DEVELOPING A GUIDELINE FOR AN INTEGRATED QUALITY, ENVIRONMENTAL, OCCUPATIONAL HEALTH AND SAFETY, AND ENERGY MANAGEMENT SYSTEM

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DEVELOPING A GUIDELINE FOR AN INTEGRATED QUALITY, ENVIRONMENTAL, OCCUPATIONAL HEALTH AND SAFETY, AND ENERGY MANAGEMENT SYSTEM

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DEDICATION

Thanks to Allah, for without His Mercy and Guidance, I would have never been able to make this happen. Also, I dedicate this thesis to my dear family and friends. A special feeling of gratitude to my beloved mum and brothers who always pray for my success. I also dedicate this thesis to my dear friend Simon Kee and his parents, without whom I may not have taken the effort to pursue further with my education. I dedicate this work also to all my well-wishers throughout this journey and thanking all for the support, motivation and confidence in me.
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ABSTRACT

The purpose of this thesis is to develop a guidance document for integrating quality, environmental, occupational health and safety and energy management systems for manufacturing industries. The thesis presents the current status and strategies of the Integrated Management System (IMS) in Malaysian manufacturing industries. As to understand the status and strategies of IMS implementation, quantitative data collections through questionnaire survey were performed. In total, 40 responses from a variety of manufacturing sectors were analyzed. The result shows that manufacturing industries are embarking on IMS regardless of the types and sizes of the organizations. They are applying various strategies as long as it is practicable for their organizations’ business activities and processes due to the absence of international or national standards as a guideline for IMS. Concurrently, qualitative data was collected through Delphi Technique Expert Opinion Method with three rounds of experts’ views collection for the purpose of developing the guidance document. Nine experts panel from the category of academician, government body, and practitioners (consultants and auditors) participated in the activity. They have agreed to the proposed content and also raised their suggestions for improvement of the proposed document. The document has been prepared using the High Level Structure documented as Annex SL by ISO Directive. This structure is similar to the current release of ISO 9001:2015 and ISO 14001:2015 International Standard.
ABSTRAK

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CHAPTER 1

INTRODUCTION

1.1. Introduction

This chapter comprises the background of the research, problem statements, objective of the research, scope of the research, importance of the research, limitation of the research and finally the order of the chapters in this thesis.

1.2. Background of the Research

The adoptions to standard-based management system standards (MSSs) are voluntary. However, the supply chain has somehow made it imperative to ensure a certain level of compliance is maintained in companies. This is because larger companies have observed positive impact when the suppliers have MSSs implemented within them (Casadesus et al., 2009; Domingues et al., 2011; Heras et al., 2010). Thus, multiple MSSs implementations in companies are increasing due to the necessity to fulfil stakeholder demand (Barnett & King, 2008; Bernardo et al., 2010a; Simpson et al., 2012; Zutshi & Sohal, 2005) despite the resources limitations that the companies are facing internally (Mohamad et al., 2014b; Simon et al., 2011). Therefore, the implementations of the MSSs are the current market trend and are gradually applied as a guide for stakeholder requirement compliance by many companies’. Evident to this fad is the continuous rise in certification to various MSSs worldwide namely ISO 9001 Quality Management System (QMS), ISO 14001 Environmental Management System (EMS), OHSAS 18001 Occupational Health
and Safety Management System (OHSMS), ISO27001 Information Security Management System (ISMS), ISO/ TS 16949 QMS for Automotive Production, ISO13485 QMS for Medical Device Industry, ISO22000 Food Safety Management System (FSMS), ISO 50001 Energy Management System (EnMS), SA8000 Social Accountability International Standard and AA1000 AccountAbility series (Bernardo et al., 2010a; ISO Survey, 2012; OHSAS Project Group, 2012). These standard based MSSs are released by either national or international bodies (Simpson et al., 2012). Due to the standards being non-integrated, some of these certificates of different standard-based Management Systems (MSs) are issued to the same companies (FMM, 2013; SIRIM QAS).

This phenomenon of the multiple MSSs implementation and certification observed in the current market situation (Zeng et al., 2007a) is tied closely with the stakeholder requirements compliance (Bernardo et al., 2010a) and the internationalization of the businesses (Kartha, 2004). As a result of the rising stakeholder requirements, companies are obliged to build their business processes in a socially responsible manner. Thus, many companies adapt to various standard-based management system that stipulates the specific management system requirements respective to the standard (Simpson et al., 2012). It is expected that through the adaptation to MSSs, the companies are able to ensure that all activities, products and services are compliant with the stakeholder requirements (Asif et al., 2008) namely quality, environmental, occupational health and safety, energy and others relevant to the organizations’ business activity.

Indeed, the adaptation to the escalating and changing stakeholder requirements (Simpson et al., 2012) are also encouraged by the industry association, to improve the perception of their industry among regulators and community (Barnett & King, 2008; Simpson et al., 2012), as well as to boost clients’ confidence level on individual companies. Additionally, certified companies are also subject to continuous improvement activity to enhance further the effectiveness and efficiency of specific areas where stakeholder requirements are demanded, for sustaining the business as well as maintaining the certifications achieved.

