# A Review of Sustainability Model in Manufacturing Organization Towards IR4.0 in Malaysia

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***Abstract* - This paper reviews a sustainability model in manufacturing organization towards IR4.0 focusing on three main factors, which are continuous improvement, organizational culture and organizational sustainability. This review is based on the several general criterias, i.e. total quality management, strategy, development model, business performance measurement, teamwork, leadership and continuous improvement practices. Then, the summary of these reviews is discussed. The results show that the sustainability model which should occur there is an improvement in terms of knowledge of tool management skills, methodology, as well as standards and network security in order to be able to take on IR 4.0. Thus, the presence of sustainability models with diverse approaches and strengths can help future researchers to achieve work practices and organizational strategies leading towards IR4.0.**

***Keywords:*** *Sustainability model, IR4.0, continuous improvement, organizational culture, organizational sustainability*

## 1. Introduction

The most efficient of quality control (QC) circle is for a group of people that work on faults encountered at the local level [34]. Those flow of processes are for learning and improvement of a product and services to emphasize the prevention of error recurrence by establishing standards and the on-going (CI). Therefore, to strengthen the company's economy and lead the current global market, organizations need to compete with each other to ensure the organization's survival. The main ingredients that the organization needs to do is the sustainability of the organization in all respects, including financial performance, product innovation and a good strategy. Unless, none of all this will not work perfectly if there is no continuous improvement activity is done to review its conditions and performance of all time.

Anees Janee Ali and Md Aminul Islam [3], stated that among other things such as business excellence, can be achieved by companies which can react quickly to new market conditions and customer needs and constantly looking for creative solutions and CI in products and processes. Hence, these companies must seek out new methods allowing them to remain competitive and flexible simultaneously, enabling their companies to respond rapidly to new demands [20].

In order for these companies to remain competitive, retain their market share in this global economy, and satisfy both external and internal economy, and satisfy both external and internal customers, CI of manufacturing system processes has become necessary [21]. This statement supported by Anees Janee Ali and Md Aminul Islam [3], where continuous improvements is a very critical tool in the manufacturing industries today to enhance customer satisfaction, to become the cost leader and also to remain competitive in the global world today. The base of quality systems relies on continuous improvement and the quality is defined as a continuous improvement of products processes. Even Abdolshah and Jahan [1]; Jagdeep Singh [20] and Jagdeep Singh [22], also described that CI has become an important strategy in improving organizational performance.

There are few criteria used to review all the sustainability model in manufacturing organization in Malaysia. Among the criteria used to review for each work are total quality management, strategy, development model, business performance model, teamwork, leadership, and continuous improvement practices. For each criteria, there are corresponding types to be further used and discussed in this article. Table 1 summarizes the sustainability model criteria, its' corresponding types and symbols.

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**Table 1**. Summary of sustainability criteria and types.

| *No* | *Sustainability Model Criteria* | *Criteria Types* | *Symbol* |
|---|---|---|---|
| *1* | *Total Quality Management* | • *Management Support*<br>• *Blame Culture*<br>• *Management commitment and involvement*<br>• *Provide a facilitator to support the programme* | *TQM* |
| *2* | *Strategy* | • *Strategic focus*<br>• *Improvement programme objectives linked to strategic goals*<br>• *Assignment of specific resources to improvement programmes: economic, time, space.*<br>• *Adequate training*<br>• *Communication of continuous programme results to the rest of the organization* | *ST* |
| *3* | *Development Model* | • *Continuous Improvement Development*<br>• *Intra-organizational cooperation*<br>• *Reward & recognition scheme*<br>• *Recognition or reward to participants* | *DM* |
| *4* | *Business Performance Measurement* | • *Integration of Continuous Improvement*<br>• *Strategic Performance Management*<br>• *Key performance indicators, linked to obtained results*<br>• *Achievement and implementation of results*<br>• *Use of appropriate methodology* | *BP* |
| *5* | *Teamwork* | • *Involvement/ engagement*<br>• *Continuous Improvement Culture*<br>• *Involvement of a task force in the improvement programme*<br>• *Getting more people involved*<br>• *Promote team working* | *TW* |
| *6* | *Leadership* | • *Extent of Continuous Improvement projects*<br>• *Adaptation to the environmental changes* | *LS* |
| 7 | *Continuous Improvement Practices* | • *Understanding of the business*<br>• *Management of Continuous Improvement*<br>• *Learning*<br>• *Knowledge Sharing*<br>• *Communication*<br>• *Selection of the appropriate areas for improvement* | *CIP* |

