

The Sustainability Challenges in the Adoption of Cleaner Production System: A Review

Muhamad Zaki Yusup^{a,b*}, Wan Hasrulnizam Wan Mahmood^a, Mohd Rizal Salleh^a, Mohd Razali Muhamad^a

^a*Sustainable and Responsive Manufacturing Research Group, Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka, 76100 Hang Tuah Jaya, Melaka, Malaysia*

^b*Department of Quality and Productivity, Kolej Kemahiran Tinggi MARA Kuantan, KM 8, Jalan Gambang, 25150 Kuantan, Pahang, Malaysia*

*Corresponding author: muhamad.zaki@kktmkuantan.edu.my

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Graphical abstract



Abstract

The adoption of cleaner production systems potentially reduces the risk of hazard in work environments, improves the environmental management performance as well as streamlining the sustainability in manufacturing operations. However, failure to identify and understand the challenges in implementing this practice may cause the implementation process becomes less efficient. The literatures showed that the requirement to balance four key challenges, namely economic performance, legislation compliance, psychological concern and social responsiveness can enhance the adaptation process of cleaner production system. The ability to detect and understanding every challenge identified is very crucial, primarily to set better focus and strategic planning on getting the optimum benefits, as well as improve the environmental performance in revolutionising sustainable manufacturing practice.

Keywords: Cleaner production; sustainable manufacturing; challenges; literature review

Abstrak

Pengamalan sistem pengeluaran bersih berpotensi mengurangkan risiko bahaya dalam persekitaran kerja, meningkatkan prestasi pengurusan alam sekitar selaras dengan usaha untuk melestarikan operasi pembuatan. Walau bagaimanapun, kegagalan mengenalpasti dan memahami cabaran dalam pengamalan ini boleh menyebabkan proses perlaksanaannya kurang berkesan. Kajian literasi membuktikan keperluan untuk mengimbangi empat cabaran utama, iaitu prestasi ekonomi, pematuhan undang-undang, kepekaan psikologi dan tindakbalas sosial dapat menambahbaik proses adaptasi sistem pengeluaran bersih. Keperluan untuk mengenali dan memahami setiap cabaran yang dikenalpasti adalah sangat penting, terutamanya dalam menetapkan fokus dan perancangan strategik bagi mendapatkan manfaat yang optimum, serta meningkatkan prestasi alam sekitar dalam merevolusikan kelestarian amalan pembuatan.

Kata kunci: Pengeluaran bersih; kemampuan pembuatan; cabaran; kajian literatur

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1.0 INTRODUCTION

In today's global challenges, manufacturers do not only being confronted with the need to increase the environmental performances, but also to improve the quality of products, work environment as well as safety and health performances. Before the idea of sustainable development becomes an important part in the manufacturing practices, the End-of-Pipe (EOP) approach are widely used to protect the environment from the pollutions generated [1, 2]. However, several manufacturers that achieved the level of sustainable manufacturing claimed that the EOP practices are costly to implement and maintained. It thus no longer efficient to be used in resolving the environmental degradation that resulted from the manufacturing activities [3].

The introduction of Cleaner Production (CP) successfully offers new opportunity in managing the environmental concerns in a more efficient and comprehensive manner. The CP that defined from the perspective of thinking based on social-technical approach has provided several essential concepts in

managing the environmental issues [4, 5, 6]. Unlike the EOP, the CP system emphasising the environmental issue at every stage of manufacturing processes. It encompasses the entire process from mining of raw material, manufacturing, production and to waste discharge [7, 8]. This finally successfully encourages the manufacturer to develop a more comprehensive prevention strategy at every stage in product development and the production cycles, primarily in handling the environmental concerns [3, 9, 10]. Moreover, the selection of CP as a key strategy to manage the environmental issues also able to cultivate the sustainable manufacturing practice as well as provide a platform to gain better economic and environmental benefits, primarily in the realisation of the circular economy [11, 12, 13, 14].