From the economic point of view, Malaysia is moving towards achieving the status of a developed country by the year 2020 (Islam, 2011). However, in achieving a developed country status, economic accomplishment is important. Statistics revealed that the contribution of the manufacturing sector is 67% of the export
(Economic Planning Unit, 2014) and is 25% of the GDP which includes 3.6 million (28.9%) employment (FMM, 2013). In addition, the Malaysian SME Master Plan 2012-2020 has set specific objective and targets for SMEs to achieve; 41% of GDP, 62% employment and 25% exports by the year 2020 (National SME Development Council, 2012). In order to generate higher contribution from the manufacturing sector, trade capacity building is important. In fact, trade capacity building is a requisite to achieve global competitiveness for Malaysian industry. However, in trade capacity building, a major concern is to address the stakeholder requirement. The phenomenon of increasing number of organizations with multiple MSS in Malaysian SMEs -mainly to address the stakeholder requirements- is considered by the analyst as part of the trade capacity building that contributes to the economic development (Tambunan, 2009). Therefore, to achieve the set national target and to support the manufacturing industries to perform better, it is beneficial to develop an Integrated Management System (IMS) guidance document that is able to fulfil varying stakeholder requirement and guide the industry in a better manner.

1.3. Problem Statements

For the sake of business sustainability, many business entities have adopted multiple management systems by using the MSSs as a tool that supports the strategic management of various elements required by the stakeholders. A compilation of database prepared during this research based on Federation of Malaysian Manufacturers (FMM 2013) and Malaysian Certified website shows that there are a number of 463 companies in Malaysia which are certified to two or more MSSs. The certifications include the interest in managing product quality, resources, energy and environment which has somewhat developed separately (Giancarlo, 2005). Although no database is available to quote the number of IMS practicing companies in Malaysia, the survey conducted by SIRIM Training Services found that the system integration is well received among the companies with multiple MSSs (Idris et al., 2012).

As to handle the rising stakeholder requirements, increasing number of MSSs are published and multiple MSSs are implemented, certified and maintained (Zeng et al., 2007a), despite the resources limitation within the companies. Thus, integration of multiplying requirements into one holistic business management system is crucial.
As a result, companies can address various stakeholder requirements in an integrated manner (Asif et al., 2010b). The researchers of the decade between year 2005 to 2014 do agree that IMS adaptation is favourable for companies (Asif et al., 2008; Casadesus et al., 2011; Rory Sullivan, 2005; Sampaio et al., 2012).

However, business survival outweighs the costly implementations of the multiple MSSs. Businesses in many sectors seek certification to the standards in order to win bids or remain in the clients’ approved suppliers list (Bendell & Boulter, 2004). Thus, “integration would ensure that only one management system is present within the organization, which could be efficiently and effectively understood, implemented and maintained” (Zutshi & Sohal, 2003). As a result, companies will be able to achieve cost saving, improve resources utilization and allows better communication within the organization (Mohamad et al., 2014b; Zutshi & Sohal, 2003). Therefore, an integration guide will be a useful aid to support the companies pursuing the IMS implementation.

Besides, at this moment, no international or national standard have addressed the process of integration of MSSs and the best way to accomplish it (Bernardo et al., 2010a; Domingues et al., 2011; Labodova, 2004; Mohammad, 2006). Therefore, it is appropriate create an IMS guideline.

1.4. Objective of the Research

In this research, in addition to exploring the status of IMS implementation in manufacturing sector, the extent of implementation and the strategies in implementing the IMS, it is also taking into consideration the scholars views, as well as manufacturing sectors multiple MSSs adoption. With the aim to fulfil the need, a framework and a draft guidance document for IMS are proposed. Hence, the objectives of this research are:

a) To assess the status of IMS implementation in the Malaysian manufacturing sector
b) To investigate the strategies for implementing IMS and its implementation in the Malaysian manufacturing sector
1.5. Scope of Research

This study focuses on developing an IMS guideline for the implementation in Malaysian manufacturing sector. The scope of this research is limited to:

a) Organization refers to companies in manufacturing sector based on FMM2013, Malaysian Certified website (companies certified by SIRIM) and also the UNIDO EnMS program first batch participants.

b) The sample consists of companies with the certification of a minimum three MSS within the range of QMS, EMS, OHSMS and EnMS.

c) The scope of the IMS is set as QMS, EMS, OHSMS and EnMS since these are the four general MSSs that are applicable to any type and size of organizations worldwide. These standards are also identified as the most common composition of IMS implementation, namely the subsets of Quality and Environmental Management System (QEMS), Environmental and Occupational Health and Safety Management System (EHSMS), Environmental and Energy Management System (EEnMS), Energy and Occupational Health and Safety Management System (EnHSMS), Quality and Energy Management System (EnMS) and Quality, Environmental and Occupational Health and Safety Management System (QEHSMS) (Mohamad et al., 2014b). The analysis concurred that the integration of these four MSSs-Quality, Environment, Occupational Health and Safety and Energy Management System- have not been well-established (Mohamad et al., 2014b). Therefore, the scope of the integration guide suggested here are the MSs relating to the elements of Quality, Environmental, Occupational Health and Safety and Energy.

d) IMS guideline refers to a general guideline to guide the manufacturing sector that intends to pursue IMS implementation for QMS, EMS, OHSMS and EnMS.

