

Environmental Management Systems (EMS) ISO 14001 Implementation in Construction Industry: A Malaysian Case Study

Sumiani Yusoff
Ridwan Nordin

Faculty of Engineering
Universiti Malaya, Malaysia

Haslinda Yusoff

Faculty of Accountancy & Accounting Research Institute
Universiti Teknologi MARA, Malaysia

Abstract

This study seeks to explore the crucial part in EMS implementation; i.e. environmental aspects and impacts, Good Environmental Practice to be developed in construction site, as well as the level of awareness or understanding amongst site staffs on ISO 14001 EMS implementation in their organizations. Data were collected via interviews, surveys and site visits. A number of environmental aspects and impacts, and Good Environmental Practices based on ISO 14001:2004 have been identified. The level of understanding of the site staffs on ISO 14001 EMS requirements has been found to be good except for matters concerning Schedule Waste Management. In conclusion, the successful implementation of ISO 14001 EMS mainly depends on staffs' understanding.

Keywords: *ISO 14001, EMS, Environment, Construction*

Introduction

Negative effects to the environment caused by construction site may contribute to a significant impact on the development if the environmental aspects are not properly managed by the management of construction sites (Hendrickson & Horvath, 2000); specifically if there is lack of awareness or understanding of EMS itself amongst site staff. Nowadays, many pollution problems caused by construction site activities are reported. Good environmental management practices would be the essential step in order to achieve sustainable development (Ling, 2006). In relation to that, to minimize the environmental impacts, continuous monitoring and assessment should be carried out all along the construction period.

It is the time now to integrate environmental as one of the construction management dimension as the development growing rapidly. The rapid expansion of construction industry in Malaysia has put pressure for the implementation and certification of Environmental Management Systems (EMS) ISO 14001 Standard Series. Awareness and understanding on ISO 14001 EMS requirements among site staff of a company are also crucially important to ensure the success of system implementation. Hence, the key objectives of this research are twofold:

1. To examine the environmental aspects and impacts from construction site activities and Good Environmental Practice.
2. To investigate the level of awareness or understanding amongst site staffs on ISO14001 EMS implementation within organization.

ISO14001 and Environmental Management System (EMS)

ISO 14001 certification enhances the efficacy of management practice and maintains a self-regulatory compliance to a position of improved productivity, significant trade and investment relationships, and better competitive advantage (Begley, 1996; Bell, 1997; Kurasaka, 1997; Chin & Pun, 1999). Hence, it is implied that ISO 14001 is a “selling” factor in promoting a new management approach and a movement away from the traditional reliance on authorities or government (Kurasaka, 1997). The survey by Corbett, Luca and Pan (2003) on 15 economies discovered that the primary motivations for seeking ISO 14001 certification were ‘environmental improvements’, ‘corporate image’, and ‘improved procedures, relations with authorities and relations with communities’.

Specifically, ISO14001 offers a practical framework for effective and efficient implementation of EMS (see Fryxell & Szeto, 2002). EMS functions as a mechanism to manage business processes especially concerning the environmental impacts (Tibor & Feldman, 1996) and improve environmental performance (e.g. Montabonet *et al.*, 2000; Anton *et al.*, 2004), hence facilitates organizations to improve environmental accountability (Heras & Arana, 2010). In general, it has also been found that implementing EMS ISO14001 results in cost reduction (Meena, 2005), improved corporate image (Bozena Iet al., 2003) and increased staff motivation (Abdullah & Fuong, 2010) as well as improved customers’ satisfaction (Ambika & Amrik, 2004). Literature also indicates that EMS implementation based on ISO14001 has led to greater integration of organizations’ environmental, safety and health management systems, and improve overall environmental and quality management systems (e.g. O’Conner, 2000; McManus & Sanders, 2001; Wilson, 2001, Emilson & Hjelm, 2002) as well as facilitate the establishment of good business strategic and long-term planning (e.g. Ambika & Amrik, 2004; Burnett & Hansen, 2007).