The adoption of CP as an environmental prevention strategy do not only successfully reduce the adverse effects on humans and environments, but also can increase the manufacturing efficiency and the level of sustainability [15, 16]. Moreover, the implementation of the CP also can minimises the environmental

contamination where waste is eliminated before it is produced, and eventually can reduce the cost of treatment [17, 18, 19]. However, not all of the strategy can guarantee's the successful implementation of CP. Several CP strategies that used to resolve the environmental issues might face some of the challenges that can create a difficulty in the implementation of the CP if not carefully identified [6]. This predominantly happens in small and medium manufacturing sectors, where the number of manufacturers that have less effort in managing the industrial waste and emission of pollution is remain higher compare to the number that actively engaged with CP [20].

The ability in implementing CP does not only depend on the process of planning, implementation and monitoring. The identification of the challenge in the implementation process also needed to make sure the CP can be smoothly implemented [21]. The use of old and inefficient technologies, lack of information about new green technologies and insufficient manufacturing infrastructures are the example that can impede the implementation of the CP [22, 23, 24, 25]. In addition, social issues such as the level of consciousness, psychological effects, work cultures and the uncertainty of economic performance are the others challenge that always occurs during the implementation process of the CP [24, 26, 27]. The ability in identifying all of these challenges, potentially can reduce the failure rate and provides the accurate focus in adopting the CP system. Therefore, this article will discuss and disclose the challenge that could arise during the implementation process. This information can provide the basic understanding and ideas to the manufacturer, primarily in developing the finest strategies in overcoming the challenge of ensuring the CP can be comprehensively implemented for the optimum result.

The organisation of this article was as follows: explanation on research method was described in section 2. Next, the discussion on the challenge faced during the implementation of CP is in section 3, and finally the discussion and conclusions along with some suggestions for future research was described in section 4.

■2.0 RESEARCH METHOD

The research in this article was carried out in two main stages. At the first stage, the main focus is on the process of collecting the information that correlated to the challenge of implementing the CP system. A systematic qualitative review against several research papers published from 1995 to 2013 was performed at this stage. By focusing on the limitations, findings and issues arising from each paper that referred, each element is carefully identified. This is to make sure the rigorous and accurate information discovered during this process are reliable [28].

As one of the environmental management methodology that can be integrated at every stage of manufacturing operations that involve with social-technical aspects, every challenge must be identified wisely [5, 29, 30]. This is because, the adoption of the CP has also depended on the ability of the manufacturer in identifying and overcoming the challenge that possibly arise during the implementation process [24].

At the second stage, the synthesis process of the information obtained from the first stage was carried out. The structural analysis was then used to identify the challenge that possibly occurs during the implementation of the CP. Next, each of the challenge is then grouped according to the classification identified. Finally, a comprehensive discussion was conducted from various aspects to obtain a better understanding of how the challenge identified can cause the failure in adopting the CP system.

■3.0 SUSTAINABILITY CHALLENGES IN CLEANER PRODUCTION SYSTEM

High competency level in identifying the challenge has a significant influence on the implementation of the CP [21, 26]. This will allow the manufacturer to plan and implement the CP strategy without any restrictions, primarily in managing the environmental issue to attain the high level of sustainable environmental management practices [17, 31, 32, 33]. Lack of understanding in identifying the challenge can cause the implementation process becomes less efficient or failed [6]. This is not only bringing the negative implications in managing the environmental issue, but also can influence the manufacturing sustainability performance by the manufacturer.

The following sections will comprehensively discuss and explore how economic performance, the legislation compliance's, the performance of psychological concern and social responsiveness can become the major challenge in the adoption of the CP system in manufacturing operations.

3.1 Economic Performance

Economic performance, perceived to have an important role in the adaptation of the CP system [7, 26, 34]. Although high investment is required at the beginning stage, CP has been proved successful in providing the economic benefits of long term operation [5, 13, 18]. It is typically occurs when the manufacturer need to invest in purchasing new machinery and equipment that use green technologies, utilisation of new materials that environmentally friendly, energy and labour in fulfilling with new environmental standard [1, 21, 27, 35]. However, several manufacturers, primarily in small and medium manufacturing sectors perceive this as a big challenge in adopting the CP system because they usually have a limited financial resources [16]. Lack of ability to provide good financial resources possibly can limit the ability in providing the suitable infrastructure in implementing the CP systems comprehensively. In addition, unwillingness or inability to provide an appropriate financial fund, primarily in research and development activities also can cause the transition process towards CP rather small or too slow [25, 36].

