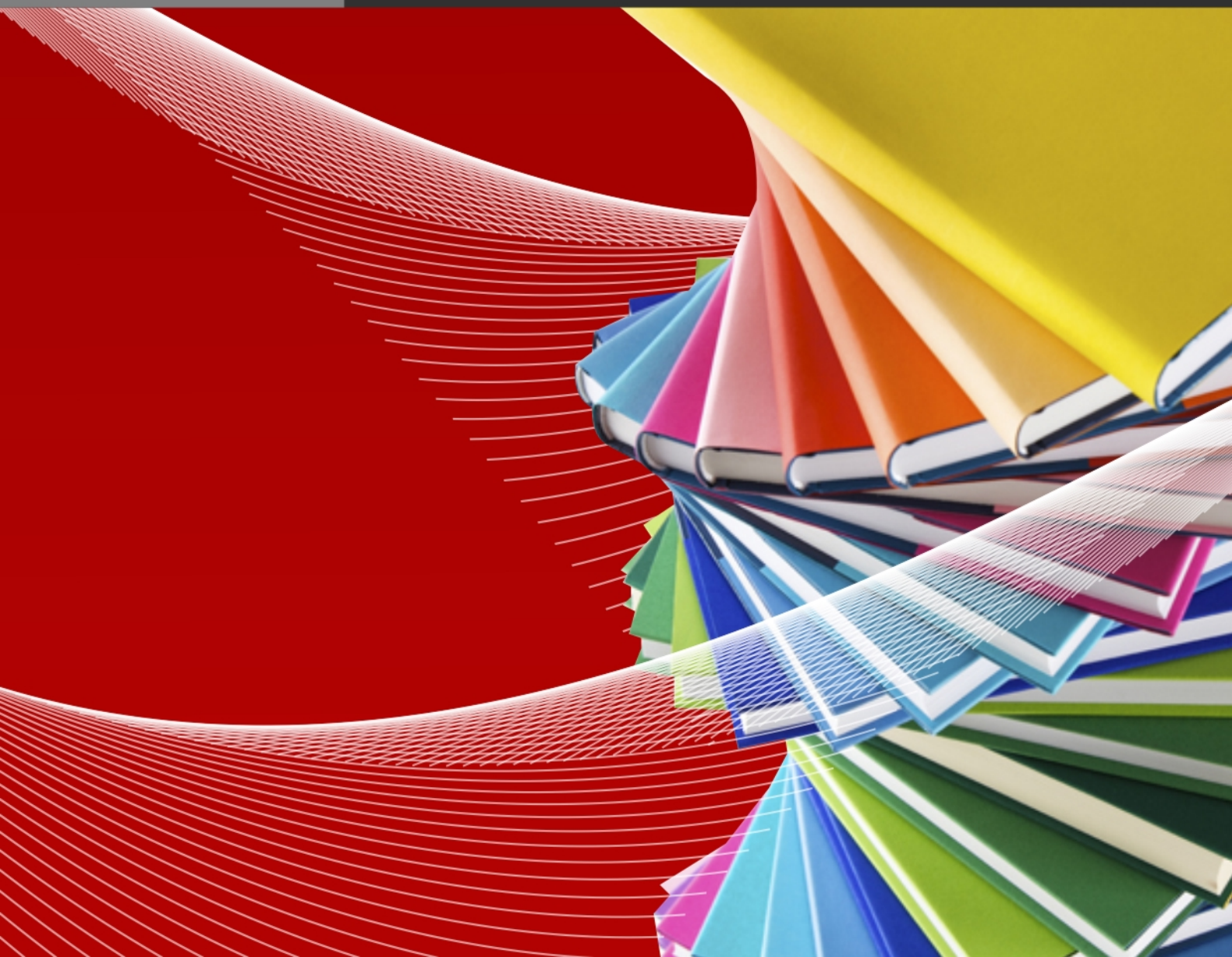
澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

Outstanding Academic Papers by Students
學生優秀作品



Necessity and Trend for Contractors in Setting Up Safety, Quality and Environmental Management Systems in Macau

by

LEONG SI UN

Final Year Project Report submitted in partial fulfillment
of the requirement of the Degree of

Bachelor of Science in Civil Engineering

2014 / 2015

Faculty of Science and Technology

University of Macau

DECLARATION

I declare that the project report here submitted is original except for the source materials explicitly acknowledged and that this report as a whole, or any part of this report has not been previously and concurrently submitted for any other degree or award at the University of Macau or other institutions.

