



# **UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

## **IMPLEMENTATION FRAMEWORK OF MANUFACTURING SUSTAINABILITY**

This report submitted in accordance with the requirement of the  
Universiti Teknikal Malaysia Melaka (UTeM) for the  
Bachelor Degree of Manufacturing Engineering  
(Manufacturing Management) with Honors.

By

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## DECLARATION

I hereby, declared this report entitled “Implementation Framework of Manufacturing Sustainability” is the result of my own research except as cited in the references.

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## APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.). The member of the supervisor is as follow:



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## **ABSTRAK**

Kemampuan adalah elemen yang penting bagi setiap syarikat untuk terus hidup dalam persekitaran perniagaan yang kompetitif. Walau bagaimanapun, masih terdapat kekurangan kajian mengenai rangka kerja pelaksanaan kemampuan pengeluaran. Matlamat projek ini adalah untuk mengkaji prinsip, ciri-ciri, dan model, menyiasat rangka kerja ini, mengetahui faktor-faktor bagi syarikat perkilangan untuk melaksanakan, dan untuk mencadangkan satu rangka kerja pelaksanaan kelestarian perkilangan. Prinsip-prinsip, ciri-ciri dan model kemampuan pembuatan dikaji melalui kajian literatur. Rangka kerja kemampuan pembuatan sedang dilaksanakan, dan faktor-faktor bagi syarikat untuk melaksanakan kelestarian perkilangan pembuatan dikaji melalui kajian literatur juga. Tiga syarikat automotif di Malaysia telah dikaji dengan menggunakan soal selidik untuk mendapatkan maklum balas daripada pakar industri mereka tentang komponen penting dan unsur-unsur ke arah kelestarian perkilangan. Selain itu, melaksanakan rangka kerja analisis dengan menggunakan kajian sebelumnya dalam pembuatan kemampuan dan sokongan dengan maklum balas daripada kajian soal selidik dapat mencadangkan satu rangka kerja pelaksanaan kelestarian perkilangan, yang terdiri daripada lima komponen utama seperti prestasi pengurusan, alam sekitar, ekonomi, sosial, dan teknologi kemajuan. Kesimpulannya, projek ini dapat membantu untuk menjadi kemampuan pembuatan bagi setiap syarikat untuk terus hidup dalam persekitaran perniagaan yang kompetitif.

## **ABSTRACT**

Sustainability is the important element for each company in order to survive in a highly competitive business environment. However, there is still lack of study on the implementation framework of manufacturing sustainability. The goals of this project are to study the principles, characteristics, and models, to investigate the framework, to find out the factors for manufacturing companies to implement, and to propose an implementation framework of the manufacturing sustainability. Through literature study, the principles, characteristics, and models of manufacturing sustainability were identified. The framework of manufacturing sustainability that have been implemented, and the factors for manufacturing companies to implement the manufacturing sustainability also being determined through the literature study. Three automotive companies in Malaysia have been surveyed using a questionnaire to get feedbacks from the industry expert regarding the importance of components and elements towards manufacturing sustainability. Besides, by using the previous researches in manufacturing sustainability and support, analytical framework can be performed and from the survey, implementation framework of manufacturing sustainability consisting of five main components such as management performance, environmental, economic, social, and technology advancement can be proposed. In conclusion, the project was able to help each company to become a manufacturing sustainable company in order to survive in a highly competitive business environment.

## **DEDICATION**

I would like to present my work to those who did not stop their daily support since I was born, my dear mother and my kindness father. They never hesitate to provide me all the facilities to encourage me foreword as much as they can. This work is a simple and humble reply to their much goodness I have taken over during that time. I don't forget my brothers, sisters, uncle and those entire how I love. Lastly, thank you everyone for the support, guidance, prayer, help and cooperation, directly or vice versa.

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# **CHAPTER 1:**

## **INTRODUCTION**

### **1.1 Background of Project**

The growth of requirement in the current market for natural resources and the constitutional challenges attendant this requirement presents a great task for manufacturing companies. Isolated from this, manufacturing industry getting more challenging because of new technologies and a demographic change of the manpower as well as the desire for new personalized merchandise (Herrmann *et al*, 2014). Sustainable manufacturing is expansive ideas that from a product perspective, cover the whole life-cycle from design of product through manufacturing to resulting reusing or transfer of an utilized item. Along these lines, acknowledging of manufacturing sustainability aspect obliges endeavors and converts in a few parts. To achieve company goal is easy, but to remain sustainable in the market is difficult. So that, implementation framework of manufacturing sustainability is a key to keeping or re-establish a strong manufacturing industry in a country, factories have to adapt to ever new challenges, trends and paradigms in manufacturing stay competitive.

