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Case Study

IMPACT OF IMPLEMENTATION OF ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEMS ON ENVIRONMENTAL PERFORMANCE: A CASE STUDY

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The Environmental Management System (EMS) structure recognizes that both environmental and economic performances are directly linked with each other. The primary objective of implementing an EMS is to improve an organization's environmental performance continuously. Benefits of successful implementation of an EMS would include cost reduction in pollution prevention activities, compliance with legislation requirements, and a better organizational image internationally and locally. This study looks into one of the most common EMS frameworks, namely ISO 14001 EMS. This study also investigates the relation of EMS implementation to environmental performance improvement. Empirical findings of a recent study on the above in a manufacturing facility which implemented ISO 14001 EMS are presented. This company had been implemented ISO 14001 EMS since 2004 and certified in early 2005. From January 2004 until August 2010, a total of thirteen Environmental Management Programs (EMP) were implemented. Out of the thirteen EMP implemented, five EMP were for legal compliances; four EMP were for environmental operational control and the other four were for cost reduction through water and chemical conservation. In August 2010, eleven EMP had already achieved the environmental performance indicators set, compliance to legal requirements and better environmental operational control that resulted in better environmental performance; water and chemical conservation that led to cost reductions. The other two EMP were still on-going while some new EMP were planned too.

Keywords: Environmental Management Systems, ISO 14001, Environmental Performance, Environmental Management Programs

INTRODUCTION

The ISO 14000 addresses various aspects of environmental management and the very first two standards, ISO14001:2004 and ISO14004:2004 deal

with Environmental Management Systems (EMS). ISO 14004:2004 provides guidelines on the elements of an EMS and its implementation, and discusses principal issues involved. ISO

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ISO 14001:2004 specifies the requirements for such an EMS. Fulfilling these requirements demands objective evidence which can be audited to demonstrate that the EMS is operating effectively in conformity to the standard (ISO, 2010). The standard is designed to address the delicate balance between maintaining profitability and reducing environmental impact, according to British Standards Institution (BSI, 2010). A company that is certified to ISO 14001 is committed to continually improve its environmental performance. This is because ISO 14001 links an organization's activities to its environmental responsibilities. The fact that organizations worldwide have such responsibilities is mainly because of the following reasons (Nicholas and Smith, 2005):

- a. Nearly every business activity of nearly every organization has some impact on the environment;
- b. Management systems are implemented to control business activities;
- c. Standards are used by Organizations to provide the framework for management systems; and
- d. ISO 14001 is the international standard for environmental management systems, and it is the tool used by many Organizations around the world to improve the environmental performances.

ISO 14001:2004 is a tool that can be used to meet both internal and external objectives (ISO, 2010). The internal objectives are ISO 14001 EMS provides assurance to management that it is in control of the organizational processes and activities having an impact on the environment as well as assures employees that they are working for an environmentally responsible

organization. Besides, ISO 14001:2004 can also be used to meet external objectives, such as provides assurance on environmental issues to external stakeholders (customers, the community and regulatory agencies); to comply with environmental regulations; to support the organization's claims and communication about its own environmental policies, plans and actions and provides a framework for demonstrating conformity via suppliers' declarations of conformity, assessment of conformity by an external stakeholder, such as a business client; and for certification of conformity by an independent certification body.

The ISO 14000 series are roughly equivalent to BS7750 (BSI, 1994) and EMAS (EEC, 1993), but more user-friendly and easier to understand, and seem likely to gain worldwide adoption (Rothery, 1993; Baxter and Bacon, 1996; Jackson, 1997 and Sheldon, 1997).

The main objectives of this study are:

- a) To analyze ISO 14001 EMS framework and evaluate how EMS implementation in an organization can lead to an improvement in environmental performance as a whole; and
- b) To carry out a case study with respect to environmental performance improvement with implementation of ISO 14001 EMS for a manufacturing facility located in Sarawak.

Benefits from ISO 14001 EMS Implementation

Based on a survey carried out by International Organization for Standardization (ISO, 2013), the world's largest developer of voluntary International Standards for business, government and society, up to the end of December 2012, at least 285 844 certificates had been issued in 167 countries

and economies. The year 2012 represented an increase of 23 918 certificates total, 9% increase as compared to year 2011, when the total was

261 926 in 157 countries and economies. The data gathered during the survey are shown in Tables 1 and 2.