1.6. Importance of the Research

The percentage of companies reporting better performance result is higher in companies’ with multiple MSS certificates than those with single certification (Casadesus et al., 2011). Malaysian organizations are paying more attention to the
needs of MSSs and best practices. It was also evident from a survey that systems integration is getting popular among the organization for example ISO 9001 being integrated with ISO 14001 and OHSAS 18001 (Idris et al., 2012). This study is important to:

a) provide assistance and structured guidance to companies for implementing IMS and getting through the implementation

b) encourage more companies to adopt IMS so that the MSSs subscribed are holistically practiced in the organization

c) recommend possible synergies within the MSSs being certified

d) be referred as an additional literature for current business environment in Malaysia.

1.7. Limitations of the Research

This study covers the manufacturing sector in Malaysia only. There are only four MSSs, namely QMS, EMS, OHSMS, and EnMS focused in the research. However, the extent of integration of MSSs in the companies is dependent on the commitment, necessity for IMS implementation, resources availability and readiness for change within the organizations itself.

A consolidated database of companies that have implemented multiple MSSs is also lacking. Due to these limitations, the respondents list were self-initiated based on FMM Directory 2013, SIRIM’s Malaysian Certified website and United Nations Industrial Development Organizations’ Energy Management Program participants. Therefore, only limited samples are taken as mentioned in the scope.

The common trios among the companies are the QMS, EMS and OHSMS. Since 2011, the companies are also being introduced to ISO 50001. Although the numbers of certified companies are less, that is a number of 14 certified companies in Malaysia by the end of 2015, the energy management is crucial in combating with the energy security challenges.
1.8. Conclusion

This thesis consists of five chapters. The Chapter 1 introduces the research background, the problem statement, the research objectives, the scope of the research, the importance of the research and the limitations of the research. The Chapter 2 explains detailed literature review relating to the IMS which helps in understanding the IMS implementation. The Chapter 3 describes the methodology to be applied to gain the appropriate result of the research title. The Chapter 4 analyses the findings of the survey based on the data collected and compiled; and the result of Delphi Method Expert Opinion gathered. The Chapter 5 discusses and concludes the finding in relation to the research objectives and recommends future research idea.
CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter presents an overview of the Integrated Management System (IMS) and the four MSs that have been selected for the integration purpose as per the Scope of Research mentioned in section 1.4 of Chapter 1. It provides a basic description of the evolution of Management System Standards (MSSs) and its trends. It is followed by the introduction of the Quality Management System (QMS), Environmental Management System (EMS), Occupational Health and Safety Management System (OHSMS), Energy Management System (EnMS) and Integrated Management System (IMS). The chapter further explains the theories and concepts of organizational improvements, the benefits and barriers, the types, the strategies, the approaches, the methods and the techniques of IMS, and the previously suggested frameworks of IMS. Finally, a conclusion of this chapter is presented.

2.1. Evolution of Management System Standards (MSSs)

The compliance and certification to MSSs are optional. However, they are being emphasized as obligatory criterion towards business and corporate sustainability. From a corporate perspective, sustainability encompasses triple bottom line (economic, environmental and social issues) that have business implications (Muhammad Asif et al., 2011). Thus, in addressing the challenges of corporate sustainability for instance rapidly changing market conditions, coordination of
operations at a global level and an increased reliance on outsourcing, a number of MSSs have emerged, with intention to help managers to systematically address the key stakeholder requirements including quality, environmental (including energy), safety, information security, supply chain security and others (Karapetrovic, 2003; Karapetrovic et al., 2010; Muhammad Asif et al., 2011). These International Standards on MSs are published by International Organization for Standardization (ISO) and OHSAS Project Group specifically on OHSAS 18001 (Muhammad Asif et al., 2011).

The ISO story is shared to the public through their website (http://www.iso.org/iso/home/about.htm). ISO began to operate since 1946, when delegates from 25 countries met at the Institute of Civil Engineers in London, followed by a decision to establish an international organization ‘to facilitate the international coordination and unification of industrial standards’. Hence, in February 1947, ISO officially begin its operation with “ISO” as its acronym. Although the term 'International Organization for Standardization' has different acronym in different languages (for instance English acronym as IOS, French acronym as OIN for Organisation Internationale de Normalisation). The founders decided to use ISO because it is derived from the Greek word “isos”, which means equal (http://www.iso.org/iso/home/about.htm). This international body have published various MSSs which includes general standards, sector specific standard and product specific organizational requirements (Romero, 2006). MSSs published by ISO are indexed with “ISO” acronym followed by an index number. However, ISO has not introduced any standard relating to safety yet (Jorgensen & Simonsen, 2002).

The safety standard, Occupational Health and Safety Assessment Series (OHSAS); OHSAS 18000 series were not introduced by any specific organization. Rather, it was a combination of various international certification bodies, for which British Standard Institute (BSI) provided the secretariat. OHSAS 18000 series were developed with the basis in BS 8800 British National standard addressing OHSMS (Jorgensen et al., 2006). Occupational Health and Safety Assessment Series (OHSAS) aims to provide guideline for OHSMS that is able to create and maintain safe workplace conditions and protect employees from workplace injuries and illnesses (Fan & Lo, 2012).
With the introduction of ISO 9001 QMS standard in the year 1987 as organizations guideline and well-received by organizations, International Standards were continuously released. Following the launch of the ISO 9000, MSSs have been progressively developed for environmental management as ISO 14001, occupational health and safety as OHSAS 18001 and ISO 45001, corporate social responsibility as (AA1000), (Karapetrovic, 2003; Karapetrovic & Jonker, 2003; Rocha et al., 2007) and efficient energy management as ISO 50001 (Casadesus et al., 2009; Ranky, 2012) to name a few. It is clear that new standards continue to emerge and existing standards are undergoing periodic updates (Karapetrovic, 2003; Rocha et al., 2007).