The sphere of business has recently attracted an unprecedented level of criticism in light of its role in a number of social, environmental and economic issues present in today's society. The contribution of business to problems of climate change, social inequity and the economic recession has led to questioning the fundamental guiding forces of business and their commensurability with a more sustainable form of development (Broughton, 2009). Sustainability frameworks are typically focused on strategy and decision making processes, rather than capability assessment. Kinderyte reviewed a number of sustainability assessment frameworks

(Kinderyte, 2008). One of these frameworks, the Sustainability Assessment for Enterprises (SAFE), developed by the Wuppertal Institute, is designed to assess a company's performance on economic, ecological, social and communication metrics. One aspect of the SAFE framework is the identification of the qualification needs of employees (Kinderyte, 2008). After reviewing existing frameworks, it was identified that there was a need to develop a new framework to assess particular capabilities across the supply chain. The framework of manufacturing sustainability that enable companies to be sustainable enlarged for a longer period of time are not clearly determined (Cetinkaya, 2011).

Therefore, the purpose of this work is to clarify the framework about manufacturing sustainability that contribute to a manufacturing company's survival especially in the automotive industry. In this regard, a case study on sustainable manufacturing of automotive companies in Malaysia which is that company want to be competitive in the current marketplace. Now, customers seek the best merchandise with more advanced technology and first-class execution. In the automotive industry, most of the company facing a trouble with growing new merchandise in order to fulfill customer satisfactions and competitiveness with another troupe. More, the part of sustainability in the assembling automotive industry has shifted and modernized in the element business environment. The sustainability is investigated in this field focuses on the measures and finds out at the three essential natural levels included; environmental, economic and societal (Zubir *et al*, 2012). Through this project, analyzes of the measures to be framework will be identified in advance through the automotive company have remained sustainable in the current market and gain some improvements. In this manner, the implementation framework of manufacturing sustainability was identified by looking the most common criteria and steps aside, and the similarities between the three aforementioned sources.

## 1.2 Problem Statements

Manufacturing sustainability is an increasingly important requirement for human action, establishing sustainable development a key object in human development. As long consumers' demands are in existence, the producers will seek to increase their output. Still, having said that, the demands of consumers have changed over time and will continue to evolve (Rosen *et al*, 2012). Therefore, the manufacturing company has to be creative, proactive and innovative to keep their business in the long run (Susman *et al*, 2006).

Furthermore, customers seek the best automotive product with more advanced technology and first-class execution. In the automotive industry, most of the company facing a trouble with growing new merchandise in order to fulfill customer satisfactions.

Therefore, this project was held to determine the main criteria for making the implementation framework of sustainability that contributed to companies used as guidance and support for those companies who aim to reach world-class standards of manufacturing through continual improvement other than the insignificant negative effect on the nature's domain, moderate vitality and characteristic assets, economically sound, are safe for workers and communities. Thus, this is important for the current manufacturing company has an implementation framework of manufacturing sustainability.



### **1.3 Research Questions**

1. What are the principles, characteristics and models of manufacturing sustainability?
2. What is the framework of manufacturing sustainability implemented in the industry?
3. What are the factors for manufacturing companies to implement the manufacturing sustainability?
4. What elements do make up the implementation framework of manufacturing sustainability in the automotive industry?

### **1.4 Research Objectives**

1. To study the principles, characteristics and models of manufacturing sustainability.
2. To investigate the framework of manufacturing sustainability being implemented.
3. To find out the factors for manufacturing companies to implement the manufacturing sustainability.
4. To propose an implementation framework of manufacturing sustainability in the automotive industry.

### **1.5 Scope of Project**

The scope of this research is analyzed on the sustainability of manufacturing in an automotive company in Malaysia. From this, there are some other limitations in this study, also the respondent from a vendor of the automotive company or automotive related. These studies focus more on a study of the implementation framework of manufacturing sustainability, which are to be involved the factors must consider making implementation framework of manufacturing sustainability.