Table 1: Worldwide Number of ISO 14001 Certification from 1999 to 2012

Year	Worldwide Total, in Number of Certificates	Annual Growth, in Number of Certificates
1999	13994	
2000	22847	8853
2001	36464	13617
2002	49440	12976
2003	64996	15556
2004	90554	25558
2005	111163	20609
2006	128211	17048
2007	154572	26361
2008	188574	34002
2009	222974	34400
2010	251548	28574
2011	261926	10378
2012	285844	23918

Source :ISO Survey, September 2013

Table 2: Top 10 Countries for ISO 14001:2004 Certification In 2012

Top 10 Countries for ISO 14001 certificates - 2012		
1	United States of America	5699
2	Romania	8633
3	France	7975
4	Germany	7034
5	Spain	19470
6	United Kingdom	15884
7	Korea, Republic of	11479
8	China	91590
9	Japan	27774
10	Italy	19705

Such increase in the total number of certification in a single year convinced that worldwide Organizations have acknowledged the importance of ISO 14001 certification and reaped from the benefits of implementing it (Muhamad Awang *et al.*, 1999). Some of the benefits of implementing ISO 14001 are as follows:

a. Reduction in Environmental Impacts

Systematic ISO 14001: 2004 approach requires the organization to take a hard look at all areas where its activities have an impact on the environment (ISO, 2010). Adverse environmental impacts derived from the environmental aspects of the processes are then to be controlled. This means that organizations that introduce the system must always have projects underway that would lead to reduced environmental impacts, and the organization's management would regularly "be forced" to orient itself with regard to how the system functions, and ensure that there exist resources for continued reduction of environmental impacts (Piper *et al.*, 2003).

Relevant measures for reducing the organization's environmental impacts are required if they are categorized as "Significant." The mechanism of ISO 14001 EMS of an organization shall indicate if the organization has difficulties in meeting the demands set by current legislation or certain significant environmental aspects are not identified. Besides, an organization's environmental policy would require the organization to pledge itself to continual improvement as well as pollution prevention.

According to Piper *et al.* (2003), not all projects undertaken towards the degree of controlling environmental aspects are particularly comprehensive. Their strength lies in its "significant effectiveness" when all projects are

implemented together. This means that when an organization decides to implement ISO 14001, the organization must also be prepared to always have projects for improvement underway. Besides, during the environmental performance evaluation of ISO 14001, Kuhre (1997) viewed that such evaluation will help an organization to identify how well it is meeting environmental regulatory requirements as most of the environmental regulations are oriented toward reducing environmental impacts. While 100% compliance could be hard to achieve all the time, performance evaluation will therefore help pointing out improvement areas so that the highest degree of compliance possible can be achieved.

b. Improvement of the Organization's Environmental Performance

Piper *et al.* (2003) urged that when environmental manager calculated the total investment made by the organizations that had introduced ISO 14001, it was beneficial also to consider how their environmental performance had improved. The manager who is "too busy managing the business" to listen to good sense about environmental management could actually be more costing the business, according to ISO (ISO, 2010). However, generally, there is no systematic experience that can correlate the investments made as compared to the cost of environmental impact. Only through personal experience as a system practitioner, as well as experience gained by others, points to significant advantages within numerous important areas.

Also, the introduction of ISO 14001 has shown to be personnel development as regards environmental issue. In many cases, it had shown that employees often appreciate that the organization has introduced an environmental

management system, and they gladly become engaged in the identification of the organization's environmental aspects, and in the process of setting objectives for reducing environmental impacts. Personnel often requested for continued personal development in environmental area, and many Organizations have realized the difficulty of finding any other area that is comparable with personnel development they have gained through introduction and implementation of ISO 14001 (Piper *et al.*, 2003). Besides, environmental issues have made more concrete and clarified for the whole organization. After having introduced the system, everyone knows both which activities affect the surrounding environment and in which way the environment is affected. ISO 14001 requires the organization's whole operation be inventoried and its environmental effects must be assessed and graded. Such inventory or assessment stage often engages the personnel in a very positive way.

Organizations that implement ISO 14001 have experienced their environmental performance continually improved. ISO 14001 requires the organizations to commit and also be reflected in their Environmental Policy that they are committed to continual environmental performance. This means that there is no final level that is to be reached, but rather work towards improvement always continues; and it is common that organizations that have adopted ISO 14001 with five to ten different improvement projects under way at the same time (Piper *et al.*, 2003).