A study by Morrow & Rondinelli (2002) on five German energy and gas companies discovered that improved documentation and increased efficiency of process were among the primary reasons that motivated them to adopt EMS. Particularly, a study on SMEs by Cardano *et al.* (2010) found that implementing EMS may result in better

environmental risk evaluation, policy implementation and continuous improvement (also see Ferenhof *et al.*, 2014).

EMS and Construction Industry

Large construction companies worldwide, using EMS via ISO 14001 certification, have demonstrated improved efficiency in occupational health and rise in the market share (Christini, Fetsco and Hendrickson, 2004). Importantly, sustainable construction is seen as a way for the building industry to respond towards achieving sustainable development on the various environmental, socio-economic and cultural facets. Nevertheless, there are several issues concerning the implementation of EMS in the construction industry. Sha, Deng and Cui (2000) who carried out a study in China found that many companies tend to focus only of the performance indicators and not on the quality and the environment. Other issues relate to scarcity of qualified personnel (Ofori, Gang and Briffett, 2002), lack of awareness (Ball, 2002), minimal attention on overall sustainability goals (Ofori, Gang and Briffett, 2000) and complexity and massive resources needed (Bakkmoen, 1996).

In Malaysia, despite the capability of EMS as a tool for sustainable construction, there are various constraints leading to a successful implementation of ISO 14001 EMS. For instance, design and construction companies face problems such as low commitment from the top management, lack of resources and infrastructure, and in appropriateness of the EMS that is suitable to the Malaysian environmental context (Zakaria, Awang and Hassan, 1999). In particular, local building and construction professionals also provided the following responses Abdullah, Madros and Ahmad (2001):

- Doubts on the cost for EMS implementation which is not be justified by improvement in environmental performance, by environmental cost savings or by increased competitive advantage;
- Lack of resources and very limited time to carry out 'extra' tasks.
- Insufficient training on the global environmental issues, and the key tools for sustainable development management such as ISO 14001; and
- Preserving the environment is not the key agenda of the business; in which, business organization is to make money not to be charitable to the environmental.

The findings of these literatures have put forward an idea that it is vital for great understanding amongst company's staffs in ensuring the success implementation of business sustainability practices. Following that, this study seeks to explore the current practice of EMS in the construction industry as well as the awareness of site staffs on the company's implementation of ISO 14001 EMS.

Research Methodology

Data has been collected via site visits and semi-structured surveys on a selected construction company. This Company X was deemed most suitable in this study based

on these following factors:

1. An ISO 14001 EMS standard certified company, since 2006;
2. The first local construction company to implement the ISO 14001 standard on project basis;
3. Has grown in reputation and renowned internationally;
4. Has excellent track records i.e. won numerous awards including Malaysian International Contractor of the Year, Malaysia Builder of the Year and Project Award (Major building Category);
5. Has high number of construction sites locally and internationally.

Six site visits have been made to attain data and assess significant environmental aspects and impacts arising from construction site activities. The selected sites were located within Kuala Lumpur and Selangor state.

Interview sessions via the semi-structured surveys were carried out on two groups of site employees which comprised of management level and site workers level. Specifically, from the approximately 200 site employees, 28 interview sessions were conducted on the former group and 21 sessions with the latter group. The survey instrument was designed based on ISO 14001 standard specification or requirements. It was divided into two main sections; namely, information on the communication of the EMS and information on the awareness training.