## **1.6 Benefits of Project**

The benefits from this project are:

- i. To assess the current framework of manufacturing sustainability.
- ii. To explore appropriate criteria to implement manufacturing sustainability.
- iii. To propose a framework for implementing manufacturing sustainability in the manufacturing industry.

## **1.7 Expected Outcomes**

The expected outcomes from this project are:

- i. Principles and models of sustainable manufacturing.
- ii. Understanding and level of implementation of sustainable manufacturing among automotive parts manufacturing.
- iii. Factors that promote on sustainable manufacturing implementation.
- iv. Framework for implementation of sustainable manufacturing.

## **1.8 Organization of the Report**

The organization of this final year project report has been organized as follows;

Chapter 1: The introduction of this study; describes the background and the problem statement of the project. The objectives, scope, importance of the project and organization of the report is also presented in this chapter.

Chapter 2: The literature review; explanation and discussion about manufacturing sustainability from previous research. This includes comparisons by definition, manufacturing, sustainability, manufacturing sustainability, framework, and previous study about this title.

Chapter 3: The methodology; presents the appropriate methodology of this project. This chapter includes the project planning, flowchart, Gantt chart and data collection method.

Chapter 4: The result and discussion; describe about analysis data collected from previous research and survey by questionnaire to propose an implementation framework of manufacturing sustainability.

Chapter 5: The conclusion and recommendation; presentation of the conclusion of the whole study and also give some recommendation in order to improve this study for future.

## **CHAPTER 2:**

### **LITERATURE REVIEW**

#### **2.1 Manufacturing Sustainability**

##### **2.1.1 Manufacturing**

General understanding of a manufacturing system as a combination of production factors, including typical input factors such as raw and auxiliary materials, semi-finished products, information, energy and space as well as typical output such as products, parts and waste has been anchored in people's mind with the help of different perspectives on manufacturing.

Manufacturing is a main factor in the prosperity of nations and an essential source of innovation and development. To ensure the competitiveness of manufacturing industry, factories have always needed to adapt to new challenges and trends, resulting in several changes of manufacturing paradigms over the last two centuries. Today's and future factories also face several evolving trends like customers demanding for highly personalized products, the necessity for an eco-friendly production by reducing its environmental impacts, an increasing importance of social aspects including the requirements of production-related learning, a still lasting technology push regarding ICT as well as the need for an improved integration of factories in their spatial context.

Besides, according to Merriam (2008), manufacturing is defined as the act or process producing something made from raw materials by hand or by machinery. The expression assembling is gotten from Latin-Manu-elements, significance made

by hand. The word manufacture is initially shown up in 1567 and the expression assembling showed up in 1683.

The statement item means something that is made and the expression item and generation seemed at some point amid the 15th C. Those saying manufacturing and generation frequently all the need aid utilized interchangeableness. Moreover, manufacturing likewise characterized similarly as process make (wares alternately other products) eventually by hand, by machinery, alternately by another agency; as, with assembling cloth, nails, glass, and so on. Furthermore, manufacturing will be characterized similarly as work, crude alternately mostly created materials, under suitability structures for utilizing; as, to manufacture wool, cotton, silk, or iron.

### **2.1.2 How Manufacturing is Achieved**

Manufacturing is characterized as the mechanical, physical, or synthetic change of materials or substances into new items. Parts are getting together into new items is likewise viewed as assembling, aside from when it is properly delegated development. Foundations in the assembling segment are frequently depicted as plants, production lines, or factories and regularly utilize power-driven machines and materials-taking care of supplies. Likewise included in the assembling area are a few foundations that make items by hand, in the same way as custom tailors and the creators of custom draperies. While manufacturers ordinarily don't offer to people in general, a few foundations like pastry shops and treat stores that make the items on premises may be incorporated.

Furthermore, according to the Business Dictionary (2008), manufacturing is defined as a process to make an item with apparatuses or machines by influencing chemical, mechanical, only the physical interpretation of materials, substances, gold parts, just by simulating common processes, typically over and over and one has an expansive scale with has division of work. Production is incorporated all steps important to change over crude materials, segments, or parts into complete merchandise that fit in with a client's desires or details.