Good financial resources can enhance the ability of the manufacturer in identifying the risks and opportunities in filling the gaps that required in adopting the CP system [37]. Meanwhile, the difficulty in providing a sufficient financial resources, budget and funds can influence the performance in providing an appropriate infrastructure, utilisation of cleaner technology, and employ the competent staff become complicated [16, 24]. Without a good economic performance and sufficient resources, the manufacturer will face a difficulty in implementing the relevant changes during the implementation of the CP [38]. This eventually can cause the implementation process of the CP cannot be fully realised. Most of the manufacturers that are comfortable in implementing the passive approach in managing the environmental issues claimed that the prioritisation in addressing the environmental issues always contributes in raising the cost of operation. Therefore, the priority in managing the environmental issues were not popular among the manufacturer, especially in small and medium sector, even though can increase the manufacturing competitive advantages [16, 27]. This eventually makes manufacturers always lag behind in cultivating the green innovation practices [39]. Moreover, it also can jeopardise the use of new environmentally friendly technologies as well as less contributes in technological change and innovation in developing sustainable green factory. As an integral part of the social process that correlated to economic, political, ethical and cultural values, the ability to overcome this challenge is crucial, primarily in achieving high adaptation process of the CP systems.

In several manufacturing sectors, the challenge of implementing the comprehensive CP practice also influenced

from the operation inertia inside the manufacturing organisation itself. Most of the manufacturers are still comfortable utilising the conventional pollution reduction technology such as EOP in managing the environmental concerns. This is because the EOP requires only a small investment, less of development, changes and disruption against current manufacturing process and existing facilities compared to CP [2, 36]. In addition, the awareness of the manufacturing organisation itself can influence on funds allocated in implementing the CP strategy. Most of the manufacturers assume that the implementation of CP is very costly and possibly unable to cover the overall production costs, particularly in small and medium manufacturing sectors [21]. This was evidenced where 21.7 percent of small and medium industrial has highlighted out these issues as main challenge that impede them from implementing good environmental programs in the polish industry at Norway [38].

3.2 Legislation Compliances

The implementation of the CP concept has surged in the 1970's, successfully improve the complementation of the environmental regulations [16]. The introduction of the regulation in promoting higher standards of quality environment management successfully stimulates and promotes the adoption of the CP systems in manufacturing operations. Through the regulation, the environmental awareness has increased [18, 31]. Conversely, weak legislative context in the enforcement can become the greatest challenges that impede and influence the implementation of the CP system [26]. This subsequently causes several parties always questioned about the commitment (the authority and government bodies) in the enforcement of the laws and regulations [37]. This potentially causes the manufacturer receives less of the information, and lack of clarity about the environmental legislation that enforced. This also can influence the compliance's level with the laws, and cause the implementation of CP was not efficient, that eventually cause lack of control in implementing the CP system [21]. This will provide the space for the manufacturer to take the advantage by not prioritise the action in overcoming the environmental issues.

High commitment level in the enforcement is important to make sure the manufacturer always complies with the environmental legislation. This indirectly will urge the manufacturer to develop the initiative and strategic plan through joint responsibility between employer and employees, and cooperation with the authority in fulfilling the requirement in the legislation, and subsequently allows CP to be adopted comprehensively [2, 40]. The ability to overcome the challenge in complying with the environmental legislation is very crucial because inability to comply with the legislation enforced will create a space for error in adopting the CP system. Although the elements of the CP are stated in the environmental policy documents, the goal of CP is possibly not achievable if do not have the ability to overcome this challenge, primarily in complying with the legislation enforced [32].

