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RESEARCH ARTICLE

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Demotivating factors affecting the implementation of ISO 14001:2015 in Malaysia

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Abstract

Industrialization has brought with it environmental problems and the consequences of pollution, which has been affecting the world for decades. Immediate action is required to raise industry's awareness of its social responsibilities toward the environment. However, experience shows that companies that have obtained International Organization of Standardization (ISO) 14001:2015 certifications in Malaysia occupy but a small niche among the country's businesses. The purpose of this study is to assess the list of barriers and challenges to implementing and obtaining certifications under the ISO 14001:2015 Environmental Management System (EMS) by Malaysian firms. In addition, this study will rank these factors relative to their importance. This study is aimed at EMS experts at the Scientific and Industrial Research Institute of Malaysia (SIRIM QAS International Sdn. Bhd.). The study uses mathematical pairwise comparisons to generate the list of critical challenges and barriers. Therefore, the study is expected to raise environmental awareness among Malaysia's industries regarding the adoption of ISO 14001:2015 standards. Furthermore, the study provides a guideline for Malaysia's industries and policy-makers to provide them with a better understanding of the barriers and challenges that companies face in implementing ISO 14001:2015 EMS, and at the same time, help them understand the need to eliminate the difficulties of standard implementation.

KEYWORDS
barriers, challenge, environmental management system, ISO 14001, Malaysia industry

1 | INTRODUCTION

In the world of technology advancement, environmental quality has deteriorated from day to day. According to Beamen (1999), business operations provide the greatest contribution to national and international environmental problems. In addition, the industrial revolution represents the turning point at which humans entered a new era of both production and styles of living; however, these gains have had, and continue to have, a deep impact on the environment (Ansah & Sorooshian, 2019).

Apart from environmental affects, industrial development has contributed to the growth of Malaysia's gross domestic product (GDP). Service sector industries contributes 55.4% of GDP (Ministry of Finance Malaysia, 2013), and the GDP rose by 6.4% in 2014 (Department of Statistics Malaysia, 2015). The increase of the GDP reflects the ongoing industrialization process, where global warming and air pollution are common environmental impacts arising from this process. For example, emissions of trace gases from industry and from other human activities have increased the concentrations of carbon dioxide and other "greenhouse" gas emissions, which has resulted in global warming (Hansen et al., 1988; Lacis, Hansen, Lee, Mitchell, & Lebedeff, 1981; Ramanathan, Cicerone, Singh, & Kiehl, 1985).

In addition, industrial operations also have an influence on human health. According to Qureshi et al. (2015), industrialization has increased the consumption of energy and fossil fuel, and therefore, emissions from fossil fuels used in energy generation have led to air pollution that increases the infant mortality rate. Air pollution is a critical issue that should receive much greater attention from the public than it has, and at the same time, be addressed. As Lves (2015) claimed, air pollution has killed around 7 million people annually, especially in the Asia Pacific region countries, such as in China and India. Furthermore, Woodford (2006) proclaimed that the environment is a huge component surrounding human life and health; thus, irresponsible human activities that are destroying the natural system will directly influence or cause the decline in the quality of human life and ways of living.

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According to Cline (1992), global warming has contributed to the rise of sea level, water scarcity, and agricultural losses. Undeniably, the increases in global temperatures are causing the melting of the polar ice caps. Thus, the global sea level is rising by significant levels. Scientific research has suggested that global warming has caused an average sea level rise of eight inches as observed between 1880 and 2009 (Union of Concerned Scientists, 2013). National Geographic (2010) also claimed that if this trend continues, it will have a significant impact on the environment as well as on living things. For example, sea level rise will affect coastal habitats, which must be abandoned and relocated, marine habitats will be disturbed, and aquifers and agricultural soils will be affected, including through contamination.

This increasingly significant environmental issue is raising public awareness and driving collaboration among a range of communities, including businesses themselves, government, nongovernment agencies, and the like (Eng Ann, Zailani, & Abd Wahid, 2006), in an effort to move toward the implementation of effective environmental management systems (EMS). This study is primarily focused on analyzing and ranking barriers that represent resistance to the implementation of EMS standards and the challenges faced by organizations in EMS implementation (specifically, the International Organization of Standardization [ISO] 14001 EMS) in Malaysian Industry. As reported in 2012, only 218 Malaysian companies in the manufacturing and services sectors had adopted the ISO 14001 EMS standard compared with the huge number of businesses that have registered with the government of Malaysia (Malaysia Certified, 2012).

2 | ISO 14001 EMS

Generally, an EMS is a set of procedures or an approach that is adopted by an organization to preserve the ecological balance, protect the environment from deterioration, and increase the organization's operational efficiency by maximizing the utilization of organizational resources (Pun, Hui, Lau, Law, & Lewis, 2002). In addition, Hillary (2004) proclaimed that EMS serves as a guidance for the organization to develop a series of management systems that assist in enhancing the organization's environmental performance.

EMS has evolved to assist in fulfilling the statutory requirements of government rules and policies, along with the overwhelming force exerted by consumers for environmentally friendly products, and public pressure to address environmental problems that affect individual safety and health (Maxwell, Rothenberg, Briscoe, & Marcus, 1997; Pun, Hui, & Lee, 2001). Thus, these are the driving forces that are encouraging the development and implementation of EMS by organizations to meet customer and public desires.

The ISO 14001:2015 EMS provides a common framework for environmental management among businesses in various sectors. ISO 14001:2015 EMS is one of a number of standards under ISO 14000 that address a number of environmental management issues. ISO 14001:2015 EMS was developed by the International Organization for Standardization, which is headquartered in Geneva, Switzerland. The advancement and transformation of technology increases awareness of environmentally related impacts in order to facilitate better waste management and the preservation of natural resources, flora, and fauna to keep them from degradation and extinction. Many multinational firms in North America have voluntarily adopted ISO 14001 EMS to standardize environmental control and performance to meet the needs of globalization (Miles, Munilla, & Russell, 1997; Miles & Russell, 1997). However, some other organizations implemented ISO 14001 EMS because their customers demand that they do so to fulfill the desires of their own customers, who request environmentally friendly products that are safe to use and whose production does not unduly degrade the environment (Litsikas, 1997). In addition to customer demands, government and other related parties are also actively advocating the implementation of ISO 14001 EMS as global environmental pollution has increasingly caused adverse effects on human health and the natural environment.