There are several literature reviews used to review all criteria in the sustainability model. Among the several studies are research conducted by Anees Janee Ali, Md Aminul Islam [3]; Karen Fryer, Susan Ogden [25]; Frances Jørgensen, Frank Gertsen [11], and Carmen Jaca, Elisabeth Viles, Ricardo Mateo [5]. But there has never been research conducted taking into account the three factors which are continuous improvement, organizational culture and organizational sustainability.

Therefore, the objective of this study is to review a sustainability model in manufacturing organization towards IR4.0 focusing on three main factors, which are continuous improvement, organizational culture and organizational sustainability. The sustainability model will be able to adapt and be relevant to the new technology in the era of Industrial Revolution 4.0 especially in manufacturing sector. This statement is supported with the research by Zheng, Ardolino, Bacchetti, Perona, and Zanardini [49], that each country is characterized by the specific peculiarities of its manufacturing landscape, leading to different adoption and implementation levels of the main principles of IR4.0.

## 2. Review on Previous Studies

In this section, a sustainability model in manufacturing industries in Malaysia will be presented.

### 2.1 Continuous Improvement Factors

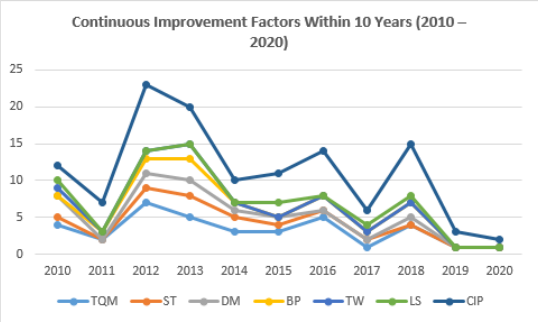


**Figure 1.** CI Factors

This research has been set based on a reference developed by the authors and presented in Figure 1. Researchers such as Dag Swartling [7], Gutierrez-gutierrez and Antony [6], Kregel [28], G Cwikla, A Gwiazda, W Banas, Z Monica [12], conducted a continuous improvement study in terms of quality management. Meanwhile, Kovach, Cudney, and Elrod [28], Hamed and Soliman, [16] added that the importance of quality management implementation by introducing Lean and Six Sigma while Damjan Maletic˘, Matjaz˘ Maletic˘ [8], also emphasizes quality management but more emphasis on maintenance management. While Pedro C. Oprime, Glauco Henrique de Sousa, Mendes Márcio [38], emphasizes continuous improvement practices by applying factor analysis as well as critical factors while Jagdeep Singh and Harwinder Singh [21], looks at the importance of leadership style, especially in the manufacturing industry.

John Meiling [33], added that leadership style must be combined with lean management to enhance the overall management capabilities of the company. But for Carmen Jaca, Elisabeth Viles, Ricardo Mateo [5], on the other hand, teamwork can help increase management commitment.

Carmen Jaca, Elisabeth Viles [5], argue that measuring employee performance can also improve the quality of company's work. This can indirectly improve the quality of management and enhance the competitiveness of the company [6],[37].

Hyun Woong Jin and Toni L. Doolen [19], Smith, Orlando, Berta, Orlando, and Berta [46], Dharmasri Wickramasinghe [9], emphasize on employee performance by introducing a quality circle. Similarly, Hani Shafeek [45], who thinks that quality circle can also be implemented in heavy industry to improve continuous improvement model.

Marco Lam, Donnell, and Robertson [30], say the development of new business models and continuous improvement can improve a company's services, and it can only be achieved through manufacturing strategy management as well as teamwork [15],[22],[ 6].