Table 2.1 consists of standards discussed by Romero (2006). The OHSAS 18001 and ISO 50001 are added-on to this table as general standards. OHSAS 18001 and ISO 50001 standards are compatible with ISO 9001 and ISO 14001 (Eccleston et al., 2012; Jorgensen et al., 2006). The demand trends of these standards are discussed in Section 2.3.

Table 2.1: Examples of MSSs (Romero, 2006)

<table>
<thead>
<tr>
<th>General Standards</th>
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</thead>
<tbody>
<tr>
<td>ISO 9001</td>
<td>Quality Management System (QMS)</td>
</tr>
<tr>
<td>ISO 14001</td>
<td>Environmental Management System (EMS)</td>
</tr>
<tr>
<td>ISO 50001</td>
<td>Energy Management System (EnMS)</td>
</tr>
<tr>
<td>OHSAS 18001</td>
<td>Occupational Health and Safety Management System(OHSMS)</td>
</tr>
<tr>
<td></td>
<td>Sector Specific</td>
</tr>
<tr>
<td>ISO 22000</td>
<td>Food Safety Management System (FSMS)</td>
</tr>
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<td></td>
<td>Product Specific</td>
</tr>
<tr>
<td>ISO/TS 16949</td>
<td>QMS for Automotive</td>
</tr>
<tr>
<td>ISO 13485</td>
<td>QMS for Medical Devices</td>
</tr>
</tbody>
</table>

2.2. Brief Introduction of QMS, EMS, OHSMS and EnMS

As mentioned in Section 1.4 of Chapter 1, the topic of this thesis intended to limit the scope on integration to the four MSSs, namely QMS, EMS, OHSMS, and EnMS. Thus, the following subsections provide the overviews on the MSSs included in the integration.
2.2.1 Quality Management System (QMS)

ISO 9001 was adopted from BS5750 (Baulch-Jones I, 1994) as a set standard for quality assurance in design, development, production, installation and service (Kartha, 2004). Kartha (2004) also described the purpose of the deployment of ISO 9001 was to simplify the international exchange of goods and services by developing a common set of quality standard (Kartha, 2004). On the other hand, Wahid & Corner (2009) described the purpose of the ISO 9000 series as a standard to assist organizations of all sizes and types to implement and operate an effective QMS (Ab. Wahid & Corner, 2009). Although the purpose are described by researchers in different perspectives, it can be summarized as a channel that creates universal uniformity in making the product and services of any type and size of organization to achieve a reasonably acceptable quality level.

Initially, ISO 9001 standard was not widely implemented in the USA and Japan. However, a major boom in ISO 9001 certification happened due to the fact that companies exporting to the EU had to become registered to ISO 9001 because European Community set ISO9001 registration as a pre-requisite for doing business with other nation (Kartha, 2004); and also due to the adoption and promotion of these standards by major governmental and professional bodies (Karapetrovic et al., 2010). Since the implementation was done due to the pre-requisite, some companies did question the merit of maintaining the quality system and added value of such system adaptation (Piskar & Dolinsek, 2006). However, the experienced companies agreed that as a result of QMS implementation, financial indicators reveals the performance improvement in terms of the efficiency and effectiveness of the business (Piskar & Dolinsek, 2006). The QMS is agreed as a value-adding element by other researchers too (Kartha, 2004; Lourenco et al., 2012). Besterfield, D. H., Besterfield, C., Besterfield, G. H., & Besterfield, M. (1995), emphasized that through continual fine-tuning of operations to achieve incremental improvements, customer satisfaction will be maximized and the financial result will follow (Besterfield et al., 1995).

The organizations can enjoy significant benefits, provided that the implementation and certification process of standards are properly understood and executed (Grant et al., 1994; Lourenco et al., 2012). Among those significant benefit is the substantial performance improvement compared to uncertified peers (Kartha, 2004). Thus, getting certified is undeniable. Key benefits of ISO 9001 discussed by
researchers in various editorials include gaining competitive advantage, improved business performance, attracting investment, enhancing brand reputation, saving money, streamlining operations, reduction of wastages, improving product and service quality, reducing customer complaints, encouraging internal communication, raising morale, and improving customer satisfaction (Heras et al., 2010; Karapetrovic et al., 2010; Lourenco et al., 2012; Mohamad et al., 2014b; WM To; Peter KC Lee; Billy TW Yu, 2012).

Historically, the series of International standard for QMS consists of the ISO 9000, ISO 9001, ISO 9002, ISO 9003 and ISO 9004 (Affisco et al., 1997; Besterfield et al., 1995). It is prepared by ISO Technical Committee 176 (ISO/TC176). Table 2.2 summarizes the release and revision of each standard in this family. The ISO 9000, which provides fundamentals and vocabulary used in the entire ISO 9000 family of standard, was released in 1987 and revised periodically.