ISO 14001 EMS is the ordinary guidance that has, since its inception in the 1990s, provided a series of guidelines pertaining to various environmental issues (Hersey, 1998). This standard typically provides a fundamental understanding to managers regarding current environmental issues and consciousness, and provides certain guidelines for regulating industrial waste management.

The ISO 14000 series provides a number of standards for addressing environmental and other allied issues. The latest version of ISO 14001 EMS was adopted in 2015 (Sorooshian & Ting, 2018; Sorooshian, Qi, & Li Fei, 2018). Firms that adopt and become certified under the ISO 14001:2015 EMS standard can be considered as having EMSs that should provide additional confidence and trust to the consumer regarding the firms' products and the environmental quality associated with it.

3 | MALAYSIAN STANDARD ISO 14001 EMS

The Malaysia Standard (MS) ISO 14000 series consists of a series of standards that are similar to 20 of the International ISO 14000

standards. The MS ISO 14000 standards were created by generally adopting the guidelines outlined in the international standards, but in conformance to local standards of concern and culture. MS ISO 14000 was generally used in issuing environmental management practices with the purpose of reducing organizational impact on the environment and to engage in for continuous environmental performance improvement (Malaysia Standard Online, 2007). There are several standards involved in MS ISO 14000:2015, such as ISO 14001, which specifies the standard requirements with guidance for use, and ISO 14004, which offers elements and implementation guidelines for EMS. These two standards are the most commonly used standards, and they appear as the top two within the ISO 14000:2015 family. MS ISO 14001 generally provides a framework for EMS development and for supporting EMS auditing programs.

MS ISO 14001 certification can be obtained through the six steps of the certification cycle, which include

1. Application,
2. Adequacy audit,
3. Compliance audit,
4. Certification,
5. Yearly surveillance, and
6. Reassessment.

The certification process begins with the application to the Accreditation of Certifications Body (ACB) by filling out the application forms downloaded from the Department of Standards Malaysia's website. After that, the completed application form will go through a series of audits, such as an adequacy audit and a compliance audit, before the acquisition of the certification. This certification is then used to evaluate the environmental performance annually, with a reassessment every 3 years (Department of Standards Malaysia, 2013).

4 | CHALLENGES OF AND BARRIERS TO EMS IMPLEMENTATION

Nowadays, small- to medium-sized enterprises (SME) make up the vast majority of businesses in Malaysia as well as in other areas such as Europe and the UK. Obviously, the number of businesses that register as SME is significantly high in Malaysia. A list of challenges and barriers to implementing ISO 14001 EMS was presented by Hillary (2004), drawing upon the Hillary (1999) paper, which covered 28 study reports, including a review of 10 study reports that emphasized the attitudes of SMEs that typically reflect the barriers and challenges that restrict the adoption and implementation of EMS by SMEs. Hillary (2004) classified the challenges and barriers into different categories in which the reviewed difficulties from the study reports are categorize into related groups. These groups include

- Resources,
- Understanding and perception,
- Implementation,
- Attitudes and company culture,
- Certifiers/verifiers,
- Economics,
- Institutional weaknesses, and
- Support and guidance.

In regard to Malaysia's manufacturing firms, Haslinda and Fuong (2010) have stated three reasons that have hampered the adoption of EMS as well as three challenges faced by organizations' top management for EMS in implementing EMS. The top three reasons that obstruct EMS adoption include

- Employees' preferences and desire to stay with the status quo,
- Employees' fear of failure arising from past experiences, and
- Employee distress with the uncertainty and unknown circumstances (unfamiliar with the ISO 14001 EMS standard).

The three challenges that typically confront top management include

- Full commitment and support needed from top management for the EMS implementation,
- Determination and assessment of the current environmental aspects and their implications, and
- The ability to achieve legal compliance (Haslinda & Fuong, 2010).

Turk (2009) also proclaimed several difficulties faced in EMS implementation in the construction industry. Turk's research paper emphasized five mains factors that significantly impede the construction industry's adopting EMS. These are

- Lack of top management concern,
- The multiple attributes of ISO 14001,
- The length of the registration process,
- High volume of documentation and paperwork activities required for registration, implementation, and certification, and
- The high cost of implementation.

Therefore, EMS implementation is typically essential to control the excessive waste and to regulate the environmental performance of the hotel industry (Hsiao, Chuang, Kuo, & Yu, 2014). Chan (2008) claimed six barriers hindered the hotel industry in EMS implementation. These barriers include

- The huge expense in implementation and maintenance costs,
- Lack of professional consultants,
- Lack of EMS knowledge and skills in the hotels,
- Lack of skillful certifiers and verifiers,
- Lack of resources, and

- Uncertainty of outcome or output arising from the EMS adoption (Chan, 2008).

A study was conducted to analyze the barriers and challenges encountered in Thailand's seafood industry. Setthasakko (2009) claimed that the difficulties faced in EMS implementation are

- Lack of system perspective for industry sustainability and
- Lack of senior management support.

Massoud, Fayad, El-Fadel, and Kamleh (2010) claimed that they identified several barriers and challenges in the acquisition by the food industry of ISO 14001 EMS. The nine vital factors they stated impede ISO 14001 EMS implementation include

- Inadequate or general lack of governmental support and incentives,
- Little customer demand,
- Lack of legislation that would make ISO 14001 adoption compulsory,
- ISO 14001 EMS implementation not required for export,
- Uncertainty regarding the output/benefit,
- High cost of implementation,
- Lack of top management commitment,
- Lack of in-house knowledge, and
- Length of time demanded by process.