### 2.2 Organizational Culture Factors

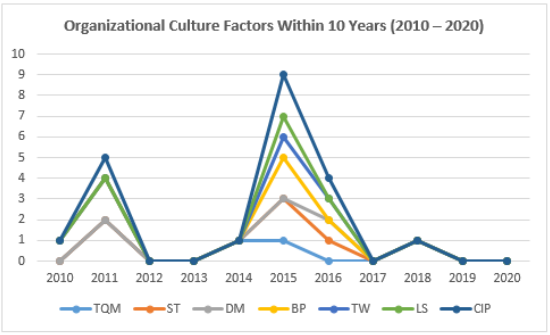


**Figure 2.** OC Factors

Figure 2, shows that all organizational culture factors have been set based on a reference developed by the authors. Almaiman and Mclaughlin [2], affirmed that organizational culture features a significant impact on supporting continuous improvement and evolved thru focus groups. Meanwhile, Jurburg, Viles, Tanco, and Mateo [24], focusing on the elements the CI system that could motivate and affect employee's intention to participate in CI activities. However, Raphaella Prugsamatz [42], using individual motivation to learn, team dynamics and organizational culture practices have significant results to influence on organization learning sustainability in the organizations.

Roya Rahimi [43], study on organizational culture that using the Mendoza model which produces a positive significant impact on CRM implementations with three components CRM such as people, process and technology. Whereas, Galpin [13], using a multidisciplinary model that can be used as a guidance for research of the relationship between organizational culture for infrastructure and sustainability performance.

Lillian Do Nascimento Gambi [32]; Joo Jung, Xuemei Su, Miguel Baeza [23], study of a firm's organizational culture affects the quality techniques and operational performance. Trerise [48], established strategy to develop a culture centred on quality, safety and innovation and shows a significant improvement have been accomplished.

Fatma Pakdil [10], has studied using relevant variables of Lean systems in relation to organizational culture and organizational infrastructures for effective lean implementation and sustainability.

Meanwhile Phan Chi Anh, Zeng Jing, [41], examines the practices of Kaizen in manufacturing plants and its influence to the national and organizational culture.

Naqshbandi and Kaur, [36] explained the findings of five dimensions of organizational culture with most and dominant in Malaysian high-tech industries. However, Kevin Baird, Kristal Jia Hu, [27], study using Kaynak's four core TQM practices (quality

data and reporting, supplier quality management, product/service design, process management) and results suggests that TQM practices are interrelated and help to achieve the operational performance goals and enhancing innovative business

### 2.3 Organizational Sustainability Factors

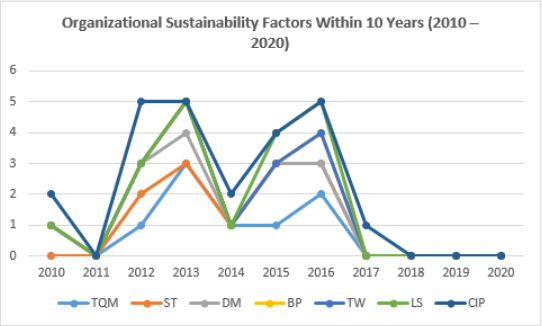


**Figure 3**. OS Factors

From a review of the extant literature, organizational sustainability is proposed and shown in Figure. 3. For example, Zokaei, Manikas, and Lovins [50], discuss and review the strategy between the field of environment in sustainability and lean in quality management for business system. With new insights to these fields, the results show that it has been evolving even though the environmental protection has a cost, it should be regarded as an opportunity for enhancing economic performance.

Hammadi and Herrouz [18], study on Lean project management as a sustainable hybrid model optimizing and controlling all processes, defining essential values and steps to well manage a manufacturing project generally. This model shows a practical step to manage a lean project chart for both model and methods to eliminate waste money, time and optimize a new product manufacturing based on industrial production system.

Perrott [39], has reviewed the awareness on the importance of sustainability that embraces the economic, social and environmental dimensions. This awareness focuses on the operations of a tactical approach for short-term to a long-term strategic orientation, including leaders, managers, and culture is an integral part of a systematic sustainability process.

Galpin [13], urges to develop an organizational infrastructure using a multidisciplinary model for the relationship between organizational culture and sustainability within their own organizations. As a result, it will use as a road map for practicing managers to create a positive employee and organizational-level sustainability performance.

Peterlin, Pearse, and Dimovski [40], discussed the effective of sustainable leadership approaches for strategic decision and the implications of worker leadership based on strategic decision making by the authority of an organization.

Sarah Elena Windolph, Stefan Schaltegger [44], discuss factors that affected the application of sustainability management tools and examined to what extent awareness may influence to support companies to contribute to sustainable development.