The respondents were required to rate their awareness (ranging between 1 = poor to 4 = excellent) on the implementation of ISO 14001 Standard Series (see also Yu, 2003). The responses were then summarised using *Average Index* formula:

$$\text{Average Index} = \frac{\sum x1i1 + x2i2...}{\sum x}$$

Where:

X = Number of respondents
i = Level/Rate of response

The overall level of awareness was summarized under following categories:

$0.00 \leq \text{Average Point} \leq 1.50$	Poor understanding / awareness
$1.50 \leq \text{Average Point} \leq 2.50$	Average understanding / awareness
$2.50 \leq \text{Average Point} \leq 3.50$	Good understanding / awareness
$3.50 \leq \text{Average Point} \leq 4.00$	Excellent understanding / awareness

All outcomes from the site visits and interviews were analysed in understanding (1) environmental aspects and impacts and (2) Good Environmental Practice.

Findings and Discussions

Identifying and evaluating of environmental aspects is fundamental in ISO 14001 implementation to control and minimize the environmental impacts arising from construction activities. According to Annex A of ISO 14001:2004, environmental aspects can be categorized as: emissions to air, releases to water, releases to land, use of raw material & natural resources, use of energy, energy emitted, waste & by-product and physical attributes (eg. size, shape, color, appearances).

Table 1.1 summarizes some of the most common environmental aspects and impacts and identified during this study, as well as relevant legal requirements.

Table 1.1. Environmental Aspects and Impacts from Construction Industry

Environmental Aspects	Environmental Impacts	Legislation Requirements
Emission to air of Particulate matters, Sox, Nox, CO & CO2 from machineries exhaust. <i>e.g. Genset, Mechanical breaker, Air compressor, Concrete Mixer, Mobile Crane, Truck and Lorry, Backhoe, Compactor, etc.</i>	Air Pollution	Environmental Quality (Control of Emission from Diesel Engines) Regulations, 1996
Emission to air of dust and particulate matters <i>e.g. Machineries or vehicles movement on site</i>	Air Pollution	Environmental Quality (Clean Air) Regulations, 1987
Physical attributes-Vibration and Noise <i>e.g. Hacking activities, Rock Blasting works, Concreting work, Machineries, etc.</i>	Disturbance to the existing structure/ Nuisance, Noise	Environmental Quality (Motor Vehicle Noise) Regulations, 1987
Generation of construction waste <i>e.g. Timber formwork, concrete, Steel bar, nails, hardener, etc</i>	Land use	Local Authority
Leakage of Oil onto Land <i>e.g. Oil leakage from Bar Bending and bar cutting machine, Mould oil, etc.</i>	Land contamination	Local Authority, Environmental Quality (Scheduled Waste) Regulations, 2005
Generation of Scheduled Waste <i>e.g. Architectural Works – Painting work, etc.</i>	Hazardous to Humans Health	Environmental Quality (Scheduled Waste) Regulations, 2005
Discharge of surface runoff <i>e.g. Muddy runoff</i>	Water pollution	Local Authority (DOE)
Resource Use <i>e.g. Diesel, Petrol</i>	Resource Depletion	Local Authority
Discharge to water of leaked oil, chemical fertilizer from planting works, etc.	Water pollution	Class II or III of the Interim National Water Quality Standards (INWQS), DOE Water Quality Standard.

Under the MS ISO 14001: 2004, Section 4.4.6, which is Operational Control, requires organization to establish and maintain control procedures to minimize the impacts of significant environmental aspects. One of the control measures is providing a guideline on the best environmental practices to be adopted not only by subcontractors but the organization's staff itself for controlling environmental impacts of construction activities and comply with legal requirements on construction sites. Based on the fieldwork study and interviews on the site key personnel, the following Table 1.2 shows the findings on Good Environmental Practices that can be adopted in construction sites.