Quazi, Khoo, Tan, and Wong (2001) proclaimed that they had identified seven prominent challenges that prevent EMS implementation in a study they conducted of companies located in Singapore. These challenges encompassed:

Complexity of the ISO standards,

- Legal ramifications,
- Insufficient support for implementation,
- Inadequate senior management commitment,
- Inadequate employee commitment and involvement,
- High implementation costs, and
- Ambiguous employee duties and responsibilities.

The automotive industry has undeniably also faced difficulties that have hindered the companies' efforts to adopt EMS. Martín-Peña, Díaz-Garrido, and Sánchez-López (2014) found five important difficulties that have been mentioned and discussed. They found that the automotive industry encountered various factors, such as

- High systems requirements,
- Difficulties in terms of organizational structure and lack of employee involvement,
- Difficulties in gathering the information required for establishing objectives,
- Difficulties in establishing the workers' environmental responsibilities.

Psomas, Fotopoulos, and Kafetzopoulos (2011) conducted a study that focused on firms in Greece with the purpose of identifying the barriers that impede the adoption or implementation of EMS by the companies in that country. Psomas et al. (2011) claimed that the complexity and demanding nature of the ISO requirements created a barrier for organizations seeking to establish organizational environmental performance measurements. Second, they found that the requirements for assessing the determinants of the environmental management process, and third, lack of an "environmental culture" and the clients' lack of support also serve as challenges that impede the companies' abilities to undertake EMS implementation in-house.

As Petroni (2001) claims, the difficulties in assessing and measuring the costs and benefits of EMS implementation generally impede adoption by companies, especially in machinery manufacturing, to take action in implementing the EMS standard. Furthermore, implementation typically consumes a long period of time for organizations to make the strategic decision to move forward with EMS implementation. Moreover, Petroni also claimed that the results of analyses made by individual firms pertaining to the pros and cons of EMS implementation are not necessarily applicable to all companies across various industrial sectors.

Organizational "change agents" frequently brought the alteration, modification, improvement and development of EMS to existing businesses in addition to assisting the companies in adapting to the continuously changing environment where those within the business hold jobs as line managers, researchers, trainers, counselors, or teachers, who then bring the improvement and development to the organization. The barriers faced by organizational "change agents" are identified by Post and Altman (1994), who classify them into two categories: industry barriers and organizational barriers. The industry barriers include

- Availability of technical information,
- Capital costs,
- Configuration of current operations,
- Competitive pressure, and
- Industry regulation.

The organizational barriers encompass

- Poor employee behavior and attitudes,
- Lack of proper interaction,
- Haunted by the past experiences or practices, and
- Lack of senior management guidance.

However, for the case of Malaysia, an initial searching in databases could not find any list of difficulties for ISO14001 implementation.

5 | RESEARCH METHODOLOGY

With the aim of generating a list of barriers to and challenges of implementing the latest version of the ISO14001 (ISO 14001:2015)

in Malaysia, the methodology used in this study employed a pairwise comparison matrix in the multiple-criteria decision-making technique. Pairwise comparison technique is applicable for ranking variables (Saaty, 1988). The targeted population for the study is the 31 EMS experts at the Scientific and Industrial Research Institute of Malaysia (SIRIM QAS International Sdn. Bhd.), the leading accredited certification services provider under the National Accreditation Body and the Department of Standards Malaysia (2015). The data were collected through the application of a questionnaire during face-to-face interviews, phone and Skype call interview, or via email.

The data were analyzed using the procedures of pairwise comparison (Alam, Jebran, & Hossain, 2012) as follows.

5.1 | Stage 1: Hierarchy development

In this stage, the complex problem is broken down into constituent components from large to small in a logical fashion. This is done to structure a hierarchical representation that prioritizes the criteria in a system. Generally, the hierarchy is constructed based on human perceptions and preferences. Based on their first impressions, the constituent parts are classified into several groups and arranged into several levels, either in rising or descending order from one level to another.

5.2 | Stage 2: Pairwise construction

The pairwise comparison takes place once the hierarchy is constructed. At this stage, pairwise comparison matrices are constructed for all the relevant criteria while the matrices are determined through a one-to-nine ratio scale. Simply put, pairwise comparisons take place to analyze all of the available criteria. The pairwise comparison is adopted from Ansah, Sorooshian, and Mustafa (2015). The pairwise comparisons follow Equation (1).

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{12} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ \vdots & \vdots & \cdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}, \quad (1)$$

where $A = (a_{ij})$, $a_{ij} > 0$, and $a_{ij} = 1/a_{ij}$.

The above process is used to calculate the weights of criteria if "n" numbers are given for a pairwise comparison. $A = n \times n$, where "A" represents the alternatives and $a_{11} - a_{1n}$, and others represent the pairwise comparisons. Aziz, Sorooshian, and Mahmud (2016) explained that the use of a one-to-nine scale can assist in analyzing and evaluating the relative important of one criterion with others. In this study, the pairwise comparison is used to rank the difficulties according to the internal challenges and barriers after the questionnaires have been distributed. The pairwise comparison scale is shown in the table in **Exhibit 1**.