The ISO 9001, ISO 9002, and ISO 9003 were released in the year 1994 and revised periodically too. The revision in the year 2000 integrated the ISO 9001, ISO 9002 and ISO 9003 into one standard, yet still address as “ISO 9001”. Hence, resulting from this revision, the ISO 9001 became the only ISO standard against whose requirements a QMS can be audited and certified by external certification bodies (Affisco et al., 1997; Zeng et al., 2007a; Zeng et al., 2007b). Meanwhile, organizations which have been certified to ISO 9002 and ISO 9003 before the year 2000 were required to upgrade their certification to the ISO 9001:2000 by December 2003 (Bendell & Boulter, 2004). Later in 2008, ISO 9001:2008 version was released and certified companies were required to upgrade by 2010. Recently, in the release of ISO 9001:2015 version, a major change is observed (Technical Committee ISO/TC176, 2015). Certified companies are required to upgrade by September 2018.
Table 2.2: The ISO 9000-QMS Families and its Evolutions (Bendell & Boulter, 2004; http://www.iso.org/iso/home/about.htm; Zeng et al., 2007b)

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>ISO 9000</td>
<td>QMSs- Fundamentals and Vocabulary</td>
<td>Released</td>
<td>Revised</td>
<td>Revised</td>
<td>Revised</td>
<td>-</td>
<td>-</td>
<td>Revised</td>
<td>Non-auditable &amp; Non-certifiable standard</td>
</tr>
<tr>
<td>ISO 9001</td>
<td>QMSs- Requirements (to companies who design their own products and services)</td>
<td>Released</td>
<td>Revised</td>
<td>Revised</td>
<td>Revised</td>
<td>-</td>
<td>-</td>
<td>Revised</td>
<td>Auditable &amp; certifiable standard</td>
</tr>
<tr>
<td>ISO 9002</td>
<td>QMSs- Requirements (to companies who do everything except design)</td>
<td>Released</td>
<td>Revised</td>
<td>Revised</td>
<td>Revised</td>
<td>-</td>
<td>-</td>
<td>Revised</td>
<td></td>
</tr>
<tr>
<td>ISO 9003</td>
<td>QMSs- Requirements (to companies where products or services can be verified only by inspection and test)</td>
<td>Released</td>
<td>Revised</td>
<td>Revised</td>
<td>Revised</td>
<td>-</td>
<td>-</td>
<td>Revised</td>
<td></td>
</tr>
<tr>
<td>ISO 9004</td>
<td>QMSs- Managing for the Sustained Success of an Organization- A Quality Management Approach</td>
<td>Released</td>
<td>Revised</td>
<td>Revised</td>
<td>Revised</td>
<td>-</td>
<td>-</td>
<td>Revised</td>
<td>Non-auditable &amp; Non-certifiable standard</td>
</tr>
</tbody>
</table>
The ISO 9001:2000 and ISO 9001:2008 QMS versions introduces eight (8) Quality Management principles. Those are customer focus, leadership, the involvement of people, process approach, system approach to management, continual improvement, factual approach to decision-making and mutually beneficial supplier relationship (Kartha, 2004). These principles provide a platform for deploying good management practice throughout the organization (Hele, 2003). Also, the standard, consist of five auditable clauses, namely Quality Management System (Clause 4), Management Responsibility (Clause 5), Resources Management (Clause 6), Product Realization, and (Clause 7) and Measurement, Analysis and Improvement (Clause 8).

The ISO 9001:2000 and the ISO 9001:2008 QMS version also applied a process approach model. All the five clauses are linked in the Process Approach model as illustrated in Figure 2.1. This research is using ISO 9001:2008 as the QMS standard.

![Figure 2.1: ISO 9001 Model (Technical Committee ISO/ TC176, 2008)](image)

However, the latest version, the ISO9001:2015 released in September 2015 stipulates only seven management principles which are the customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making and relationship management (Technical Committee ISO/ TC176,
2015). The format is restructured to adapt to Annex SL format that consist of seven auditable clauses namely Context of the Organization (Clause 4), Leadership (Clause 5), Planning (Clause 6), Support (Clause 7) Operation (Clause 8), Performance Improvement (Clause 9) and Improvement (Clause 10). This standard employs the process approach, which incorporates Plan-Do-Check-Act (PDCA) Cycle and Risk Based Thinking (Technical Committee ISO/ TC176, 2015).

Meanwhile, ISO 9004 is guidance on a wider range of objectives of a QMS particularly in managing the long-term success and continual improvement of an organization. It addresses both effectiveness and efficiency (Bendell & Boulter, 2004). It was released in 2000 and revised in 2009, in line with the release of ISO 9001: 2008, the most popular QMS standard in Malaysia and worldwide. Meanwhile, ISO 9004:2009 is approved for revision on 3rd December 2015 in line with the recent release of ISO 9001:2015 (Technical Committee ISO/ TC176, 2015).