Table 1.2. Good Environmental Practices for Construction Site Activities

Description	Good Environmental Practices/ Environmental Control
<u>Air Quality</u>	
Project Boundary	Sheet piles / Bund wall / Fence Hoarding should be provided to minimize dust generation and attenuate noise from site activities.
Vehicles - transported dusty load from project site (Earth/ aggregates/ sand)	<ul style="list-style-type: none"> Vehicle(s) with load of dusty materials should be covered entirely by clean impervious sheeting, which extends over the edges of properly fitting side and tail boards and dampen materials before transportation. Vehicles tyres should be cleaned before being allowed to go onto public road. Lorries transporting goods should be covered.
Vehicles – tyres washing from project site	Wash thru / wash trough / water spray should be provided to make sure vehicles' tyres cleaned before being allowed to go onto public road.
Dusty road - Earth access road	Water spray/Water browser/Water tank/Water sprinkler. Suitable spraying equipment for regular spraying of water over existing roads, tracks, access roads, in-complete road and other barren areas should be provided by the project.
Dusty condition – Workplace Hacking, Pile cutting	Personal Protection Equipment (PPE) should be provided to protect worker(s) from excessive dust generation from site activities. Safety helmet, Safety shoe, Safety belt, Glove, Eye Protection, Ear plug, Mask
Dusty materials – Stockpiles for size with more than 20 bags cements) (Earth/aggregates/sand/cement)	<ul style="list-style-type: none"> Cover stockpile over 50m³ entirely by impervious sheeting with enclosure extending at least 1 m above and beyond the stored materials. Water sprinkler / Water spray / Plastic sheet should be provided to avoid dust generation from site activities.
Speed limit & Traffic control	Traffic control / Signage / Roll over bund should be provided to control speed limits of vehicles to avoid accident at site.

Smoke-Emission - Machinery (black smoke)	<ul style="list-style-type: none"> • Use fuel of quality specified by manufacturer/supplier. Shut down all vehicles and plant in intermittent use between work periods or throttle down to a minimum idling speed (if the former is not possible). • Conduct routine and major maintenance in accordance to manufacturer's instructions, and maintain records of all inspections and maintenance works to ensure optimal performance and minimal air pollution, especially fume emission from diesel generators.
Smoke Emission - Vehicles (black smoke)	<ul style="list-style-type: none"> • Use fuel of quality specified by manufacturer/supplier. Shut down all vehicles and plant in intermittent use between work periods or throttle down to a minimum idling speed (if the former is not possible). • Conduct routine and major maintenance in accordance to manufacturer's instructions, and maintain records of all inspections and maintenance works to ensure optimal performance and minimal air pollution.
Open Burning	<p>Forbid open burning of wastes (Construction & Demolition waste, tyres, cables, or other solid waste).</p> <ul style="list-style-type: none"> • No open burning of cleared vegetation, debris and construction waste or other materials is allowed at site unless approval obtained from the Director General of the Department of Environment (DOE).
<u>Water Quality</u>	
Algae formation – Water ponding	<p>Earth drain / Earth bund</p> <ul style="list-style-type: none"> • Work place and bathing area should be maintained cleaned regularly from any water ponding to avoid mosquito breeding and formation of algae.
Drainage system & Surface runoff & Perimeter Drain	<ul style="list-style-type: none"> • Earth drain / Earth bund / Retention pond / Detention pond / Silt trap/Check dam. <p>Temporary drain should be established at site. Establishment of temporary perimeter/earth drains will divert the surface runoff and minimize the effects of erosion. Drainage system should be maintained from clogging and silting throughout construction period.</p>
Silt trap	<p>Gabion wall / Riser / Sedimentation pond / Silt fence / Flood retention pond / Detention pond / Siltation pond</p> <ul style="list-style-type: none"> • Silt trap should be constructed and maintained throughout construction period to ensure their effectiveness. Any discharge from the silt trap should not violate the water quality standard regulations.
Stockpiles - (earth/aggregates/sand/ cement)	<p>Sand bag / Plastic sheet</p> <ul style="list-style-type: none"> • Earth stockpiles should be protected with sand bags from muddy water discharge to public drain during heavy rain and plastic sheet from dust generation.