EXHIBIT 1 One-to-nine ratio scale

Intensity of importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	Compromises between the above

5.3 | Stage 3: Weight determination

Weights of the criteria and alternatives are determined and calculated by placing all of the weights into pairwise comparison matrices in order to obtain the value at each row and column on the matrix. The equation is illustrated as follows:

$$Aw = \begin{bmatrix} \frac{a_{11}}{\sum a_{i1}} & \frac{a_{12}}{\sum a_{i2}} & \cdots & \frac{a_{1n}}{\sum a_{in}} \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ \frac{a_{n1}}{\sum a_{i1}} & \frac{a_{n2}}{\sum a_{i2}} & \cdots & \frac{a_{nn}}{\sum a_{in}} \end{bmatrix}. \quad (2)$$

5.4 | Stage 4: Weight evaluation or synthesis

This stage involves the calculation of eigenvectors or eigenfunctions to evaluate and synthesize the weights. Weight synthesis involves the computation of the eigenvectors of matrix A and is determined by calculating Ci, which is the average value of each row and column of the matrix [Equation (3); Ansah et al., 2015]. Thus, the higher the weight obtained, the more prominent the factor of a particular problem or issue.

$$C = \begin{bmatrix} C_1 \\ C_2 \\ \cdot \\ : \\ C_n \end{bmatrix} = \begin{bmatrix} \frac{a_{11}}{\frac{\sum a_{i1}}{n}} + & \frac{a_{11}}{\frac{\sum a_{i1}}{n}} + & \cdots & + \frac{a_{1n}}{\frac{\sum a_{1n}}{n}} \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ \frac{a_{n1}}{\sum \frac{a_{i1}}{n}} + & \frac{a_{n2}}{\frac{\sum a_{i2}}{n}} + & \cdots & + \frac{a_{nn}}{\frac{\sum a_{in}}{n}} \end{bmatrix} \quad (3)$$

6 | RESULT

After our review of the literature and consultation with the experts at SIRIM QAS International Sdn. Bhd., we used 26 barriers and 27 challenges as shown in the table in **Exhibit 2** to continue our study. The study defines barriers and external difficulties facing facilities seeking to implement the standard, and the challenges, which are the difficulties originating from inside the company, both of which negatively affect EMS implementation.

EXHIBIT 2 Barriers and challenges

Code	Challenges	Code	Barriers
C1	Lack of management and/or staff time for implementation and maintenance	B1	Certifiers/verifiers (e.g., lack of experienced verifiers, duplication of effort between verifiers/certifiers and internal auditors)
C2	Lack of training	B2	Distortion in the market
C3	Multifunctional staff easily distracted by other work	B3	Changing economic climate alters the priority given to an EMS in SME
C4	Loss of environmental champion	B4	Lack of promotion of EMSs
C5	Perception of bureaucracy	B5	Absence of a central source of information on environmental legislation
C6	Implementation is an interrupted and interruptible process	B6	Inconsistence approach of consultants to EMS implementation
C7	Inability to see the relevance of all stages	B7	Lack of external assistance (e.g., consultants needed to interpret ISO 14001:2015, environmental review, and EMS implementation)
C8	Doubts about ongoing effectiveness of EMSs to deliver objectives	B8	Lack of sector-specific implementation tools and examples
C9	Uncertainty about how to maintain continuous improvement	B9	Absence or lack of trade association or business network support
C10	Lack of top management support	B10	Multiple attributes of ISO 14001
C11	Management instability	B11	Long registration process
C12	Resistance to change	B12	High volume of documentation and paperwork activities
C13	Negative view or experience with ISO 9000 standards rubs off on acceptance of ISO 14001	B13	High cost of implementation
C14	Preferences and employees at the company desire to stay with status quo	B14	Lack of professional advice
C15	Employees distressed by the uncertainty and unknown circumstances	B15	Lack of resources
C16	Lack of knowledge and skills	B16	Lack of system perspective for industry sustainability
C17	Unclear with the output	B17	Diversification of organizational culture
C18	Inadequate employee commitment and involvement	B18	Lack of government supports and incentives
C19	Ambiguous employees' duties and responsibilities	B19	Lack of customer demand
C20	Lack of workers' environmental responsibilities	B20	Not legal requirement
C21	The determinants of environmental performance process	B21	Not required for export
C22	Lack of environmental culture and client's support	B22	Determination and assessments of the current environmental aspect and its implication
C23	The results of analyses on the pros and cons of EMS implementation is not applicable across all industries	B23	Lack of ability to achieve legal compliance
C24	Configuration of current operations	B24	Legal ramifications
C25	Poor employee' behavior and attitudes	B25	The results of analyses on the pros and cons of EMS implementation is not applicable across all industries
C26	Lack of proper interaction	B26	Competitive pressure
C27	Haunted by the past experiences or practices	–	–

The result of our analysis was obtained by synthesizing the responses from 25 of the total 31 EMS experts in SIRIM QAS International Sdn Bhd. Six experts chose not to participate in this study. The tables in **Exhibits 3 and 4** present the standardized collected data.

The result of the analysis for this study illustrated the top 10 internal challenges of ISO 14001:2015 EMS implementation in Malaysia Industry are C18, C2, C10, C16, C25, C22, C7, C12, C20, and C3. In contrast, B13, B15, B20, B23, B3, B4, B16, B14, B7, and B9 are ranked as the top 10 external barriers of ISO 14001:2015 EMS implementation in the Malaysian industry. The summarized, ranked challenges and barriers are shown in **Exhibits 5** and **6**.

7 | CONCLUSION

The objectives of this research were to identify and rank the barriers to and challenges of ISO 14001:2015 EMS implementation in the Malaysian industry. The finding of this study shows that inadequate employee commitment and involvement, lack of training, and lack of top management support are the critical internal challenges that confront Malaysia's businesses in implementing ISO 14001:2015 EMS. Undeniably, the result of this research demonstrates that an organization's employees are the main source of challenges within the organization for ISO 14001:2015 EMS implementation. Lack of employees'