2.2.2 Environmental Management System (EMS)

The Chernobyl accident is one of the “worst technogenic environmental disaster” (Serebriakova, 2005), where a nuclear-power complex had two explosions in one of the reactors, which blew-off 1 000 tons of cover plate and the roof of the building (Bell & Shaw, 2005). The accident occurred at 01:23 a.m. on 26 April 1986, owing to a fatal combination of design error, illegal operation, and unauthorized experiment. Due to this accident, a land area of 23,000km² was heavily contaminated, followed by a large-scale restriction of agricultural activities and mass evacuation of both urban and rural areas. The surrounding area of the accident spot remains as “Exclusion Zone” (Bell & Shaw, 2005). This accident is a typical example of the dangers of ignoring environmental matters (Bell & Shaw, 2005). On the other hand, there are many other “environmental disasters” happened and have caused significant impact worldwide. Browsing the internet using the keyword “industrial accident” will result in too many cases indeed.

Respectively, quality of natural environment surrounding the products, activities and services are also being discussed as an additional requirement for business in the 21st century (Zeng et al., 2005). Thus, processes are deemed necessary to be assessed for its environmental friendliness. Therefore, the ISO 14000 standards for EMS Requirements with Guidance for Use were introduced by ISO, as
a result of the negotiations at the Uruguay round of the General Agreement on Tariffs and Trade (GATT) and the ISO commitment to respond to United Nations Conference on Environment and Development (UNCED) in year 1992 at Rio de Janeiro (Zeng et al., 2005).

ISO 14001 is an EMS standard that is widely used to provide a structured approach. It is applied by companies that are considering to institute good environmental management practices such as planning and implementing environmental protection measures and by which, if effectively implemented, may help the company to continually improve environmentally and economically (Chavan, 2005; Searcy et al., 2012). Moreover, the EMS standard provides an orientation for establishing the EMS that can help firms to demonstrate publicly their commitment towards the protection of the natural environment. It is based on three principles, which are the pollution prevention, continuous improvement and voluntary participation (Bansal & Hunter, 2003; Murillo-Luna & Ramon-Solans-Prat, 2008).

The ISO 14001 were first launched in 1996 and revised in 2004 and 2015. A newly revised standard have been released by ISO in 2015. This is an auditable standard and organization can apply to be certified by an external certification body (Bansal & Hunter, 2003). In particular, ISO 14001 helps to guide environmental management in a structured manner and reduces the impact of organizations’ activities on the environment and helps to demonstrate sound environmental management.

The ISO 14004 provides additional guidance and useful explanation for the purpose of implementation and continual improvement of ISO 14001 (ISO, 2009). Table 2.3summarizes the release and revision of ISO 14001 and ISO 14004.

Table 2.3: The ISO 14000-EMS Families and its Evolutions (ISO, 2009)

<table>
<thead>
<tr>
<th>Standards</th>
<th>Description</th>
<th>1996</th>
<th>2004</th>
<th>2015</th>
<th>2016</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 14001</td>
<td>EMS-Requirements with Guidance for Use</td>
<td>Released</td>
<td>Revised</td>
<td>Revised</td>
<td></td>
<td>Auditable &amp; Certifiable standard</td>
</tr>
<tr>
<td>ISO 14004</td>
<td>EMS- General Guidelines on Principles, Systems and Support Techniques</td>
<td>Released</td>
<td>Revised</td>
<td></td>
<td>Target publication date: 17th Apr 2016</td>
<td>Non-auditable &amp; Non-certifiable standard</td>
</tr>
</tbody>
</table>
The remaining standard within the family focuses on other areas of environmental sustainability such as environmental labels and declaration (ISO14020), environmental performance (ISO14031), Life-cycle Assessment (ISO14040), Environmental Communication (ISO14063), Greenhouse Gas accounting and verification, and accreditation (ISO14064, ISO14065) and many others which can be referred for detail on http://www.iso.org (ISO, 2009).

ISO 14000 series developed by ISO is a collection of voluntary standards that assists organizations to achieve environmental and financial gains through the implementation of effective environmental management. It provides a model for streamlining environmental management and a guideline to ensure environmental issues are considered within decision-making practices (Chavan, 2005).

Among the benefits of ISO 14001 EMS are the minimization of environmental liabilities, efficient use of resources, reduced wastes, good corporate image, build environmental awareness among the employees, gain better understanding of the environmental impacts of business activities, increased profit and improving environmental performance through more efficient operations (Chavan, 2005) and as a self-regulatory system in compliance with legal requirements (Zutshi & Sohal, 2003).

The EMS implementation Model is based on Plan-Do-Check-Act (PDCA) cycle as described in Figure 2.2 which includes five (5) auditable sub-clauses including:

a) formulation and documentation of “Environmental policy”,

b) EMS “Planning” by assessing environmental aspects and impacts, and the necessary control measures, as well the identification of relevant legal and other requirements and its’ evaluation of compliance. Based on this information, objectives, targets, and environmental program shall be formulated,

c) EMS “Implementation and operation” is to allocate resources available as per the requirement in order to set-up an adequate EMS suitable for the organizations, capacity and capability building, setting the operational control, fixing internal and external communication channels by suitable means, documentations control and the emergency preparedness and response,
d) “Checking” allows measurement of the performance based on the objectives, targets and EMPs set as well the evaluation of compliance performed. Also, it focuses on the tackling of the non-conformities, corrective action, and preventive actions.

e) Management review phase is to review the result of the items detailed by the top management, managers and key personnel’s and to obtain feedback in order to proceed with continual improvement of environmental performances and EMS.