The manufacturers must always implement more proactive measures in overcoming the challenge that is outlined in the legislation that's being enforced [27]. Unlike the EOP that was known as the reactive approach, the implementation of CP can be integrated in all process to attain the optimal results. Although several manufacturers actively used the EOP approach in complying with the environmental regulations, this initiative still not reached the level of CP. This is because the EOP only been used at specific stage when problem occurs, but the CP can be adapted at every stage of the manufacturing process as early as the beginning stages of product development [27]. Therefore, the cooperation between manufacturers and authorities is crucial in enforcing the environmental legislation, primarily in promoting the CP system. This will encourage the manufacturer taking early action without waiting for the problem occurs. The weakness in enforcement action will lower the rate of legislation

compliance's, which can give a bigger challenge in adapting the CP system in manufacturing operations.

Environmental law that is not strictly enforced, low awareness level, not consistent and lack of coordination are the challenges that can restrict the compliance of environmental policy [24,39]. This consequently can cause the environmental policy not fully understood and causes the implementation of CP becomes less efficient [41]. As a medium of communication and information dissemination from management to employees, the ability to develop good environmental policy that in line with the environmental legislation is important. This is because the environmental policy can provide the precise information as well as able to retain good internal communication in ensuring the formation of environmental policy is fully implemented. The absence of clear environmental policy can cause lack of cooperation, and possibly can restrict the communication within the manufacturing organisation [29]. This consequently can create a big challenge to the manufacturer in complying with the environmental legislation, and eventually impede the adoption of the CP practices.

Besides, the lack of technology, the absence of appropriate infrastructure and low technical skills also can create a great challenge in complying the environmental legislation, and eventually influence the performance level in adapting the CP system [22, 26]. This is one of the reason why manufacturers not able to fulfil the requirement of this legislation, especially in addressing a complex environmental issues. For example, less ability in managing the increases of natural resources utilisation and energy can cause the manufacturer do not able to provide a good response to an environmental issue that possibly arises due to not able to provide an appropriate infrastructure and good facilities [16]. Moreover, lack of technical collaboration, low information sharing level, low manufacturing capacity and only the small number of employees have a relevant technical skills also was the challenges that potentially reduce the level of environmental legislation compliance [24]. This consequently can increase the gap in complying with the environmental regulations that been enforced. Therefore, the ability to improve the technical skills and increase management capacity is critical, not only complying with the legislation, but also in increasing the successful implementation of the CP [42].

Technological innovation also plays an important role, primarily in improving the efficiency of manufacturing operation as well as in managing the environmental issues [43]. The efficiency in adapting the innovation through the utilisation of CP technology, manufacturers not only can comply with the requirement in environmental legislation, but also capable of reducing the usage of labour in the traditional management model [44]. Moreover, it is also can provide the opportunity in increasing the ability to detect the preliminary causes of the environmental problem from various aspects at an earlier stage. This will subsequently provide the advantages to the manufacturer in obtaining good economic benefits [6, 16, 34]. However, low awareness in implementing the innovation process and less of acceptance with CP technology also was the challenges that need to overcome in practising the CP system [9, 21]. The lack of ability in overcoming this challenge not only can create the big gap in adopting CP technology, but also can increase the chances of non-compliance or breaches the existing environmental legislation. If this challenge is not being carefully handled, it will also produce the negative effect to the other subsystem in manufacturing organisations [45].

Therefore, the manufacturer must have a comprehensive plan on increasing the pace of innovation process, primarily in streamlining the development and the utilisation of the CP technology in entire manufacturing operations [26, 30]. The reluctance to adopt the CP technology or accept the technological change in environmental management can create a big challenge to the manufacturer, primarily in obtaining the optimum benefits from the adoption of the CP systems. Ability to overcome this challenge not only increases the compliance level to the

legislation, but can increase the level of sustainability in implementing the CP system in manufacturing operations.