EXHIBIT 3 Matrix of challenges: Pairwise comparison

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
C1	0.0153	0.0134	0.0128	0.0538	0.0460	0.0426	0.0087	0.0256	0.0466	0.0117	0.0369	0.0145	0.0503	0.0535	0.0094	0.0109	0.0291	0.0211	0.0446	0.0037	0.0481	0.0107	0.0563	0.0520	0.0105	0.0532	0.0531
C2	0.1273	0.1118	0.1224	0.0571	0.0502	0.0882	0.1027	0.0556	0.0885	0.2096	0.0968	0.1118	0.0709	0.0673	0.0870	0.1716	0.0880	0.0627	0.0823	0.1273	0.0467	0.1598	0.0577	0.0518	0.1692	0.0660	0.0623
C3	0.0232	0.0177	0.0194	0.0609	0.0478	0.0786	0.0079	0.0528	0.0466	0.0120	0.0344	0.0137	0.0411	0.0462	0.0408	0.0115	0.0489	0.0246	0.0386	0.0185	0.0485	0.0152	0.0614	0.0500	0.0123	0.0568	0.0361
C4	0.0021	0.0145	0.0024	0.0074	0.0201	0.0020	0.1090	0.0141	0.0019	0.0121	0.0020	0.0050	0.0037	0.0030	0.0029	0.0098	0.0020	0.0219	0.0020	0.0033	0.0172	0.0067	0.0057	0.0035	0.0079	0.0028	0.0051
C5	0.0019	0.0130	0.0024	0.0021	0.0058	0.0014	0.0042	0.0025	0.0018	0.0111	0.0021	0.0045	0.0016	0.0019	0.0022	0.0107	0.0018	0.0217	0.0017	0.0032	0.0037	0.0068	0.0019	0.0021	0.0098	0.0016	0.0015
C6	0.0037	0.0132	0.0026	0.0389	0.0444	0.0104	0.0052	0.0338	0.0082	0.0110	0.0057	0.0101	0.0213	0.0065	0.0063	0.0111	0.0053	0.0215	0.0078	0.0036	0.0340	0.0069	0.0039	0.0388	0.0085	0.0168	0.0245
C7	0.0600	0.0373	0.0835	0.0023	0.0475	0.0691	0.0342	0.0543	0.0658	0.0164	0.0497	0.0731	0.0604	0.0773	0.1421	0.0458	0.0302	0.0287	0.0930	0.0475	0.0501	0.0354	0.0551	0.0533	0.0282	0.0657	0.0626
C8	0.0038	0.0129	0.0024	0.0034	0.0152	0.0020	0.0040	0.0064	0.0023	0.0110	0.0027	0.0049	0.0017	0.0016	0.0024	0.0100	0.0017	0.0219	0.0017	0.0034	0.0143	0.0067	0.0022	0.0028	0.0081	0.0016	0.0022
C9	0.0048	0.0184	0.0061	0.0571	0.0465	0.0184	0.0076	0.0413	0.0146	0.0133	0.0137	0.0164	0.0270	0.0216	0.0374	0.0114	0.0291	0.0213	0.0214	0.0044	0.0492	0.0080	0.0611	0.0475	0.0088	0.0550	0.0511
C10	0.1250	0.0508	0.1538	0.0580	0.0502	0.0904	0.1994	0.0557	0.1045	0.0953	0.0987	0.1148	0.0837	0.0876	0.1020	0.1373	0.0764	0.0694	0.0618	0.1142	0.0485	0.1135	0.0594	0.0533	0.1446	0.0672	0.0615
C11	0.0066	0.0184	0.0090	0.0593	0.0442	0.0293	0.0110	0.0381	0.0169	0.0154	0.0159	0.0079	0.0548	0.0345	0.0530	0.0145	0.0412	0.0214	0.0307	0.0036	0.0488	0.0111	0.0614	0.0480	0.0094	0.0562	0.0577
C12	0.0392	0.0373	0.0528	0.0552	0.0487	0.0387	0.0175	0.0485	0.0331	0.0309	0.0751	0.0373	0.0805	0.0820	0.1176	0.0315	0.1083	0.0326	0.0916	0.0113	0.0497	0.0336	0.0583	0.0538	0.0291	0.0571	0.0618
C13	0.0031	0.0159	0.0047	0.0202	0.0364	0.0049	0.0057	0.0387	0.0054	0.0115	0.0029	0.0047	0.0101	0.0073	0.0048	0.0098	0.0052	0.0219	0.0078	0.0037	0.0415	0.0068	0.0203	0.0260	0.0104	0.0177	0.0159