Slope protection	<p>Turfing (Spot or Close turfing), hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shortcrete or temporary covers with plastic sheet.</p> <ul style="list-style-type: none"> • Turfing or hydroseeding shall be carried immediately to slopes upon reaching their formation levels. If turfing cannot be carried out immediately, temporary protection/cover (ex. Plastic sheets or equivalent) shall be applied to the exposed slopes.
Toilet & Septic tank	<p>Ensure sewage handling and disposal by authorised and approved contractor. Periodical servicing & maintenance.</p> <ul style="list-style-type: none"> • The temporary toilet system shall be built to the specifications of the Sewerage Service Department. The cleanliness of toilets should be properly maintained and the de-sludging work should be carried out on regular basis. All wastewater (sewage, sullage) must be treated such that the effluent complies with all existing regulations/legislations.
<u>Noise Quality</u>	
Vehicles	<ul style="list-style-type: none"> • Periodical servicing & maintenance • Vehicles should be inspected and maintained regularly to prevent excessive noise.
Machinery	<p>Hoarding / Enclosures / installing mufflers / acoustic enclosures / vibration dampers / increasing distance between noise source and exposed personnel / ceilings and wall with noise-absorbing material. Periodical servicing & maintenance.</p> <ul style="list-style-type: none"> • Noise control methods i.e. installing mufflers, acoustic enclosures, vibration dampers, increasing distance between noise source and exposed personnel, and treating ceilings and wall with noise-absorbing material should be used when necessary to reduce exposure to excessive noise. Noisy equipment and activities should be sited as far as possible from sensitive receivers.
<u>Construction Waste</u>	
Use (reuse / recycle)	<ul style="list-style-type: none"> • Establish on-site waste segregation with separately allocated storage areas (for timber, paper, metal, plastic, inert C&D waste). • All inert construction waste material suitable for reclamation or land formation should be segregated and such material should be disposed at a public dumping area approved by the authorities. • All non-inert construction waste material deemed unsuitable for reclamation or land formation and all other waste material should be disposed-off at public landfill. • Maintain records of waste generated/ disposed/recycled.
Unused	<p>Handling – Storage, collection and disposal</p> <ul style="list-style-type: none"> • Forbid open burning at site. A licensed contractor should be appointed to handle all construction wastes collection generated from the project site.

<u>Domestic Waste</u>	
Workplace	<p>Handling – Storage, collection and disposal</p> <ul style="list-style-type: none"> • A licensed contractor should be appointed to handle all domestic wastes collection generated from the project site.
Workers Quarters (Kongsi)	<p>Handling – Storage, collection and disposal</p> <ul style="list-style-type: none"> • A licensed contractor should be appointed to handle all domestic wastes collection generated from the project site.
Canteen	<p>Handling – Storage, collection and disposal</p> <ul style="list-style-type: none"> • A licensed contractor should be appointed to handle all domestic wastes collection generated from the project site.
Site Office	<p>Handling – Storage, collection and disposal</p> <ul style="list-style-type: none"> • A licensed contractor should be appointed to handle all domestic wastes collection generated from the project site.
<u>Land Contamination</u>	
Generator	<p>Generator cannot be sited near the following areas: Close to waterways (rivers/drains) or drinking water resources, Close to welding workshops/naked flames, Close to public areas, Close to labour camps and Close to overhead high tension cables.</p> <ul style="list-style-type: none"> • Generator storage should be provided with secondary containment i.e. concrete containment with shelter, label internal perimeter drain, oil sump and clean up material or steel plate containment to prevent oil spillage on the ground (recommended for space constraint).
Bar Bending Machine & Bar Cutting Machine	<ul style="list-style-type: none"> • Secondary containment. Periodical servicing & maintenance • Bar bending machine should be placed inside secondary containment to prevent oil spillage on the ground. E.g. Steel plate containment (recommended for space constraint) or concrete floor with bund.
<u>Oil & Petroleum Product Storage</u>	
Temporary scheduled waste storage area (Used oil from vehicles or machineries)	<ul style="list-style-type: none"> • Concrete floor, shelter, label, concrete containment, internal perimeter drain, oil sump and clean up material. • Temporary scheduled waste storage area with shelter, label, concrete containment, internal perimeter drain and oil sump or placed inside secondary containment should be provided to prevent oil spillage on the ground. E.g. Steel plate containment (recommended for space constraint).