3.3 Psychological Concern

The level of psychological concern also one of the challenges that need to be prioritised in ensuring the CP system can be implemented comprehensively. The function, culture, behaviour and the mind set of employer and employees prominently influence the performance of psychological concern in promoting the adaptation of CP practice. This is because it will directly influence the action taken in handling the environmental issues, primarily during the exchange process of information within the organisation in promoting green technology innovation, primarily through the adaptation of CP technology [10, 26]. Conversely, the low level of psychological concern will produce a low awareness level over the environmental issues, that possibly due to lack of knowledge about CP, thus cause a difficulty in the implementation of the CP [24]. Moreover, the implementation of the CP systems also highly depends on the continuous knowledge of employers and employees in streamlining the innovation process in manufacturing operations. In large manufacturing sectors, the level of information sharing and knowledge plays an important role in developing the radical innovation in manufacturing operations [46]. Lack of knowledge, prominently will influence the stability level of psychological concern of both employers and employees, primarily in achieving a high acceptance level in CP practices.

Besides, lack of knowledge about the environmental legislation, potentially creates the chances in the violation of legislation, and thus creates a bigger challenge to the manufacturer in adapting the CP practices. Andrews *et al.* [47] claimed that nearly 49 percent of small and medium manufacturing sectors do not share their knowledge and experience in the implementation of CP. This possibly occurs because of several manufacturers have lack of information on the consequences, the importance and the requirement against the community in the surrounding. This eventually can increase the gap in the implementation of CP, where manufacturer potentially not able to identify the current techniques and technology in CP that available in the market [36]. This consequently brings new challenges to the manufacturer in determining the risk, finding new opportunities, and formulating new strategies in addressing the environmental issues [37]. Additionally, lack of relevant information, possibly cause manufacturer using improper technique and take unsuitable action in implementing CP strategies. As a result, the techniques used are not consistent with the need of manufacturers in adopting the CP system. Therefore, it is important to have the structural information about CP, primarily on increasing the awareness on the psychological concern in ensuring the environmental issues are manageable efficiently [31].

Hoof and Lyon [16] claimed that lack of resources, low level of knowledge, the limited technical information, lack of analytical skill of know – how, are among the major challenge that need to resolve in implementing the CP practice. This consequently will influence the performance of psychological concern in addressing the environmental problems. As an efficient approach in dealing with environmental issues, the adaptation of CP techniques and practices at a faster rate were required [48]. Therefore, high awareness level on the psychological concern over environmental issues is required. The ability to overcome this challenge is very crucial, not only to make sure CP successfully adopted, but also to streamlining the action required in handling the competitive pressures that arise from outside market that can create additional difficulty in implementing the CP systems [27]. The inability to overcome this challenge will cause a conflict situation where manufacturers must choose either want prioritise the action in handling the environmental issue through the adoption of the CP system, or focuses on the action in fulfilling the business goals [21, 32].

The level of sensitivity and psychological concern by manufacturers, prominently successfully increase the environmental management performance, particularly because of the pressure from the strict enforcement by authority [35]. However, the increase pressure in operation and material costs, uncertainty in market, looseness of enforcement and lower consciousness level of the society on the standard in handling the environmental issues will cause the manufacturer less concern, and eventually the implementation of CP systems turns into less efficient [49]. This is because the efficient implementation of the CP system requires a good knowledge and broad understanding with specific focus, comprehensive strategic plan and sufficient financial budget to be adopted, implemented and maintained [50]. In addition, lack of ability and the low psychological concern in handling the uncertainty of market and environmental can cause manufacturers become less sensitive, and the flexibility in addressing the environmental issues is not being prioritised. Thus, the adoption of CP systems can become a great challenge, primarily at the beginning adaptation stage if this challenge not carefully handled [51].

3.4 Social Responsiveness

The sustainable development of the CP system requires excellent support and cooperation from all parties involved. This will offers the opportunity to the continuous improvement activities, particularly in handling the environmental issues. However, lack of ability in providing the correct guideline in environmental stewardship, service, quality of product and safety can reduce the responsiveness level by manufacturers over environmental issues, and eventually creates another challenge in the implementation of the CP systems, possibly due to by the culture in the organisation itself [52, 51]. The organisation that is not sensitive to the needs in increasing the environmental performance can cause the implementation level of the CP become less effective. Therefore, the ability in overcoming the challenge to increase the social responsiveness is important, primarily in ensuring the successful implementation of the CP system are fully achievable. It is not only allows the manufacturer to respond quickly against the needs of the market, but also can increase the level of responsiveness in handling the environmental concern [53]. This potentially be enhanced through systematic product reformulation, stability of the manufacturing process, standard of analytical instruction and documentation because of the changes in the legislation that enforced [2].