C14	0.0031	0.0179	0.0045	0.0269	0.0333	0.0172	0.0048	0.0445	0.0073	0.0117	0.0050	0.0049	0.0148	0.0108	0.0105	0.0101	0.0060	0.0216	0.0321	0.0034	0.0381	0.0062	0.0311	0.0318	0.0087	0.0257	0.0234
C15	0.0276	0.0218	0.0081	0.0434	0.0452	0.0282	0.0041	0.0445	0.0066	0.0159	0.0051	0.0054	0.0359	0.0174	0.0170	0.0108	0.0522	0.0237	0.0535	0.0677	0.0483	0.0298	0.0531	0.0553	0.0271	0.0443	0.0606
C16	0.1207	0.0559	0.1444	0.0649	0.0467	0.0807	0.0642	0.0551	0.1096	0.0596	0.0942	0.1016	0.0880	0.0915	0.1351	0.0858	0.0660	0.0688	0.0642	0.1091	0.0494	0.1577	0.0571	0.0528	0.1364	0.0565	0.0491
C17	0.0072	0.0175	0.0054	0.0505	0.0455	0.0273	0.0156	0.0510	0.0069	0.0171	0.0053	0.0047	0.0265	0.0249	0.0045	0.0179	0.0137	0.0241	0.0237	0.0051	0.0463	0.0075	0.0540	0.0508	0.0084	0.0458	0.0505
C18	0.1322	0.3257	0.1437	0.0618	0.0491	0.0886	0.2181	0.0534	0.1250	0.2507	0.1360	0.2086	0.0839	0.0912	0.1308	0.2278	0.1040	0.1827	0.0707	0.1617	0.0481	0.1787	0.0571	0.0525	0.1937	0.0639	0.0560
C19	0.0040	0.0158	0.0058	0.0428	0.0396	0.0157	0.0043	0.0437	0.0079	0.0179	0.0060	0.0047	0.0151	0.0039	0.0037	0.0155	0.0067	0.0300	0.0116	0.0044	0.0454	0.0067	0.0426	0.0460	0.0086	0.0474	0.0433
C20	0.1044	0.0222	0.0264	0.0564	0.0467	0.0727	0.0182	0.0472	0.0831	0.0211	0.1106	0.0834	0.0685	0.0808	0.0063	0.0199	0.0676	0.0285	0.0673	0.0253	0.0492	0.0116	0.0571	0.0545	0.0118	0.0611	0.0618
C21	0.0018	0.0136	0.0023	0.0024	0.0090	0.0017	0.0039	0.0025	0.0017	0.0111	0.0019	0.0043	0.0014	0.0016	0.0020	0.0098	0.0017	0.0215	0.0015	0.0029	0.0057	0.0062	0.0016	0.0018	0.0086	0.0027	0.0027
C22	0.0754	0.0368	0.0668	0.0580	0.0453	0.0796	0.0508	0.0501	0.0958	0.0441	0.0751	0.0582	0.0782	0.0912	0.0300	0.0286	0.0959	0.0537	0.0909	0.1148	0.0484	0.0526	0.0577	0.0540	0.0377	0.0541	0.0569
C23	0.0019	0.0138	0.0023	0.0093	0.0222	0.0191	0.0044	0.0211	0.0017	0.0115	0.0019	0.0046	0.0035	0.0025	0.0023	0.0107	0.0018	0.0228	0.0020	0.0032	0.0253	0.0065	0.0071	0.0128	0.0099	0.0040	0.0051
C24	0.0018	0.0135	0.0024	0.0134	0.0170	0.0017	0.0040	0.0143	0.0019	0.0112	0.0021	0.0043	0.0024	0.0021	0.0019	0.0102	0.0017	0.0217	0.0016	0.0029	0.0198	0.0061	0.0035	0.0063	0.0082	0.0017	0.0025
C25	0.0995	0.0451	0.1073	0.0639	0.0405	0.0836	0.0828	0.0536	0.1125	0.0449	0.1161	0.0873	0.0660	0.0851	0.0429	0.0429	0.1110	0.0643	0.0923	0.1458	0.0448	0.0950	0.0493	0.0520	0.0682	0.0648	0.0638
C26	0.0022	0.0129	0.0026	0.0202	0.0286	0.0047	0.0040	0.0305	0.0020	0.0108	0.0022	0.0050	0.0043	0.0032	0.0029	0.0116	0.0023	0.0219	0.0019	0.0032	0.0160	0.0074	0.0136	0.0284	0.0080	0.0076	0.0219
C27	0.0021	0.0129	0.0039	0.0106	0.0284	0.0031	0.0039	0.0213	0.0021	0.0112	0.0020	0.0044	0.0046	0.0033	0.0020	0.0126	0.0020	0.0235	0.0019	0.0030	0.0149	0.0067	0.0102	0.0179	0.0077	0.0025	0.0072