I also acknowledge that I am aware of the Rules on Handling Student Academic Dishonesty and the Regulations of the Student Discipline of the University of Macau

Signature : 

Name : LEONG SI UN

Student ID : D-B1-2730-5

Date : 18th May, 2015

APPROVAL FOR SUBMISSION

This project report entitled "**Necessity and Trend for Contractors in Setting Up Safety, Quality and Environmental Management Systems in Macau**" was prepared by Leong Si Un in partial fulfillment of the requirements for the degree of Bachelor of Science in Civil Engineering at the University of Macau.

Endorsed by,

Signature : 

Supervisor: Dr. Ao Ieong, Tai Man

ACKNOWLEDGEMENT

First, I would like to express my sincere thanks to all interviewees and organizations. Without their kindness in sparing time and support, this study would not be possible to gather such valuable information, and most importantly, would not be so successfully done.

Most importantly, I am heartily thankful for the indebtedness by my supervisor Dr. AO IEONG Tai Man, who gave me valuable instructions from the initial to the final level of the study. His advice and constructive suggestions have kept the study in the right direction.

I would also like to thank my partner, Andy for his corporation in searching research targets and distribution out the questionnaires. Without him, the collection of data would not be so efficient.

Finally, I would like to thank my all friends who provided support and encouragement when the time that I felt frustrated with this dissertation. Allowing me to take away so much time that I should be supposed with them.

ABSTRACT

Macau construction industry is lagging far behind its neighboring regions such as Hong Kong and Singapore in the implementation of various management systems. In these regions, the implementation of some common management systems, such as quality management system ISO9000, environmental management system ISO14000 and safety management system OHSAS18000, is considered as the basic tender requirement for Government projects. In Macau, a few local construction contractors started considering the implementation of these management systems only in the late 90s. Nevertheless, not until recent years, management systems have been receiving much attention in the construction industry. However, management systems still remains uncommon in tendering government projects. The requirement from the government and local clients is the main driving force for the local contractors. If there is no promotion and support of these management systems from the government, local contractors would not invest additional cost for the implementation. There is a need for Macau construction industry to be geared to the international standards and practice. Aside from meeting the requirement of the government and clients, the implementation of various management systems has the advantages of standardizing a company's internal documentation and raising labours' awareness of quality, environmental protection and safety through training. Before all these can be emerged,

government's push is the most important motivation factor in promoting the management systems. This study focuses on the recent development on the implementation of various management systems of contractors in Macau. A questionnaire-based survey for both local contractors and foreign-based contractors with branches established in Macau was conducted. It was found that local contractors mostly do not have any management systems while all foreign-based contractors have implemented the three management systems for quite a long time. In order to provide local contractors a more positive image towards the implementation of various management systems, recommendations are made for enhancing the popularity of the management systems in construction industry and for promoting benefits of management system that are experienced by foreign-based contractors. Bringing out an important insight that management systems has a positive long-term impact on the development of Macau construction industry.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLE

CHAPTER 1 INTRODUCTION

1.1 Background for Management Systems in the Macau Construction Industry

Gambling tourism is the backbone of Macau, in which the economy in Macau is dominated by gambling-related tourism. Anon, (2015) reported in Macau Daily that in the first 9 months of the year of 2014, the tax collected from casinos was about 80% of the total revenue of the government (Macau daily, 2014), showing that gambling industry is an important source of revenue for Macau government. Also because of the legalization of gambling in Macau, a great volume of constructions are ignited, large commercial projects like casinos and hotels were invested and were notably increased in the past decade. However, these large projects were usually lead by foreign firms, in another words, foreign contractors be the main contractors while local contractors could only be subcontracted in some parts of the project. A quick comparison was made between Macau contractors and Hong Kong contractors, and it was found that there was an obvious difference in management system. ISO-based system have been widely adopted and required by Hong Kong Housing Authority (HKHA) in Hong Kong construction industry (Choi and Chin 2003). However, Macau did not follow this trend, there is no compulsory requirement for local contractors to implement management systems. The manager form CPTTM during an interview, mentioned that in early 1997, firms that applied ISO-based and OHSAS-based were mostly