The awareness and the involvement of all parties in the organisation is essential in improving the sustainability action in handling the environmental concern, as well as to increase the success rate in implementing the CP strategy [21, 32]. Meanwhile, lack of awareness level can decrease the focus against environmental stewardship, and consequently can increase the challenge in implementing the CP system in manufacturing operations comprehensively. This is because, the level of responsiveness and the affordability in identifying the issues before the problem arises is better than the actions taken after the problem occurred [27]. This indirectly can increase the chances to the manufacturer to develop the best strategy and practices at the early stage, and eventually allows the suitable action be implemented in managing and controlling any issue and challenge that arise in the manufacturing operation with more efficiency.

The values and behaviours that form the culture in the organisation also contribute to the action in handling manufacturing operations. Lack of sensitivity in the organisation and low commitment level of employees over environmental issues also contributes in decreasing the responsiveness level in implementing CP practice [26]. The performance of environmental management and employee's involvement has a close relationship with each other, primarily in encouraging the process of innovation and increase the momentum for

improvement in implementing CP systems [9]. The extensive contribution and high continuous support in implementing CP can provide a broad range of implications for the community in a manufacturing environment, particularly to overcome any challenge arises. Furthermore, through the process standardisation and the proactive action also crucial to develop a good culture in retaining high sensitivity in implementing the CP system [52].

Moreover, lack of effective training programs and weak management style can cause employee less involved in the transformation action towards the CP, thus causes the implementation process relatively slow or less efficient. Conversely, the ability to have high employee involvement and high motivation level, particularly in decision making prominently can improve the quality of work environment, and developed competent personnel in increasing the adaptation of the CP technology [4]. Furthermore, it will increase the ability to develop the best practice, and increase the opportunity in implementing the CP system. This is because the employees have a large influence on the manufacturing environment since directly involved in each stage of the manufacturing process [54]. Lack of participation and involvement by employee, particularly in decision making can cause lack of responsiveness in handling the environmental concern, subsequently creates another great challenge in adapting the CP system in manufacturing operations [21, 27].

4.0 DISCUSSION

The literatures shows that each challenge identified can influence the level of implementation of the CP system. Each challenge does not only creates a difficulty in the implementation of the CP, but also indirectly contribute in increasing the difficulty against the other challenge identified in the implementation the CP system as illustrated in Figure 1.

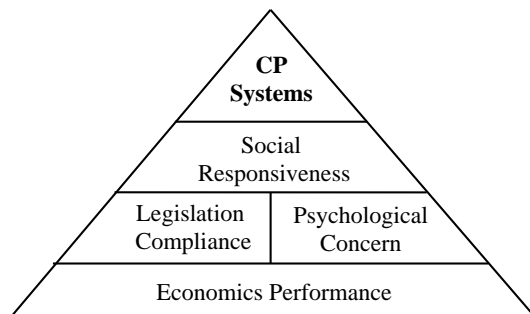


Figure 1 The pyramid of the challenge of implementing the CP system

From Figure 1, the economic performance observed as the major challenge that may influence the adaptation level of the CP system in manufacturing operations. Most of the strategy in the CP requires the radical action in innovation by the manufacturer, where several changes over the manufacturing process and the work arrangement is required [6, 9, 55]. These changes require the manufacturer allocate additional investment budget such as to purchase new machinery and equipment in improving the efficiency of the process and operations [56]. The lack of ability to allocate the sufficient budget and resources could cause the manufacturer always lags behind in the innovation process and miss a chance to adapt with the latest green technology. This consequently will create the risk to the violation of the legislation, reduce the performance of psychological and lack of focus in addressing environmental issues that arise, primarily in a small scale manufacturing organisations [16, 45, 57, 58].