Figure 2.2: EMS Model (ISO/TC207 Environmental Management, 2004)

2.2.3 Occupational Health and Safety Management System (OHSMS)

Global companies are facing safety risks, making the statistics of occupational accidents higher, both fatal and non-fatal. The facts and figures released by International Labour Organization (ILO), summarizes as follows:

a) 2.02 million people die each year from work-related diseases,

b) 321,000 people die each year from occupational accidents,

c) 160 million non-fatal work-related diseases per year and

d) 317 million non-fatal occupational accidents per year.
This also means that every 15 seconds, a worker dies from a work-related accident or disease. Besides, every 15 seconds, 151 workers have a work-related accident. Undeniably, this deaths and injuries take a particularly heavy toll in developing countries, where a large part of the population is engaged in hazardous activities, such as agriculture, construction, fishing and mining and others (ILO, 2013).

In addition to the statistics from ILO, as to quote an example, one of the most terrible industrial accidents in the history to be recapped is in Bhopal, India, (http://www.bhopal.com/, 2014) whereby more than 40 tonnes of methyl isocyanides gas leaked from a pesticide plant, which immediately kills 3, 800 people and caused significant morbidity and premature death for thousands more. This disaster that happened on 3rd December 1984, affected Union Carbide’s operation worldwide (Broughton, 2005). After 25 years of the disaster, more than 500,000 registered victims have survived the tragedy. Clinical studies have also shown chronic illnesses in exposed groups. The survivors continue to experience a higher incidence of reported health problems (Mishra et al., 2009). This and many others are the eye-openers to International Labour Organization (ILO) in announcing a framework covering a systematic approach to OSH that includes all industries and workers (International Labour Organization, 2011). Considering the industrial accidents and the occupational health and safety risks of Chernobyl, Bhopal and other similar occurrence, the necessity for a guidance standard on Occupational Health and Safety (OHS) are deemed relevant by ILO (International Labour Organization, 2011).

Therefore, further to the adoption of the ISO 9000 QMS and ISO 14000 EMS standards in the early 1990s, the possibility of developing an ISO standard on OSH MSs was discussed at an ISO International Workshop in 1996 (International Labour Organization, 2011). During this workshop, the participants agreed that ISO should discontinue its efforts on OHSMS standard. Instead, because of its tripartite structure, the International Labour Organization (ILO) would be a more appropriate body than ISO to elaborate international guidance documents for the establishment and implementation of an effective occupational safety and health MSs (International Labour Organization, 2011). Therefore, ILO proceeded with its work in 1998. Concurrently, in 1999, British Standard Institute (BSI) launched official proposal on OHSMS as an ISO standard. This caused strong international opposition and a
campaign to stop the ISO work. Later, BSI developed OHSMS guidelines in the form of private technical standard that is OHSAS 18001 (International Labour Organization, 2001; Jorgensen et al., 2004). The OHSAS 18001 was formulated by international certifying bodies, with the basis in BS 8800 and was first published in 1999, for which BSI provided the secretariat (Jorgensen et al., 2006).

Although ISO have twice conducted ballot (in 1999 and in 2007) about whether to develop an ISO standard in OHS field, both times the proposals were voted down (International Labour Organization, 2011; Jorgensen et al., 2004). This was due to the international agreement since ISO Workshop in 1996, during which it was agreed that the ILO is more appropriate to take charge of the OHSMS development due to its tripartite structure - as an agency by United Nation which consists of the government, employer, and worker representatives - (International Labour Organization, 2011). Communication regarding the development of OHSMS standard had been initiated again by BSI in February 2013, and again, ISO seeks out for a ballot vote by 11 June 2013. New Work Item Proposal (NWIP) had been circulated for the purpose of seeking ISO International Experts’ opinions on the matter again (BSI & ISO, 2013). The NWIP had been accepted and ISO has formed Project Committee 283 (PC283) to proceed with the development of the standard and estimated to release the finalized standard as ISO45001:2017 (BSI & ISO, 2013).

Occupational Health and Safety Assessment Series (OHSAS) aims to provide the guideline for OHSMS that is able to create and maintain safe workplace conditions and protect employees from workplace injuries and illnesses (Fan & Lo, 2012). “It is also to systemize the safety management, which often left to the discretion of the employers” (Scipioni et al., 2001). It can be described as a de facto standard and is used as the basis for certification of OHSMS (Jorgensen et al., 2006). OHSAS 18000 series of standard consist of OHSAS 18001 OHSMS Requirements and OHSAS 18002 Guidelines for the Implementation of OHSAS 18001. Table 2.4 summarizes the release and revision of OHSAS 18001 and OHSAS 18002 (http://en.wikipedia.org/wiki/OHSAS_18001). OHSAS 18001 is developed to be compatible with ISO 9000 and ISO 14001 since its development in the 1990s Jorgensen, T.H. et al., 2004).
Table 2.4: The OHSAS 18000-OHSMS Families and its Evolutions
(http://en.wikipedia.org/wiki/OHSAS_18001)

<table>
<thead>
<tr>
<th>Standards</th>
<th>Description</th>
<th>1999</th>
<th>2000</th>
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<th>2008</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHSAS 18001</td>
<td>OHSMS-Requirements</td>
<td>Released</td>
<td>Revised</td>
<td></td>
<td></td>
<td>Auditable &amp; Certifiable standard</td>
</tr>
<tr>
<td>OHSAS 18002</td>
<td>Guidelines for the implementation of OHSAS 18001</td>
<td>Released</td>
<td>Revised</td>
<td></td>
<td></td>
<td>Non-auditable &amp; Non-certifiable standard</td>
</tr>
</tbody>
</table>

The benefits of adopting the OHSMS discussed in literature includes improved company image, improved productivity, efficiency and safe working environment, risk reduction on occupational safety and health accidents and as a self-regulatory system in compliance with legal requirements (Fan & Lo, 2012; Omran et al., 2008).