My own experience shows that it is generally easy to find areas that can be improved even in the case of Organizations which would like to see themselves as well-organized and having good control over everything that happens. This is because many Organizations do not have

sufficient control over what is emitted in the form of emissions, waste and scrap while products are manufactured. Such outflow generally both costs money and should be reduced. Thus, implementing ISO 14001 has shown itself to be a good investment to reduce such costs and overall improving organization's environmental performance.

c. Effect on Organization's Costs and Profits

It is important to consider how an environmental management system would affect the organization's costs and income (ISO, 2010). Experience shows that it is just about as difficult to show true costs and income as it is to define investments made solely for environmental reasons. This is in practice very difficult, and the result depends on the definitions an organization employed. Both income and costs are affected. For example, some environmental impacts have not been solved as an organization might have invested in certain "end-of-pipe" solutions (Piper *et al.*, 2003). This is because one might not have analyzed or investigated the correct root causes for the problems that arise. Common examples of this are when investments are made in installations that treat the water used in processing, such as water used in cleaning, without analyzing whether the cleaning process is necessary. Such experience shows that every step in the process must be analysed, according to ISO 14001, so as also to find solution earlier in the various processes to avoid the expensive "end-of-pipe" solutions. Such actions taken would result in more "unseen" income than the "foreseen" costs that would have occurred. Kuhre (2007) also viewed that a thorough and well-planned system would help to improve overall organization efficiency. Most environmental

improvements would have a positive impact on profitability since the organization has become more cost-effective.

MATERIALS AND METHODS

This case study was carried out for in a manufacturing facility in Sarawak, to evaluate degree of improvement of environmental performance through the implementation of ISO 14001 Environmental Management Systems (EMS). In the course of this study, the "facility understudy" shall be entitled, "Company ABC."

Company ABC had established, implemented and maintained ISO 14001 EMS since December 2004. Company ABC was certified to ISO 14001 by external Certification Body in February 2005. The researcher has conducted performance evaluation of a total of 13 Environmental Management Projects carried out in Company ABC from the period of year 2005 until June year 2010. Details of each project and the performance evaluation are described in Results and Discussion section.

This study attempted to analyze and evaluate the extent of improvement in Environmental Performance with Implementation of ISO 14001 EMS.

RESULTS AND DISCUSSION

Detail of each Environmental Management Programs (EMP) and their respective performance evaluation are described in the following sections.

EMP 1 : Legal Compliance for Chimneys

Project Background: The project started in November 2004 and completed in May 2007. The identified environmental issue was 4 non-compliances identified by Department of

Environment (DOE) for all chimneys in Company ABC in year 2004. ISO 14001 EMS required that Company ABC to take actions to comply with legal requirements in order to be certified. This EMP was set in order to achieve full compliance with DOE requirements.

EMP 1 was achieved fully in May 2007. EMP 1 has resulted legal compliance to Environmental Quality Act (EQA), Clean Air Regulation for all chimneys in Company ABC.

EMP 2 : Waste Management Program Implementation

Project Background: EMP 2 was started in January 2004 and achieved completion in December 2005. EMP 2 was initiated as initially, wastes were not categorized or segregated nor having any disposal bin at any specific area. Besides, staff awareness on waste management was low and there was no established procedure for registration and disposal of any identified new waste. As a result, inappropriate waste disposal was carried out, for example, scheduled waste was disposed as non-scheduled waste and caused land pollution.

EMP 2 was achieved company wide in December 2005. Company ABC has successfully developed and implemented procedure and work instructions for managing and disposal of wastes generated through the company's activities.

EMP 3 : Provision of Sheltered Scheduled Waste Storage Area and Spill Containment

Project Background: EMP 3 was started in January 2004. EMP 3 was initiated for scheduled waste storage area was an open area and there would be potential spillage due to exposure to sun or rain. At that time, there was no provision for spill containment established. The environmental impact was identified through the environmental

aspect assessment of ISO 14001 EMS development.

EMP 3 was achieved in June 2004. Potential of spillage from unsheltered scheduled wastes was minimized with the construction of sheltered scheduled waste storage area. Spill containment features were also built in too.

