Green Industry System Development by Applying International Standards

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***Abstract*—Environmental management and corporate social responsibility become important business improvement priorities especially for factories in Thailand. The objective of this research is to develop a green industry system by applying international standards. This research focuses on developing a quality management system (QMS) by integrating ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010 to pursue green industrial system standard. The quality manual is developed, tested and evaluated in the pork processing case factory. The integrated QMS has surfaced the problems regards to environmental management and the way to solve them. Consequently, the case factory has achieved the green industrial system according to Thailand's standard. This research will be useful to practitioners and researchers in guiding the way to develop a green industry system.**

***Index Terms*—green industry system, ISO 14001, ISO 50001, ISO 26000, integration.**

I. Introduction

The business competition today has never been fiercer. Organizations tend to focus on reducing costs to maximized profit. Causing the inefficiency in productions, as a result, the use of excessive amounts of resources and lacking of awareness may also leads to pollutions and accumulation of countless contaminations, which inevitably creating impact to the environment. The sequel to cause global warming, depletion of natural resources, air pollution and many natural disasters [1] follows, for examples, earthquake, flood and tsunami, destructing to the global economy as well as lives and property greatly.

The effect due to the growth of the economy and industry without regard to the impact on the environment causes pressure on business organizations to take responsibility socially and put more awareness environmentally and possible future impacts. The concept of the green industry is a way for organizations to prepare for adaptation to create a balance between the economy and the environment, all the while focus on promoting the growth and development of the industry [2]. This is to encourage industry to engage environmental friendly environment. As a result, the industry has a good image, reliabilities [2], that can coexist with society, gaining public trusts and the creation of a green economy that would also leads to the increase in the Green GDP of the country and reduction on the use of hazardous substances. This enhances the competitiveness in the green market [3] which will contribute to sustainable development in the future. Hence, this research aims to develop an integrated green industry system model by application from ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010 in a case company.

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II. Literature Review

Nowadays, there has been increasing interest and demand for green products that are more environmentally friendly in Thailand [2]. This will bring Thailand to be a low-carbon society. Establish rules to ensure a balanced development of industry and the environment. To this end, in 2011, was a year of awakening green towards sustainable development. The Government sector of Thailand, Ministry of Industry, as the lead agency, has the development strategy for the environment and society by implementing proactive way with the understanding of the firm's technological responses to the implementation of environmental management tools and integrating it with other standards by providing better opportunities can create value to the organizations [4], focusing on the promotion and development of industry growth and sustainable development, as it has ratified in the Johannesburg Declaration on Sustainable Development in 2002, as well as Manila Declaration on Green Industry in Asia in 2009, and has progressed to full drive industries into green ever since. The green industry of the Ministry of Industry in Thailand situated on two main ideas. Business operations should be environmentally friendly with a strong sense of social responsibility, and business operations will need to be updated continuously to advance sustainable development. So that green industries means, an industry is committed to eco-friendly operations to create a sustainable development with a focus on the development and improvement of the production process and the ongoing management of the environment, including both internal and external corporate social responsibility throughout the supply chain, from Level 1 to Level 5 as follows.

The development and implementation of green industry are lead by the strategy of the Ministry of Industry in Thailand is base on a concept of operations that are environmentally conscious and socially responsible and continuous improvement towards

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sustainable development. The Ministry of Industry in Thailand, has divided the green industry into 5 levels base on the concentrations of the operation as Table I.

TABLE I. LEVEL OF GREEN INDUSTRY DESCRIPTIONS

Level of Green Industry	Description
Level 1: Green Commitment	Committed to reducing the environmental impact with a good broadcast internal communication within an organization.
Level 2:Green Activity	Activities to reduce the environmental impact can be achieved by the determined set.
Level 3:Green System	The environmental management system has been assessed and reviewed for continuous improvement, includes receiving environmental related award that are recognized and certified.
Level 4:Green Culture	Is that everyone in the organization, cooperate to create an eco-friendly operations in all aspects of business to become part of the corporate culture of the organization.
Level 5:Green Network	Is to extend the network throughout the supply chain by encouraging green suppliers and partners becomes a part of a certified green industry.