manufacturing industries, only few construction firms had the certifications.

Management systems act as a fundamental trust in the aspect of, for example, quality (ISO9000), environmental (ISO14000) and safety (OHSAS18000). With increasing invested commercial projects in Macau, management systems would be a basic requirement for client assessment. With the aim to better under the management system situation in Macau, this study would investigate the reasons for local contractors to implement or not to implement the management systems and the motivators that could drive them to implement. Besides, a future trend of requirement for implementing management system in Macau would be analyzed.

1.2 Objectives and Scope of Study

Upon the increasing construction project scale and the domination of main contractors by foreign based contractors, there is a need for local contractors to increase competitiveness and achieve globalization in order to have the opportunity to bid international projects. Management system qualifications are the basic elements for international projects assessment during the bidding process. The objective for this study is to investigate the current status of management systems in Macau and to evaluate the necessity for management systems implementation by local contractors. A future trend about management system implementation in the coming 5 years will be proposed as a reference for the local contractors. In this study, only three quality

management systems would be focused, quality management system (ISO 9000), environmental management system (ISO 14000) and Occupational Health and Safety Management System (OHSAS 18000), in short, QMS, EMS and OHSAS would be used to symbolize the three management systems respectively. In the end of this study, recommendations on management systems implementation requirements are suggested to the Macau government and local contractors.

In order to meet the above objectives, the following investigation will be considered as scope of work in this study:

- To review on the trend of past management system situation in Macau and worldwide construction industry
- To investigate the similarity and differences of reasons for local and foreign-based contractors to or not to implement management systems;
- To investigate the characteristics of contractors that could affect the choice of management systems implementation;
- To compare the expectation before and outcome after management systems implementation;
- To investigate the benefits, drawbacks and difficulties in the implementation process in each of the individual form of management system;

- To investigate the point of views from representatives from local and foreign-based contractors towards future management systems trend in Macau;
- To investigate the possible solutions based on the future management systems trend in Macau construction industry.

1.3 Limitation

First of all, the sampling size of this survey will not be large and is limited. Only contractors from the lists of DSSOPT and Macau Construction Association will be considered. Besides, due to limited time and resources, it is hard to find out all contractors that are active during the study period from different association. In addition, the contractors from the list obtained from DSSOPT are those who have submitted tenders to government projects, any contractors that did not tender government projects would also be excluded. As a result, it is difficult to search for all targets in Macau but could only be narrow down to the lists that can be directly obtained from the webpage. Even though two lists of contractors with more than 70 contractors are found to be active, the response rate is expected to be not high due to a general lack of cooperative culture in filling questionnaires or surveys in Macau. As a result, in order to have a better response rate, delivery of surveys in person rather than sending questionnaires through mails or e-mails will be used.

CHAPTER TWO LITERATURE REVIEW

2.1 Worldwide Trend on the Implementation of ISO-Based and OHSAS-Based Management Systems

The ISO-based Quality Management System (QMS) is a powerful tool in managing product quality effectively. It is adopted and accepted by over 170 countries worldwide (ISO 2008). International standards give world-class specifications for products, services and systems, to ensure quality, safety and efficiency. Survey of certifications was updated every year from ISO the website; it shows the number of certificates to ISO management standards given in each country. This study will only focus on ISO 9000 and ISO 14000, which are quality management system and environmental management system respectively.