EMP 4 : Classification of Scrap Material

Project Background: EMP 4 started before year 2005. EMP 4 was initiated following the initial environmental review that scrapped material were not properly classified or disposed off. For example, spent solder was not disposed off through DOE licensed collector. The objective of the project was setting of a system in classification of scrapped material as well as compliance to legal requirement in selling recyclable scheduled wastes.

EMP 4 was achieved successfully. Scrapped material was identified and recyclable scheduled wastes were sold to DOE approved collector. Potential land pollution was eliminated through the implementation of ISO 14001 EMS.

EMP 5 : Upgrading of Sewage Treatment System

Project Background: EMP 5 was initiated in November 2004. Environmental issue such as water and land pollution happened because the discharges from septic tanks were not within the sewage effluent specification of DOE. The reading of BOD, COD and SS were as following:

- BOD : 80 to 400 ppm
- COD : 100 to 800 ppm
- SS : 10 to 1000 ppm

The objective of EMP 5 was to comply with the sewage and effluent regulation, EQA 1974 and

to have only one centralized sewage treatment system for the entire manufacturing facility.

EMP 5 was achieved in November 2006. A centralized sewage treatment system was built. The reading of BOD, COD and SS were as following:

- BOD < 50 ppm
- COD < 100 ppm
- Suspended Solid < 100 ppm

The specification of the final treated sewage effluent has complied with the discharge specification of sewage and effluent regulation, EQA, 1974.

EMP 6 : Upgrading of Wastewater Treatment System

Project Background: EMP 6 was initiated in July 2005 after non-compliance on the wastewater discharges issued during an EMS internal and external audit. At that time, SS, copper and COD measurements from treated wastewater discharges from Waste Water Treatment Plant was not within DOE specifications. The reading of SS, copper (in 24-h composite sample) and COD were as following:

- SS : 150 to 200 ppm
- Copper : 2 - 5 ppm
- COD : 300 - 500 ppm

EMP 6 aimed to ensure treated wastewater discharges complied with DOE specifications and the following targets were set for this project:

- SS < 100 ppm
- Copper < 1 ppm
- COD < 100 ppm

EMP 6 was in progress, not fully achieved yet.

The last project progress report dated November 21, 2009 reported that Company ABC was still looking for an effective COD reduction treatment method, including proposal of getting COD treatment system based on biological treatment. The target set was zero non-compliance of COD specification by end of June year 2011.

EMP 7: Awareness Training for Proper Handling of Chemical, Water and Draining of Wastes

Project Background: EMP 7 started in February 2006. It was started because happened of accidental discharges of used chemical and water from the production lines, especially during and after each preventive maintenance schedule. Such situation caused over discharge of used chemical or rinse water that were beyond the treatment capacity of the wastewater treatment plant. Besides, additional cost incurred for treating the chemicals discharged and also causing non-compliance to the waste water discharge regulations. EMP 7 aimed to prevent operators from over discharging of used chemicals, rinse water and eliminate poor handling of waste draining.

EMP 7 was achieved in February 2007. Awareness trainings were conducted to production operators and supervisors to ensure over discharge of used chemicals, rinse water and improper draining of wastes were prevented at all time. Benefits from the project also were cost savings from chemical and water usage as well as reducing costs of treating chemical and water discharged to wastewater treatment plant.

EMP 8: To Obtain Approval of Waste Treatment Plant and the Change in Final Discharge System Design

Project Background: The project was started

in December 2004 after issuance of 5 non-compliances during ISO 14001 EMS legal requirements compliance audit. EMP 8 aimed for Company ABC's waste treatment plant to comply to DOE approval.

EMP 8 was successfully achieved in December 2007. DOE has approved the application of waste treatment plant after its 7th year expiry date and has approved also on the change in wastewater final discharge system design of Company ABC.

EMP 9: Labeling of All Listed Poison

Project Background: EMP 9 was carried out officially in March 2006. EMP 9 was initiated due to the industrial chemicals used in Company ABC were not labeled as required by Poisons Regulations 1952. Chemical suppliers of Company ABC did not label "POISON" and did not provide red color sticker as required by Poisons Act and Regulations (2009): The Poisons Regulations 1952, Regulation 9 (1) (b) as well as Regulation 10 (1) (c). EMP 9 aimed to ensure chemical suppliers would label all listed poison under the company's poison license to comply with The Poison Regulations 1952.

EMP 9 was achieved in June 2006. The chemical suppliers of listed poisons have labeled all listed poison according to The Poisons Regulations 1952.