It can be seen that the aim for the green industry to gain balanced and sustainable development, is key to the economic growth of the industrial sector to be consistent with potential and the feasibility of the ecosystems along with the well-being of society. Some of the good examples are the conservation of energy in the production process, resource use and cost by using the 3Rs Reduce, Reuse, Recycle and Clean technology, Green Productivity, Eco-Design, Eco-Product, Green Label or Eco-Label, The study and analysis of the product life cycle (LCI-LCA), Pollution reducing, Greenhouse gas emissions reducing, etc [2].

Table 1show that the green industry consists of all 5 levels. Each level of the green industry varies, where organization with green industrial development should have the following: Level1, Green Commitment. Level2 Green Activity, before stepping into the green industry. Level 3, Green System. Level 4, Green Culture and Level 5, Green Network respectively. Level 1 is the Green Commitment; the organization must have a policy and communications staff in the organization's environment as thoroughly. Level 2 is the Green Activity; the organizations need to be treated like Level1 in every respect, but with subject to the environmental plan, environmental plan must includes, objectives, goals, procedures, responsibility and time frame for completion. Then the organization should put environmental plans into action in order to create effectiveness. Level 3 is the Green System; organizations should be treated just like in Level 1 and Level 2 in all respects of the green industry. In addition, in Level 3 is the Green System of criteria in the form of environmental policy, planning in order to minimize environmental impact and pollution prevention, introduction to the practice of environmental, monitoring and evaluation, Monitoring or measurement of environmental quality, reviewing and maintaining an environmental management system [5] in accordance with the time limit to ensure that the environmental management system to be effective and corresponded with the various requirements. It can be seen all three Levels, from Level 1 to Level 3 is associated with Environmental management system. The international standard for environmental management systems (ISO14001:2004), aims to create sustainable improvements in the practices of participating firms through the integration and implementation of appropriate environmental management tools [4]. EMS helps firms in reduction of inputs, raw material utilization and operational safety [6] and to make the organization is aware of the importance of the environment and reduce harmful effects on the environment of activities going on, that will contributes to the environment improvement, along with business development [7].The preparation of an environmental management system standard, this has strengths to create satisfaction in buying products that are environmentally friendly and to promote sustainability. Additionally, increase confidence in financial institutions and insurance investment due to the prevention and control of risks and hazards that can occur [7]. It also helps the employees in the organization to be aware and encourage more participation in environmental management [7]. Resources are to be used cost-effectively in energy management system standard (ISO50001:2011) [8], with a focus on pollution prevention and continuous improvement, and energy management system. It is compatible with the environmental management system standard (ISO14001:2004) [9], in order to help focus energy and take into account the added expense of using more energy. All the following are associated with environmental concerns, therefore, the energy management system will help further reduce energy costs; reduce greenhouse gas emissions, and environmental aspects. The preparation of this energy management system standard has a distinctive strength to assist in the satisfaction of buying an energy efficient manufacturing process by monitoring and energy management system and continuously monitored periodically to assess the cause for defects that should be fixed. It can be seen that the environmental management system is also the basis for the development to enter a green industries, according to “Plan, Do, Check, Action” [5], with the provision of energy management systems (ISO50001:2011) standard fulfill the environmental management system (ISO14001:2004) [9]. These two systems have similar requirements and (ISO 14001:2004) EMS more closely into alignment with the (ISO 50001:2011) EnMS. Where the Energy management system (ISO50001:2011), will focus mainly on improving the energy consumption continuously, including energy efficiency, energy use and consumption [8]. When the two standards are adapted to be use in the green industry, it will increase competition and an opportunity to strengthen the organization. This would result in the recognition of the quality of the product, and recognition from the consumers, as well as sustainable trusts from related agencies, both domestic and international.

Moreover, as you can see that in Fig. 1, in Level 4 is Green Culture and Level 5 is Green Network. The Level

4 and Level 5 will increase in concentration respectively. The study found that the criteria of the sector in terms of Corporate Social Responsibility to play an active role in the development of green industries in Level 4 and Level 5. According to standard guidelines for social responsibility, also known as, ISO26000: 2010 [10], is to be used in the culture of the organization. The purpose of this standard shall be used for the inspection and certification standards, but is intended to support and encourage organizations to voluntarily comply. Because the act to take socially responsibility is the willingness to do good by heart, not by forced, the legal proceedings is just the basis act of responsibility. This social responsibility standard focuses on the activities are consistent with the law, promoting a better understanding about social responsibility. Creates honesty in the implementation of various aspects [11], and to promote and encourage the practice in an ethical manner [10], respecting respond to the interests of people who will benefit or loss from the situation. Creating a culture of social responsibility within the organization, including the protection of health, safety of consumers, pollution prevention and the creation of added value, promote product brand and companies' reputation with ethics, will help to develop and implement projects to drive the green industry according to the Ministry of Industry in Thailand as stated above.