Meanwhile, weaknesses in the implementation and the enforcement of the environmental legislation was the another challenge that can create a difficulty in the implementation of the

efficient CP system. The legislation compliance issues such as less efficient in the coordination and different enforcement level from the authority on regulatory compliance status will cause the transparency in enforcement is questionable [37]. These further causes the manufacturer has less of consciousness, and not prioritise the environmental issues in manufacturing operations. Besides, ambiguity of information on environmental legislation because of the rigidity and complexity in legislation will cause the environmental policies and goals that be formulated might not achievable and difficult to be complied [32]. In addition, the legislation that often changes could also create a difficulty for manufacturers to comply with the requirement. This indirectly urges the manufacturer to develop more comprehensive action, where the implementation of few strategy possibly requires the utilisation of the outside expertise [36]. However, this resolve involves of high costs, and for small scale manufacturing sectors might do not have a sufficient financial resource in handling this challenge, and thus creates lack of compliance with the legislation [21].

Besides, the large gap between latest information on CP and the adoption level of CP technology will produce big challenge on psychological performance in adapting CP practice in manufacturing operations. This will influence on the action in use, primarily in identifying the source and strategy in overcoming the inherent environmental problems, as well as in implementing efficient CP practices. The existence of this gap possibly due to lack of training and also because of less of technical and management information on implementing the CP system [37]. Lack of ability in handling this challenge could cause the absence of knowledgeable staff that is in line with the updated technology and strategy in handling and managing the environmental issues [16, 26, 47]. Lack in providing the sufficient knowledge and not able to provide good motivation to the employee always creates a difficulty, particularly in promoting the innovation of the best practice in adapting the CP practice. In addition, lack of action in reducing the gap also caused by the financial constraints in the organisation itself. This occurs due to the pressure from the market that requires the manufacturer to provide more effort in streamlining the production process instead of tackling the environmental issues. Lack of ability in increasing the psychological performance, eventually will affect the corporate behaviour and social changes, the values and the paradigm in implementing the CP strategy. It is very crucial in increasing the awareness level and ensuring the implementation of CP practice is achievable [49].

Moreover, both challenges, namely legislation compliance issues and psychological issues able to stimulate the performance of social awareness level in the implementation process of CP. The level of social awareness will influence the action taken in dealing with the environmental problem that occurs from the manufacturing operations [13, 15, 27, 31]. Conversely, lack of awareness level that influenced by the culture of organisational will cause the development of environmental stewardship always at the lower level [26]. Based on the literature, failure to enforce the law, weakness in duplicating the law, lack of monitoring, loss of motivation and less serious, potentially produces a low performance level in social awareness [24, 58]. Lack of ability in overcoming all the challenge identified, ultimately cause the manufacturing organisation do not prioritise the strategy and action in implementing the CP practices, and consequently cause the implementation of the CP systems become less efficient or doomed to failure.

5.0 CONCLUSION AND FUTURE RESEARCH

As a conclusion, each of the challenges identified must be understandable in ensuring the implementation of the CP system can be streamlined. Each of the challenges must be carefully identified, be ranked and prioritised before the environmental policy can be formulated and developed in addressing the

environmental issue. The ability to identify the challenge is crucial in identifying the strength and weaknesses of organisations, specifically in designing and formulating the strategic plans in obtaining the optimal benefits from the implementation of the CP system in manufacturing operations. Lack of understanding of these challenges can cause the manufacturer always lags in the decision making process, thus the implementation process of CP becomes difficult to be realised, especially developing a sustainable solution in dealing with problems associated with the environment. This process is also very crucial, primarily on increasing the success rate in integrating the CP systems at every stage of the manufacturing operations.

For future research, the finding in this article is suggested to be used in the field study in evaluating the performance of an adaptation of the CP system in the Malaysia's manufacturing industry. This can provide a better understanding as well as to validate each of the challenges identified, primarily in formulating the action required for the radical innovation in adopting the CP systems. The analysis and the investigation on each challenge also can provide valuable information for the manufacturer in developing a better contingency plan in overcoming the challenge that be highlighted. Furthermore, it is also can be used to form a basic understanding and provide new ideas to the manufacturer in increasing the effort to overcome the challenge, and thus make sure the CP systems can effectively implement as well as in achieving high level in manufacturing sustainability.

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