The OHSMS implementation model is also based on PDCA cycle as described in the Figure 2.3, same as ISO 14001 EMS (Zeng et al., 2007a). The OHSAS 18001 standard consists of five (5) auditable sub-clauses:

a) formulation and documentation of “OHS policy”,

b) OHSMS “Planning” by developing a methodology for identifying and assessing the hazard, and determining the control methods as well the identification of relevant legal and other requirements and its evaluation of compliance. Based on this information, objectives, targets and OHS program shall be formulated.

c) OHSMS “Implementation and operation” is to allocate resources available as per the requirement in order to set-up an adequate OHSMS to the organization, capacity and capability building, setting operational control, fixing the internal and external communication channels by suitable means, participation and consultation methodologies, documentation and its control as well the emergency preparedness and response. Also, it focuses on the tackling of the incident investigation, non-conformities, corrective action and preventive actions.

d) “Checking” allows measurement of the performance based on the objectives, targets and OHS programs set as well as the evaluation of compliance performed.
Management review phase is to review the result of the four phases by the top management, managers and key personnel’s and to obtain feedback in order to proceed with continual improvement OHS performance and OHSMS.

2.2.4 Energy Management System (EnMS)

Energy is embedded in any type of goods and is needed to produce any kind of service (Mohamad et al., 2014a). Currently, energy security is one of the global issues. British Petroleum in 2009 were quoted to have reported that the world’s growing thirst for energy/second amounts to almost 96,000 meter$^3$ of natural gas, 1,000 barrels of oil and 222 tons of coal (Setti & Balzani, 2011). Looking up to the statistics, the world electricity consumption is quantified as 42.6% in the industrial sector (International Energy Agency, 2013) which causes the increase of carbon dioxide (CO$_2$). Thus, the rising CO$_2$ level results in the greenhouse effect which, in turn, caused climate change (Setti & Balzani, 2011). The climate change leads to natural disasters such as floods, droughts and tornadoes, which have a tendency to reduce the environmental impact if protection of the climate is done globally through a sum of local contributions by adopting efficient EnMS (Fiedler & Mircea, 2012).
Therefore, there exist serious need to control and manage the energy worldwide whereby industrial development is relied on in reducing poverty and improving the quality of life, through sustainable practices (United Nations Industrial Development Organization, 2011). In the meantime, the proliferation of national energy management standards, which were introduced in Denmark, Sweden and Ireland since 2001 onwards that have shown significant energy performance improvement and continuous improvement (Gudbjerg et al., 2009; Mohamad et al., 2014a). Thus, United Nations Industrial Development Organization (UNIDO) recognized the industry’s need to enhance competitiveness while responding effectively to climate change, with a systematic management method.

Hence, in March 2007, UNIDO hosted a meeting of experts from developing countries and emerging economies, nations that had adopted or were developing national energy management standards and representatives from the ISO Central Secretariat. That meeting led to the submission of a formal recommendation to the ISO Central Secretariat to consider undertaking work on an international energy management standard. Responding to the recommendations, in February 2008, the Technical Management Board of ISO approved the establishment of a new project committee (PC 242 –Energy Management) to develop the new Management System Standard for Energy Management. Close coordination of the planned activities led to the first meeting of ISO PC 242 in September 2008 in Washington with participation by delegates from 25 countries from all regions of the world, as well as representation from UNIDO, which acted as liaises. The goal of ISO PC 242 is to develop the new management system ISO 50001 on an accelerated schedule. Between the first meeting in September 2008 and the second meeting in March 2009 in Rio de Janeiro, Brazil, ISO PC 242 produced two working drafts for experts’ review and comment by member countries. In March 2009 meeting, a decision was made to escalate the version as a Committee Draft (CD) in June 2009, following additional experts’ review and input. Eventually, this allows the release of ISO 50001 on track for publication in early 2011(McKane et al., 2010). Additional EnMS guidance requirements were also released by ISO since year 2014. Table 2.5 Summarizes ISO 50001 EnMS families and its evolutions.
The purpose of ISO 50001 Energy Management System (EnMS) standard is to enable organizations to establish the systems and processes necessary to improve energy performance, including energy efficiency, use, and consumption. Implementation of this International Standard is intended to lead to a reduction in greenhouse gas emissions and other related environmental impacts and energy cost through systematic management of energy (Project Committee ISO/PC 242 Energy Management, 2011).

By practicing the EnMS, companies are enabled to achieve major savings potentials of 40 to 45% of energy use and consumption of energy (United Nations Industrial Development Organization, 2011), improve energy efficiency (20% or more) and reduce GHG emissions worldwide (McKane et al., 2010).

The EnMS implementation model applies PDCA cycle too, similar to ISO 14001 and OHSAS 18001 (Project Committee ISO/PC 242 Energy Management, 2011). The EnMS model is described in Figure 2.4. This consists of seven (7)
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