A guide of green manual will be created to prepare for the green industry system that will guide other organizations to reduce the time to prepare a system manual and reduce redundancy in the performance of the employees and improve communication within the organization by removing traditional management system [12] to help the industry with an environmentally conscious and socially responsible. As a result, more jobs are created, shop safety, and reduction of energy and resources usage, lessen the impact on the environment and surrounding communities, improved internal management methods, increased employee motivation and creating a good image of corporate responsibility [7] which leads to the creation of new market.

III. Green Industry System Development

Green industry system is the standard management with production, equipment, raw materials, subsidiary materials, technology, organization, and environment. Therefore, this research chooses ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010 for green industry system development. This is because these rules are a standard guideline. In addition, the above mentioned benefits from implementation of all the three international standards characterize a green industry system. After successfully implement this green system, the factory would be better comply with environmental laws regulations [13], reduce energy consumption [9], and increase social responsibility to promote and encourage the practice in an ethical manner [10]. The process of green industry development consists of 4 steps. These steps are shown in Fig. 1.

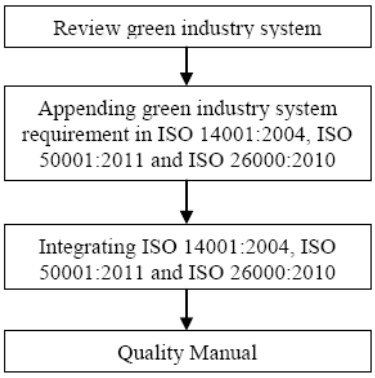

Figure 1. The process of green industry development

A. Review Green Industry System Requirement

The Ministry of Industry in Thailand describes that the green culture system (level 4) is the suitable environmental management system within organizations because this green system supports organization to create an eco-friendly operations in all aspects of business to become part of the corporate culture of the organization. Therefore, this research would select the level 4 of green industry system. After studying, it is found that there are 31 criteria in the green culture system.

B. Appending Green Industry System Requirement in ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010

In this phase, this paper Appends green industry system requirement in ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010 by Delphi technique because this approach is a method to obtain or collect the opinion of experts on a particular subject without necessarily bringing them together face to face [14]. The environmental experts consists of 3 people including auditors from the Ministry of Industry in Thailand, the expert from the educational institution and the expert with International Organization for Standardization. The Delphi result of Appending green industry system requirement in ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010 is presented in Fig. 2.

C. Integrating ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010

Integrated management system is a good approach for combination all International Organization for Standardization. This is because the integration of management system helps organizations to integrate all of an organization's systems and processes into one complete framework, so they can work a single system with unified objectives [15]. Therefore, this paper would use the integrated management system to combine ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010 to one system. The overarching model is shown in Fig. 3.