### 2.1.3 Sustainability

According to Gregory (2012) the current confirmation focuses on a connection between sustainability practices and advancement. Keeping in mind the end goal to test this independently for environmental and social practices in the setting of little and medium-sized assembling firms, we propose the accompanying theories:

- a. The appropriation of environmental administration practices is decidedly identified with item development execution.
- b. The reception of social administration practices is absolutely identified with item development execution.
- c. The reception of environmental administration practices is emphatically identified with procedure development execution.

Also, authoritative practicality as, ‘an insightful equalization among economic advancement, environmental stewardship, and social value’. Besides, according to Vince (2009) specifies that sustainability can be reached by balancing of three dimensions:

**a) Economic:**

Sustainability with supply and demand considerations in providing for the resource need of populations and communities. Profits and stabilization of businesses are the motives.

**b) Social:**

Sustainability is concerned with communities, lifestyle, and populations.

**c) Environmental:**

Sustainability with ecological considerations for air, water and land, quality, and preservation.

Furthermore, sustainability has turned into a progressively vital issue among organizations around the globe. Likewise, expanding concerns to maintain quality have constrained assembling organizations to consider the parts of sustainability into their methods and exercises. Because of the developing practicality concerns, fabricating organizations need to form measures to assess practical assembling execution, going for coordination of sustainability aspects (Amrina and Yusof, 2011).

According MSA (2008), we have an expansive comprehension about sustainability that permeates all that we do. More, that includes everybody in the association, including managers, employees, and stakeholders. An expanded understanding of sustainability has many factors, including:

- a) Environmental impacts.
- b) Corporate citizenship.
- c) New machines, equipment and systems are designed.
- d) Health and well-being of guests, workers, and the encompassing group.
- e) Quality and effectiveness of items and methods - to expand benefit as well as to spare utilization of crude materials and energy.
- f) Research into the utilization of distinctive sorts of fuel and vitality, materials taking care of, warming and cooling procedures, the capacity and pumping of fluids and gasses, and ecological controls.
- g) Management, determination, choice, establishment and support of manufacturing plant generation and hardware.
- h) Research into the utilization of diverse sorts of crude and changed

#### **2.1.4 The Complexity of Sustainability**

Organizations, experts, and communities has been admitted as the Sustainability is a complex problem (Metcalf and Benn, 2013). This complexity comes up from the impression that sustainability takes place as part of an incorporating organizations, larger system, the environment, and society as agents

(Loorbach, 2010). Hence, doing innovation to calls for transformation for target achieving sustainability, instead a modification or switch agent of the system (Gaziulusoy et al., 2013).

System diversity from the norm is most zoned as “a transition from such social-technical route to another” (Geels, 2005) and occurs when crowd shifts independently from such way of doing material to another, for the lesson, the adaptation of the truck from the horse and ride in cars (Gaziulusoy et al., 2013). These types of basic transitions enforcement not abandoned individuals in restriction of development, and experienced by the whole of their environment, but besides organization in doubt of productive society, a departure from the norm, and engage in activity application direction. Furthermore, these transitions sooner or later impact the nation at large as they brought pressure to bear upon changes in markets, code, and the habit of cultural and urban norms (Gaziulusoy et al., 2013).

In at variance words, organisations that proactively receive in incorporating sustainability initiatives within their engagement in activity application, strive to do so to ensure athletic event regulatory requirements, finance a human of legislative or transaction compliance, or am a party to in more factual and cost-effective methods of conducting trade (Gaziulusoy et al., 2013), preferably than as a show of brilliant that an departure from the norm will violence larger sustainability issues a well known as thermal reading change. Motivations for moving concerning sustainable practices are before largely driven by the require to embrace to exterior pressures (Ervin et al. 2013) as a substitute than a summary of “global” or environmental responsibility.

Given the interconnectedness of these agents (environment, economy and society), and the bold nature of achieving sustainability in skepticism of environmental and governmental changes, neither of these agents gave a pink slip be substituted as for the most part need to be with a free hand considered to move up in the world sustainable outcomes (Gaziulusoy et al., 2013). In essence, taking only self interested action is unlikely to provide a sustainable human future in and of itself. Furthermore, Metcalf and Benn (2013) were been stated organisational sustainability