EMP 10: Water Recycling Project

Project Background: EMP 10 was a water recycling project, targeted to reduce 5% of the total volume of city water purchased by end of year 2005 (baseline was data in year 2004) in Company ABC. There were 2 smaller projects under EMP 10, namely Treated Wastewater Recycling project (from May 2003 to November

2005) and Reject Water Recycling project (from May 2004 to October 2004). Wastewater Recycling project was initiated due to the environmental issue concern that high volume (about 200 gpm) of treated wastewater was discharged into public drain daily. The project aimed to recycle the treated wastewater for production use again to reduce the total volume of treated wastewater discharged into public drain. As for the initiation of Reject Water Recycling project, it was done so that reject water could be recycled for the use of cooling tower make up purpose. Both of the projects were aimed to reduce consumption of city water.

For both of the projects, at the end of year 2005, a total of 47,542,404 Gal of city water usage reduction was achieved compared to the usage in year 2004. The figure contributed to a reduction of total 16.4%. In conclusion, EMP 10 was achieved successfully. Cost saving achieved as a result of reduction in consumption of city water as well as recycled of better quality water for production use.

EMP 11: Water Conservation Project

Project Background: EMP 11 started officially in February 2005. The project was about reducing water consumption or discharge per throughput for production purpose. To measure the total water usage, measuring devices and interlocking valves were installed on vertical and horizontal water lines in production floor. The project aimed for cost reduction by water conservation. The specific target set was 5% reduction of total water consumption by end of year 2005 compared to year 2004.

EMP 11 was achieved successfully in December 2005. The project has exceeded the target of 5.0% reduction in total volume of water

usage for production. Cost reduction happened through the implementation of ISO 14001 EMS.

EMP 12 : Electricity Conservation Project

Project Background: EMP 12 started in September 2005 and targeted completion date would be December 2010. EMP 12 specifically looking into reduction of electricity usage per throughput. Main areas for this project were on lighting and HVAC cost saving and shutdown of non-essential equipment during non-production time. Awareness training on electricity conservation was believed to be an essential factor for the success of the project too. Besides, training had been included in the new employee induction training program by training department.

Referring to EMP12 Project Progress Report dated December 11, 2007 by project leader, the average electricity usage per throughput data between year 2006 and 2007 did not show any cost savings. The project leader explained that it was due to the lower production rate in the first three quarters of year 2007. When production lowered, the electricity consumption was still on because frequent shutting on and off of the production machines might cause machines problem too. Therefore, although production was lowered, the electricity consumption still needed to continue to power the production equipment, thus contributed to the total electricity usage in Company ABC. The researcher viewed that though EMP 12 did not show any cost reduction for year 2006-2007 for the above reason explained, however, efforts for energy conservation were implemented throughout the company. And when production did pick up, the cost reduction through energy conservation effort would be achieved. The project was stopped in year 2007 after the evaluation. And EMR, when interviewed by researcher, told the researcher that

this project was being revised again in July 2010 for normal production. And In December 2010, there would be a new evaluation on the project progress.

EMP 13 : Chemical Conservation Project

Project Background: EMP 13 started in September 2006. The project was identified by the engineering manager from one of the production zone, namely Zone S. The purpose of the project was to reduce usage of process chemicals per throughput in Zone S. The specific target set was 2% consumption reduction of total process chemicals in Zone S by end of the year 2007. Chemical consumption data for year 2006 was used as the baseline for cost saving efforts started only in September 2006.

EMP 13 was achieved successfully in August 2007. Total chemical cost per throughput has been reduced by 8.15%, which has exceeded the target set, 2% reduction.

CONCLUSION

ISO 14001 provides a comprehensive and reliable framework for implementing an environmental management system. The benefits of ISO 14001 are broad and significant; from improving yields at the production line to giving a company a marketing edge. This is because ISO 14001 EMS requires setting of policy, objectives and targets in facility with consistent evaluation and reporting, as well as external verification and or certification. Some of the environmental performance is in the form of compliance to the local statutory and regulatory requirements. Organizations have to operate under local, state and federal environmental laws and regulations and the Organizations' directors and managers face the legal and financial risks of not meeting these standards.

A study had been carried out on implementation of ISO 14001 EMS in Company ABC, a manufacturing facility, and proofing that its ISO 14001 EMS implementation since year 2004 until 2010 had improved the environmental performance through the various EMP in the facility.

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