-Gutiérrez, J., Cabanelas, P., Lampón, J. F., & González-Alvarado, T. E. (2019). The impact on competitiveness of customer value creation through relationship capabilities and marketing innovation. *Journal of business & industrial marketing*, 34(3), 618-627
  - 22-Suwanda, S., Al-Ashaab, A., & Beg, N. (2020). The development of knowledge-shelf to enable an effective set-based concurrent engineering application. *International Journal of Internet Manufacturing and Services*, 7(4), 407-427.
  - 23-Xiang, Z. T., & Chin, J. F. (2021). Implementing total productive maintenance in a manufacturing small or medium-sized enterprise. *Journal of Industrial Engineering and Management (JIEM)*, 14(2), 152-175.