EXHIBIT 4 Matrix of barriers: Pairwise comparison

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	B23	B24	B25	B26
B1	0.0065	0.0043	0.0080	0.0080	0.0027	0.0027	0.0032	0.0024	0.0031	0.0016	0.0024	0.0023	0.0207	0.0036	0.0179	0.0047	0.0018	0.0014	0.0035	0.0123	0.0034	0.0029	0.0097	0.0012	0.0030	0.0016
B2	0.0101	0.0067	0.0073	0.0076	0.0021	0.0026	0.0031	0.0019	0.0027	0.0016	0.0023	0.0021	0.0209	0.0036	0.0171	0.0046	0.0047	0.0016	0.0040	0.0124	0.0035	0.0040	0.0098	0.0033	0.0028	0.0020
B3	0.0503	0.0567	0.0616	0.1459	0.0894	0.0922	0.0751	0.0729	0.0826	0.0804	0.0642	0.0779	0.0356	0.0820	0.0492	0.1286	0.0546	0.0840	0.0502	0.0582	0.0538	0.0605	0.0466	0.0683	0.0620	0.0930
B4	0.0514	0.0552	0.0266	0.0629	0.0747	0.0769	0.0751	0.0902	0.0700	0.0672	0.0783	0.0732	0.0543	0.0496	0.0762	0.0650	0.0515	0.0636	0.0502	0.0522	0.0563	0.0565	0.0596	0.0663	0.0597	0.0762
B5	0.0355	0.0475	0.0101	0.0124	0.0147	0.0116	0.0062	0.0406	0.0071	0.0415	0.0046	0.0056	0.0232	0.0067	0.0189	0.0086	0.0551	0.0233	0.0504	0.0142	0.0545	0.0579	0.0111	0.0586	0.0603	0.0264
B6	0.0443	0.0464	0.0122	0.0150	0.0232	0.0183	0.0070	0.0495	0.0122	0.0459	0.0111	0.0065	0.0229	0.0074	0.0213	0.0093	0.0554	0.0694	0.0507	0.0183	0.0499	0.0502	0.0166	0.0590	0.0518	0.0743
B7	0.0517	0.0547	0.0205	0.0210	0.0592	0.0652	0.0250	0.0710	0.0124	0.0613	0.0388	0.0474	0.0248	0.0173	0.0176	0.0135	0.0596	0.0836	0.0516	0.0202	0.0545	0.0562	0.0205	0.0653	0.0579	0.0849
B8	0.0316	0.0421	0.0099	0.0081	0.0042	0.0043	0.0041	0.0117	0.1172	0.0176	0.0038	0.0043	0.0218	0.0072	0.0187	0.0046	0.0347	0.0051	0.0360	0.0142	0.0391	0.0365	0.0117	0.0141	0.0218	0.0066
B9	0.0445	0.0531	0.0157	0.0189	0.0439	0.0315	0.0427	0.0021	0.0211	0.0543	0.0492	0.0522	0.0270	0.0101	0.0178	0.0199	0.0593	0.0474	0.0519	0.0148	0.0551	0.0619	0.0203	0.0586	0.0620	0.0484
B10	0.0373	0.0381	0.0070	0.0086	0.0033	0.0037	0.0037	0.0061	0.0036	0.0092	0.0039	0.0042	0.0210	0.0042	0.0171	0.0052	0.0210	0.0012	0.0303	0.0125	0.0257	0.0237	0.0116	0.0184	0.0204	0.0041
B11	0.0509	0.0534	0.0179	0.0150	0.0590	0.0308	0.0120	0.0574	0.0080	0.0438	0.0186	0.0339	0.0222	0.0109	0.0180	0.0074	0.0565	0.0441	0.0523	0.0144	0.0512	0.0493	0.0121	0.0402	0.0509	0.0364
B12	0.0489	0.0531	0.0134	0.0146	0.0441	0.0477	0.0089	0.0461	0.0068	0.0371	0.0093	0.0169	0.0213	0.0114	0.0185	0.0090	0.0565	0.0320	0.0521	0.0124	0.0553	0.0582	0.0103	0.0445	0.0582	0.0316
B13	0.0543	0.0552	0.2994	0.2003	0.1095	0.1381	0.1749	0.0926	0.1350	0.0756	0.1450	0.1378	0.1730	0.1732	0.2342	0.1878	0.0601	0.0844	0.0509	0.1943	0.0551	0.0570	0.1820	0.0586	0.0576	0.0743
B14	0.0522	0.0543	0.0217	0.0366	0.0632	0.0717	0.0417	0.0471	0.0602	0.0627	0.0495	0.0427	0.0288	0.0289	0.0325	0.0226	0.0560	0.0757	0.0509	0.0204	0.0556	0.0610	0.0098	0.0586	0.0585	0.0734
B15	0.0518	0.0558	0.1787	0.1180	0.1110	0.1227	0.2035	0.0891	0.1691	0.0766	0.1484	0.1305	0.1055	0.1268	0.1428	0.1474	0.0571	0.0765	0.0504	0.2499	0.0540	0.0622	0.2438	0.0683	0.0582	0.0849
B16	0.0496	0.0526	0.0173	0.0349	0.0618	0.0711	0.0672	0.0927	0.0383	0.0635	0.0905	0.0680	0.0333	0.0461	0.0350	0.0361	0.0565	0.0736	0.0502	0.0269	0.0520	0.0590	0.0189	0.0720	0.0597	0.0777
B17	0.0247	0.0100	0.0079	0.0085	0.0019	0.0023	0.0029	0.0024	0.0025	0.0031	0.0023	0.0021	0.0201	0.0036	0.0175	0.0045	0.0070	0.0018	0.0144	0.0117	0.0131	0.0045	0.0096	0.0029	0.0026	0.0023
B18	0.0469	0.0437	0.0076	0.0103	0.0066	0.0027	0.0031	0.0240	0.0046	0.0791	0.0044	0.0055	0.0213	0.0040	0.0194	0.0051	0.0403	0.0104	0.0483	0.0126	0.0520	0.0522	0.0116	0.0590	0.0530	0.0021
B19	0.0111	0.0101	0.0074	0.0075	0.0017	0.0022	0.0029	0.0019	0.0024	0.0018	0.0021	0.0020	0.0204	0.0034	0.0170	0.0043	0.0029	0.0013	0.0060	0.0116	0.0037	0.0025	0.0095	0.0013	0.0009	0.0025
B20	0.0526	0.0532	0.1050	0.1194	0.1024	0.0989	0.1227	0.0814	0.1412	0.0726	0.1286	0.1350	0.0883	0.1405	0.0567	0.1331	0.0594	0.0818	0.0512	0.0992	0.0566	0.0573	0.1430	0.0670	0.0635	0.0882
B21	0.0122	0.0122	0.0074	0.0072	0.0017	0.0024	0.0030	0.0019	0.0025	0.0023	0.0023	0.0020	0.0202	0.0033	0.0170	0.0045	0.0034	0.0013	0.0105	0.0113	0.0064	0.0047	0.0097	0.0021	0.0029	0.0018
B22	0.0158	0.0119	0.0073	0.0079	0.0018	0.0026	0.0032	0.0023	0.0024	0.0028	0.0027	0.0021	0.0216	0.0034	0.0164	0.0044	0.0110	0.0014	0.0168	0.0123	0.0097	0.0071	0.0105	0.0035	0.0051	0.0027
B23	0.0545	0.0556	0.1075	0.0858	0.1074	0.0897	0.0990	0.0808	0.0843	0.0644	0.1247	0.1341	0.0772	0.2405	0.0476	0.1557	0.0594	0.0726	0.0513	0.0563	0.0539	0.0551	0.0813	0.0697	0.0626	0.0868
B24	0.0469	0.0170	0.0076	0.0079	0.0021	0.0026	0.0032	0.0070	0.0030	0.0042	0.0039	0.0032	0.0247	0.0041	0.0175	0.0042	0.0205	0.0015	0.0394	0.0124	0.0257	0.0172	0.0098	0.0084	0.0140	0.0038
B25	0.0159	0.0176	0.0072	0.0077	0.0018	0.0026	0.0031	0.0039	0.0025	0.0033	0.0027	0.0021	0.0218	0.0036	0.0179	0.0044	0.0196	0.0014	0.0476	0.0114	0.0159	0.0101	0.0094	0.0044	0.0073	0.0020
B26	0.0484	0.0393	0.0079	0.0099	0.0067	0.0030	0.0035	0.0211	0.0052	0.0267	0.0061	0.0064	0.0279	0.0047	0.0202	0.0056	0.0362	0.0596	0.0290	0.0135	0.0439	0.0322	0.0112	0.0265	0.0434	0.0120