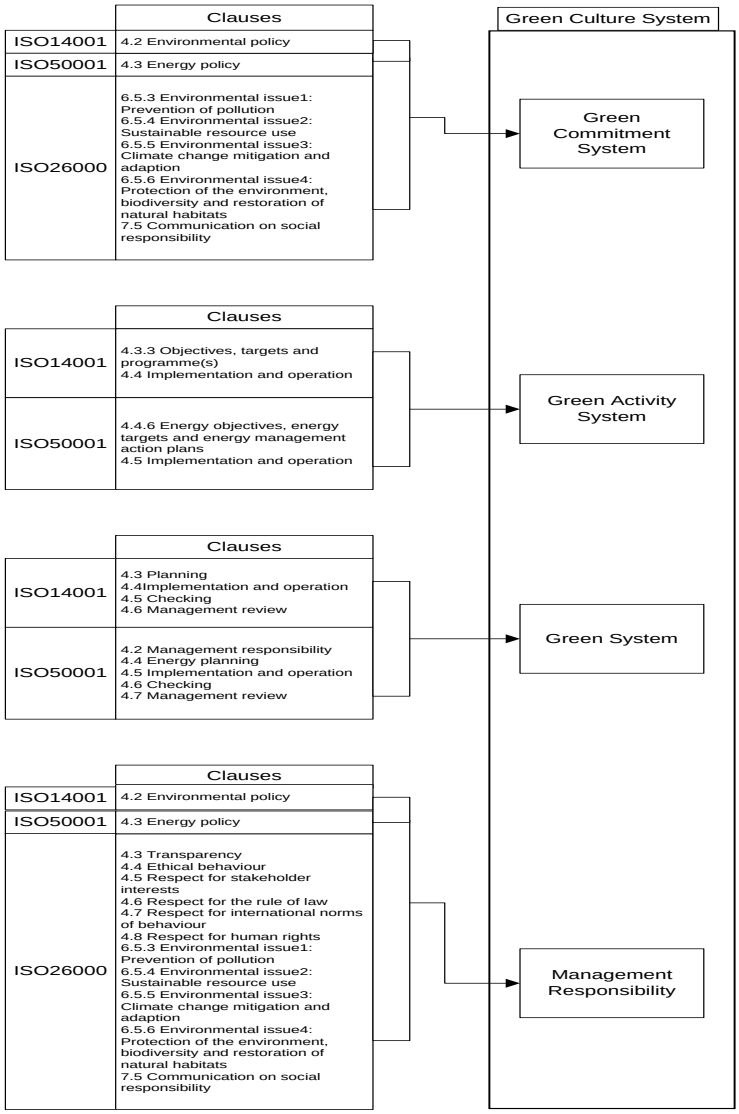

Figure 2. The relationship between green industry system requirement and ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010

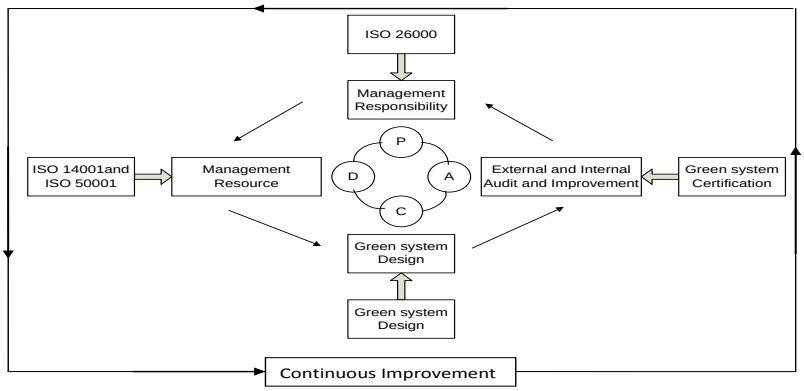

Figure 3. Model of green system development

The Green system model represents process model, which bases on green industry system requirement, for the design and systematic improvement of green industry system in Thailand. Additionally, this approach support organizations to be continuous improvement with environment management.

D. Quality Manual

After Integrating ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010, the new one system would be analyzed for green industry system development. The result of analyzing was used in writing quality manual

for green industry system development. The clauses of quality manual as follows:

1) *General requirements*
   a) *Environmental management systems, Energy management systems and Social responsibility*
   b) *Principles social responsibility*
2) *Primary assessment*
3) *Policy*
4) *Planning*
   a) *Objectives, targets and programs*
   b) *Legislation and other requirements*
   c) *Green performance indicator*
   d) *Stakeholder identification and engagement*
5) *Implementation and operation*
   a) *Operating structure and responsibilities*
   b) *Training, knowledge and awareness*
   c) *Communication, consultation and engagement*
   d) *Documentation system*
   e) *Document control*
   f) *Operational control*
   g) *Emergency preparedness and response*
   h) *Social responsibility*
6) *Checking*
   a) *Monitoring measurement and analysis*
   b) *Compliance with environmental laws and standards*
   c) *Nonconformity corrective and preventive action*
   d) *Control of records*
   e) *Internal audit*
7) *Management review for green industry*

IV. Evaluation of Green Industry Development

The evaluation of new approach should be an organized and systematic procedure that involves people in a participative manner, basic data collection and joint discovery by subsequent analysis, so this will lead to creatively identify improvement opportunities [16]. Therefore, the quality manual was implemented in the pork processing factory. Additionally, the quality manual was evaluated above of feasibility, usability and utility by discussion including the participants and observations in the pork processing factory [17]. The following conclusions were written against each of these criteria:

- Feasibility: It could be concluded showed that the quality manual could be applied and followed thorough all clauses of quality manual.
- Usability: the result showed that the quality manual was easy to use and apply because this book describes procedures and best practices in each clause.
- Utility: the results represented that after implementing the quality manual, the case study would achieve green industry system development at green culture level and will get a certification from the ministry of industry in Thailand in the future.