Skid Tank	<ul style="list-style-type: none"> • When storing petroleum products, the following guidelines should be adhered to: • Create a shelter around the area with cover and wind protection, • Line the storage area with suitable material Clearly label all products, • Keep tanks off the ground and keep lids securely fastened. • Skid tank should be constructed according to BOMBA Guidelines and placed on a concrete floor with bund, which is capable of containing 110% capacity of the largest container within with shelter. It should be located at isolated area far from water bodies.
Engine oil	<p>Create a shelter around the area with cover and wind protection,</p> <ul style="list-style-type: none"> • Line the storage area with suitable Clearly label all products, • Keep tanks off the ground and keep lids securely fastened. • Oil drums and containers should be provided with secondary containment i.e. concrete containment with shelter, label internal perimeter drain, oil sump and clean up material or steel plate containment to prevent oil spillage on the ground (recommended for space constraint).
Chemical Storage	<p>Handling –Segregation and Storage</p> <ul style="list-style-type: none"> • Chemical products and containers should be segregated and placed inside concrete floor and bund at all times with shelter, label to prevent liquid spillage on the ground.

In summary, for the level of understanding amongst site staff on the EMS ISO 14001 requirements, Table 1.3 below has quantified the rating of all specific items in average index and has shown the result based on the respondents understanding or awareness on their company's environmental procedures. The overall result has been found to be good except for the understanding on Schedule Waste management, where respondents marked on average or percentage of only 1.92%. The site staffs have been found to highly aware and understand the company's environmental policy (average of 3.38) followed by environmental objective, target and programme (average of 3.33), and knowledge on handling and storage of waste at site (average of 3.29).

Table 1.3. Average Index of Awareness and Understanding on Different Ems Requirements

Level of understanding on EMS items	Frequency				Average	Category
	1	2	3	4		
Environmental Policy	0	0	15	9	3.38	Good
Environmental Objective, Target and Programme	0	1	14	9	3.33	Good
Overall Roles and Responsibilities	0	4	14	6	3.08	Good
Understanding on PEMP, WMP, etc.	0	8	11	5	2.88	Good
Environmental Aspects and Impacts	0	10	8	6	2.83	Good
Schedule Waste Management	14	3	2	5	1.92	Average
Knowledge on handling and storage of waste at site	0	0	17	7	3.29	Good

Based on the interviews conducted and conversation with some site staffs on the Schedule Waste Management, it has been found that most of them have insufficient knowledge, specifically the storekeeper, QS and supervisors. This is because they are not encouraged to attend training on Schedule Waste Management since the training is specifically for environmental coordinators and safety and health officers who are responsible for handling and storage of schedule waste on site. These results indicate that having good environmental management procedures does not guarantee the project proponents can implement it accordingly if it is not understandable.

The success of Environmental Management Systems (EMS) ISO 14001 implementation largely depends on the understanding of project site staff about the systems itself. All staffs must be trained in environmental risk reduction and must understand their organisation environmental policy (www.touchbriefings.com). All company's documented ISO 14001 procedures should be highly communicated in ensuring that it is understandable by all site staffs or parties who works on behalf the company. These findings are also similar to studies in Madrid and Turkish (see Gracia, Francisco and German, 2011; Ahmet, 2009).

In general, the study findings demonstrate that there were a number of environmental aspects and impacts, and Good Environmental Practices in the construction companies studied. It has also been found that the level of understanding amongst the site staffs on ISO 14001 EMS requirements is good except for matters concerning Schedule Waste Management. Particularly, such a finding was due to lack of knowledge among the site staffs.