## 3. Findings

Although some issues regarding the limitations of the study have been clarified earlier in the previous study, nevertheless this research also highlights some issues and areas of improvement that feel need to be explored further to achieve an inclusive understanding of continuous improvement, organizational culture and organizational sustainability.

1. There are several important tools identified in this study used for sustainability model in the automotive manufacturing industry in Malaysia such as ISO9000, Lean management (Toyota Production System), 5S, PDCA, Kaizen, FMEA, QFD, TRIZ, BSC, 6 Sigma, TOC, Benchmarking, TQM, SPC, MBNQA and others. It is very important and helps the organization to improve the sustainability as well as business performance. But according to Nadia Bhuiyan, Amit Baghel [35], in addition to tools, methodology is also very important to be used in problem solving especially to achieve IR4.
2. In-depth knowledge is required of the equipment needed by an organization. Sometimes the use of external specialists is needed to increase the effectiveness of equipment management [3]. The Malaysian Manufacturers Association (FMM), reported that most manufacturers are aware of the concept of Industry 4.0 (IR4.0), but only 30 percent have started investing and taking advantage of modern technology. This is supported by Zheng, Ardolino, Bacchetti, Perona, and Zanardini [49], indeed, the industrial revolution 4.0 (IR4.0) encompasses specialized technologies that require high knowledge and skills to improve critical technical management and towards improving organizational performance.
3. Although it is acknowledged that Malaysia has already driven efforts towards the 4.0 industrial revolution (IR4.0), however, many experts are of the opinion that Malaysia should show its ability in making and producing high-tech products through its own skilled workforce. This is especially the case in Small and Medium Enterprises (SMEs) which show a shortage of skilled manpower which to some extent interferes with their ability to be competitive and sustainable.
4. Zheng and colleagues [49], argue that most Small and Medium Enterprises (SMEs) entrepreneurs in Malaysia still lack of strategy, especially do

not have in-depth knowledge of the IR4.0 principle. This means that although there are manufacturing companies that use this technology, they do not know the paradigm adequately; in other words, the level of acceptance is not in line with the level of knowledge. This is because, IR4.0 not only involves IT functions, but it requires knowledge of new strategies, management, human resources and other business processes.

5. In fact, some manufacturing companies that are trying to move towards IR4.0 are severely affected by the mastery of technology, equipment, and processes, as well as the lack of ICT integration, especially in developing countries. Therefore, Gamil and Asad [14], urge that future studies be more focused on research conducted to focus on the formulation of standards and network security to produce more effective product.

## 4. The Proposed Sustainability Model for IR4.0

From the reviews conducted on previous studies and findings found, a model called sustainability model to take on the industrial revolution 4.0 in the manufacturing sector in Malaysia has been proposed and is shown in Figure 4.

In this model, there are two main components that are formed, namely organization and technology. These two components form the basis of industry 4.0 which according to Szertlik [47], it can increase in work efficiency and overall productivity. While the findings show that for organizations there are three main characteristics of forming an organization that supports industry 4.0 namely in-dept knowledge in managing equipment, high-tech product through its own workforce and the last is to use new strategies. Meanwhile, for technology, there are 3 features, namely the practice of sustainability important tools, ICT integration and network security. This is in line with the recommendations of Zheng [49]; Lee, Lapira, Bagheri, and Kao [31], advances in digital technologies are changing the way products are designed and manufactured.

While according to Zlotin, Boris; Zusman, Alla; Smith [51], that introduction of the new technology or competitive innovation, may shift in our way of thinking to a new paradigm. So it proves that mastery of technology by attaining appropriate knowledge and skills becomes a crucial to achieve work practices and organizational strategies leading towards IR4.0.


**Figure 4**. The Proposed Sustainability Model for IR4.0

## 5. Conclusion

In this study, the main objective is to identify and re-evaluate all elements from previous research and develop a new sustainability model that will be able to support the sustainability of the Organization in IR 4.0. This new model approach provides a basic framework on how something should be done that will lead to continuous quality improvement.

Mike Kaye, Rosalyn Anderson [26], suggests that there must be a planned and integrated approach otherwise, the quality of a product is not or a slight improvement will be achieved.

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