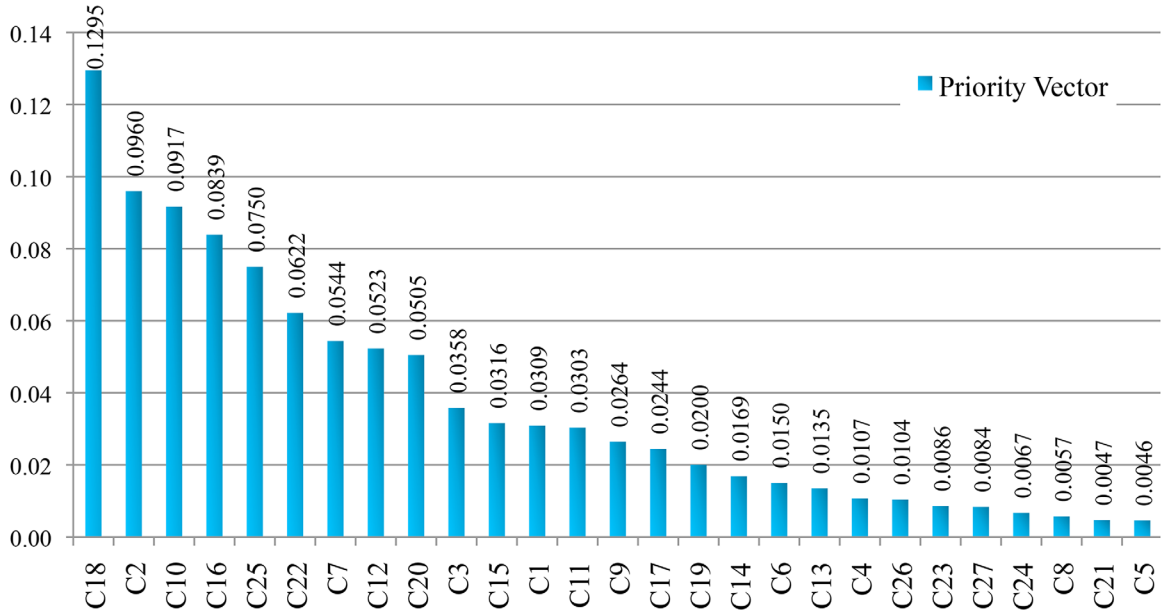

EXHIBIT 5 Ranking of challenges [Color figure can be viewed at wileyonlinelibrary.com]

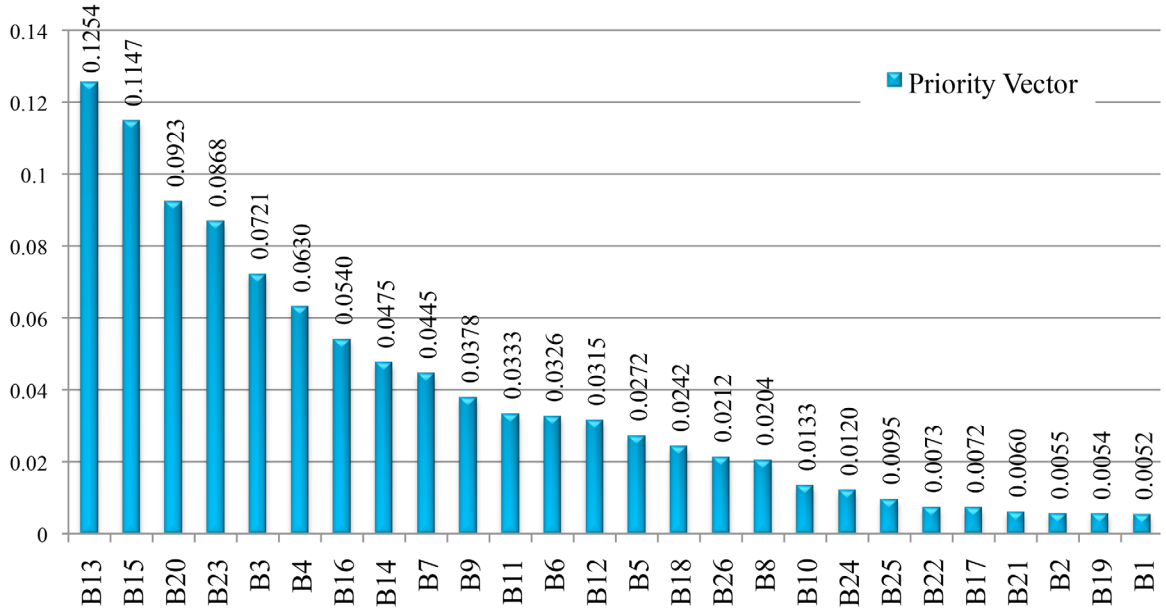

EXHIBIT 6 Ranking of barriers [Color figure can be viewed at wileyonlinelibrary.com]

commitment and involvement and lack of training serve as the primary sources of internal challenges regarding an organization's personnel. This is followed by a lack of top management support: upper management is the decision maker and serves as the leader for a business's operation. Where there is a lack of support from top management on ISO 14001:2015 EMS implementation, employees will definitely be demotivated.

The dominant external barriers to ISO 14001:2015 EMS implementation in Malaysia are the high cost of implementation, lack of resources, and the lack of legal requirements for implementation. The high cost of ISO 14001: 2015 EMS implementation was mentioned by several researchers as common and significant external barriers, especially for the smaller enterprises as well as for companies that are cutting costs and lack of cash flow. Furthermore, a lack of resources, such as a lack of accessible information and enough journals that pertain to ISO 14001:2015, also serve as a dominant barrier to the adoption of EMS.

Other than discussing the most important internal challenges of and external barriers to ISO 14001:2015 EMS implementation for Malaysia's industry, perceptions of bureaucracy and of certifiers

or verifiers (e.g., lack of experienced verifiers, duplication of effort between verifiers/certifiers and internal auditors) are the least important internal challenges and external barriers, respectively.

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