Conclusion

Environmental impacts contributed by the construction sector are in various types and various degrees. Whether the development is large or small, the respective companies should consider the impact they will have on the environment, during construction and

in the future. Good environmental practices should also be adopted into the construction site management in order to achieve greener construction and sustainable development.

ISO 14001 EMS is becoming the essential aspect to the construction sector. It is something that should be considered by all contractors in Malaysia. Being certified by ISO 14001 helps the company to identify, assess and manage significant environmental aspects on projects it undertakes, thereby minimizing environmental impacts and associated threats to the company's environmental reputation.

In conclusion, good environmental practices should be largely adopted into the construction site management in order to achieve greener construction and sustainable development. Staffs' awareness and understanding are essential for the successful implementation of EMS ISO 14001 hence communicating related information to staffs are indeed crucial.

References

- Abdullah, A. M., Madros, N. H. & Ahmad, A. S. (2001) "Environmental Problems Confronting The Construction Industry in Producing Sustainable Development" Conference Proceedings of the National Conference of Construction Industry, Skudai, Malaysia.
- Abdullah, H. & Fuong, C. C. (2010) "The Implementation of ISO 14001 Environmental Management System In Manufacturing Firms In Malaysia", *Asian Social Science*, Vol. 6, No. 3., pp. 100-107.
- Ahmet, M. T. (2009) "The Benefits Associated With Iso14001 Certification For Construction Firms: Turkish Case", *Journal of Cleaner Production*, Vol. 17, No. 5., pp. 559-569.
- Ambika, Z. & Amrik, S. (2004) "A Study of The Environmental Management System (Ems) Adoption Process Within Australasian Organizations – Role Of Stakeholders", *Technovation*, Vol. 24., pp. 371-386.
- Bakkmoen, K.I. (1996) "The Relationship Between The Services Offered By Icis Members And International And Regional Standards" The ICIS delegates assembly in Sydney.
- Ball, J. (2002) "Can ISO 14000 And Eco-Labeling Turn The Construction Industry Green?", *Building and Environment*, Vol. 37., pp. 421-428.
- Begley, R. (1996) "Is ISO 14000 Worth It?", *Journal of Business Strategy*, Vol. 17, No. 5., pp. 50-55.
- Bell, C., L. (1997). The ISO 14001 Environmental Management Systems Standard: One American's View. In C. Sheldon (Ed.), *ISO 14000 and Beyond: Environmental Management Systems in the Real World*. Sheffield: Greenleaf Publishing. Pp. 61-92
- Bozena, P., Jens, J. D. & Eklund, J.A.E. (2003) "Implementing ISO 14000 in Sweden:

- Motives, Benefits And Comparisons With ISO9000", *International Journal of Quality & Reliability Management*, Vol. 20, No. 5., pp. 585-606.
- Burnett, R. D. & Hansen, D. R. (2007) "Eco-efficiency: Defining A Role for Environmental Development: A Case Study Of Gw Power Utilities", *International Journal of Information Management*, Vol. 26., pp. 339-348.
- Chin, K.-S., & Pun, K.-F. (1999 "Factors influencing ISO 14000 Implementation In Printed Circuit Board Manufacturing Industry In Hong Kong", *Journal of Environmental Planning & Management*, Vol. 42, No. 1., pp. 123-134.
- Christini, G., Fetsco, M. & Hendrickson, C. (2004) "Environmental Management Systems And Iso 14000 Certification For Construction Firms", *Journal of Construction Engineering and Management*, pp. 330-336.
- Cardano, M., Marshall, R. S. & Silverman, M. (2010)."How Do Small And Medium Enterprises Go "Green"?" A Study Of Environmental Management Programs In The Us Wine Industry", *Journal of Business Ethics*, Vol. 92, No. 3., pp. 463-478.
- Ferenhof, H. A., Vignochi, L., Selig, P. M., Lezana, A. G. R. & Campos, L. M. S. (2014) "Environmental Management Systems In Small And Medium-Sized Enterprise: An Analysis And Systematic Review" *Journal of Cleaner Production*, Vol. 74., pp. 44-53.
- Fryxell, G.E. & Szeto, A. (2002) "The Influence Of Motivations For Seeking ISO 14001 Certification: An Empirical Study Of ISO 14001 Certified Facilities In Hong Kong", *Journal of Environment Management*, Vol. 65, No. 3., pp. 223-238.
- Gracia, R., Francisco, J. A. & German, M. (2011) "Evaluation Of Environmental Resources (ISO14001) At Civil Engineering Construction Worksites: A Case Study Of The Community Of Madrid", *Journal of Environmental Management*, Vol. 92, No. 7., pp. 1858-1866.
- Hendrickson C., & Horvath A. (2000) "Resource Use And Environmental Emissions Of US Construction Sectors", *Journal of Construction Engineering and Management*, Vol. 126, No. 1., pp. 38-43.
- Heras, I. & Arana, G. (2010) "Alternative Models For Environmental Management In SMEs: The Case of Ekoscan vs. ISO 14001", *Journal of Cleaner Production*, Vol. 18, No. 8., pp. 726-735.
- Kurasaka, T. (1997). Attitudes And Experiences of The Japanese Community Vis-A-Vis EMS Standards. In C. Sheldon (Ed.), *ISO 14000 and Beyond: Environmental Management Systems in the Real World*. Sheffield: Greenleaf Publishing. Pp. 155-168
- Ling, S. (2006) "Good Environmental Management in Construction Industry" University Technology Malaysia.
- McManus, M. & Sanders, L. (2001)" Integrating An Environmental Management System Into A Business And Operating Culture", *The real value of an EMS Pol-*

lution Engineering, Vol. 33, No. 5., pp. 24–27.

- Meena, C. (2005) “An Appraisal Of Environment Management Systems: A Competitive Advantage for Small Business”, *Management of Environmental Quality: An International Journal*, Vol. 16, No. 5., pp. 444 – 463.
- Morrow D, & Rondinelli D. (2002) “Adopting Corporate Environmental Management Systems: Motivations And Results of ISO 14001and EMAS Certification”, *European Management Journal*, Vol. 20, No. 2., pp. 159–171.
- O’Conner, R. (2000). ISO 14001 Certification—A Case Study. Columbus, Ohio: ABB Automation, Inc.
- Ofori, G., Gang, G. & Briffett, C. (2000) “Impact of ISO 14000 on construction enterprises in Singapore”, *Construction Management and Economics*, Vol. 18., pp. 935-947.
- Ofori, G., Gang, G. & Briffett, C. (2002) “Implementing environmental management system in construction: Lessons from quality systems”, *Building and Environment*, Vol. 37., pp. 1397-1407.
- Sha, K., Deng, X. & Cui, C. (2000) “Sustainable construction in China: Status quo and trends” *Building Research & Information*, Vol. 28, No. 1., pp. 59-66.
- Tibor, T. & Feldman, I. (1996). *ISO 14000: A Guide to the New Environmental Management Standards*. Irwin, Chicago.
- Wilson, R. C. (2001) “Ford spreads the word about its EMS success” , *Pollution Engineering*, Vol. 33, No. 6., pp. 32–33.
- Yu, T. L. (2003) “ISO 9001:2000 Quality Standard – Implementation and Effectiveness in Local Construction Industry” unpublished dissertation, Universiti Teknologi Malaysia.
- Zakaria, Z., Awang, M. & Hassan, M. N. (1999) “Strategies to overcome barriers to ISO 14001, EMS development and implementation for SMIs in Malaysia” Conference Proceedings on Environmental Management Standard ISO 14001 towards A Sustainable Future, University Putra Malaysia Press, Malaysia.