V. Conclusion

The paper presents a comprehensive quality manual for developing green industry system by integrating ISO 14001:2004, ISO 50001:2011 and ISO 26000:2010. The main outcome of this paper is the creation of a practical and procedural methodology to introduce practitioners through the quality manual for developing green industry system. This quality manual is a holistic and a step-by-step workbook to enable the users to start the green industry system development effectively. The developed quality manual has shown high feasibility, usability and usefulness to the pork processing case factory in Thailand. The company substantially benefits from implementing this integrated green system in terms of enhancing corporate image, reducing duplication of documents sharing among the three standards, reducing auditing effort by combining the entire three standards into one green system audits. In addition, the company also benefits from each standard such as reducing Co2 emission, reduce complaint from the society, reduce energy consumptions and create customers' confidence in its product and process. The green industry system would enhance company's competitiveness, support long-term sustainability, and prepare Thai factory towards Asean Economic Community (AEC).

References

[1] H. N. A. Yong, "Implementation of integrated management system: environmental and safety performance and global sustainability," in *Proc. IEEE international Conference on Energy and Environment*, 2009, pp. 232-241.
[2] Green Industry, Ministry of Industry, Thailand, 2012.
[3] B. Nunes and D. Bennett, "Green operations initiatives in the automotive industry: An environmental reports analysis and benchmarking study," *Benchmarking: an International Journal*, vol. 17, no. 3, pp. 396-420, 2010.
[4] S. P. Sebhatu and B. Enquist, "ISO 14001 as a driving force for sustainable development and value creation," *Emerald The TQM Magazine*, vol. 19, no. 5, pp. 468-482, 2007.
[5] ISO 14001:2004, "Environmental management systems-requirements with guidance for use," International Organization for Standardization, Geneva, 2004.
[6] M. Chavan, "An appraisal of environment management systems: A competitive advantage for small businesses," *Management of Environmental Quality: An International Journal*, vol. 16, No. 5, pp. 444-463, 2005.
[7] C. Searcy, O. Morali, S. Karapetrovic, S. McLeod, D. Fraser, K. Wichuk, and D. McCartney, "Challenges in implementing a functional ISO 14001 environmental management system," *Emerald International Journal of Quality & Reliability Management*, vol. 29, no. 7, pp. 779-796, 2012.
[8] ISO 50001:2011, "Energy management systems-requirements with guidance for use," International Organization for Standardization, Geneva, 2011.
[9] T. Virtanen, M. Tuomaala, and E. Pentti, "Challenges in energy efficiency performance measurement in the process industry," *Emerald Group Publishing Limited Global Issues Studies in Managerial and Financial Accounting*, 2012, vol. 25, pp. 139-166.
[10] ISO 26000:2010, "Guidance on social responsibility," International Organization for Standardization, Geneva, 2010
[11] J. Y. Park and S. W. Kim, "Global corporate social responsibility standard, ISO 26000 and its effect on the society," *Emerald Asian Journal on Quality*, vol. 12, no. 3, pp. 315-322, 2011.
[12] A. Griffith, "Improving environmental performance through integrated management systems (IMS) in the UK," *Emerald Journal Management of Environmental Quality*, vol. 19, no. 5, pp. 565-578, 2008.

[13] I. Heras-Saizarbitoria, G. A. Land ń, and S. Sebasti án, "Do drivers matter for the benefits of ISO 14001," *International Journal of Operations & Production Management*, vol. 31, no. 2, 2011.
[14] C. Jensen, Delphi in Depth: Power Techniques from the Experts Berkeley, Singapore: McGraw-Hill, 1996.
[15] H. Eriksson and J. Hansson, "Integrated management systems – theoretical and practical implications," *Asian Journal on Quality*, vol. 7, no. 2, pp. 69–82, 2006.
[16] K. W. Platts, "A process approach to researching manufacturing strategy," *International Joumal of Operations & Production Management*, vol. 13, no. 8, pp. 4-17, 1993.
[17] N. Thawesaengskulthai and J. D. T. Tannock, "A decision aid for selecting improvement methodologies," *International Journal of Production Research*, vol. 46, no. 23, pp. 6721–6737, 2008.

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