ISO9000 provides the requirement for quality management systems. Certification to the standard is used to provide assurance about suppliers' ability to satisfy quality requirements and to enhance customer satisfaction in supplier-customer relationships in global supply chains. ISO14000 provides the requirements for environmental management systems, and is used for companies and organizations to identify and control their environmental impact and constantly improve their environmental performance. For OHSAS 18000 series, it is a framework for an occupational health and safety management system which helps an organization to better control the risks

from occupational health and safety.

2.1.1 ISO9001 Implementation Worldwide Trend

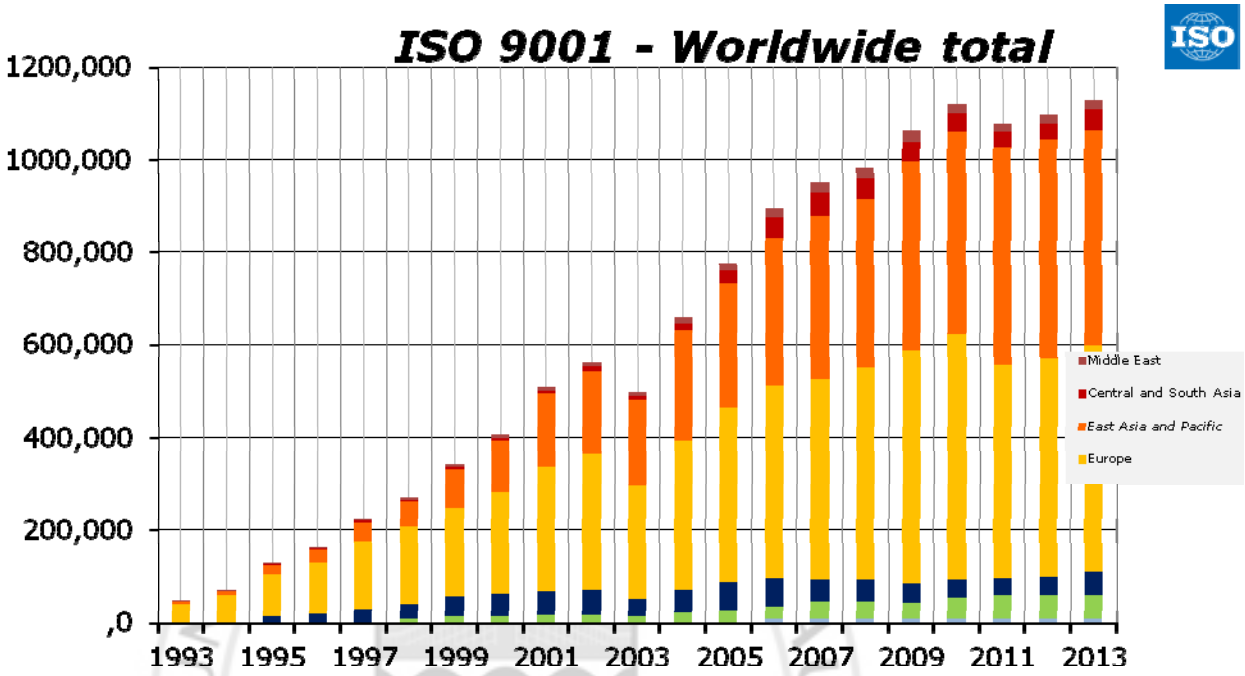


Figure 2. 1 The number of ISO 9001 certificates issued each year worldwide. (ISO, 2013)

From Figure 2.1, it shows the number of ISO9001 certificates issued from year 1993 to 2013 in all sectors worldwide, which is the most updated data from ISO-Organization. The ISO Survey of Management System Standard Certifications (ISO 2013) reported that, ISO9001, as a leading standard on quality management, continued to show very respectable growth of 3% between the year of 2012 and 2013, it remains popular with an increased catchment area of 187 countries. From the graph, it is observed that the overall trend for ISO9001 implementation is increasing worldwide with a slight fluctuation in year of 2003 and between 2011 and 2013. This

indicated that the awareness and concern about quality have been increasing. Besides, the increase in the number of implementation can be group in two categories: government regulation and voluntary implementation.

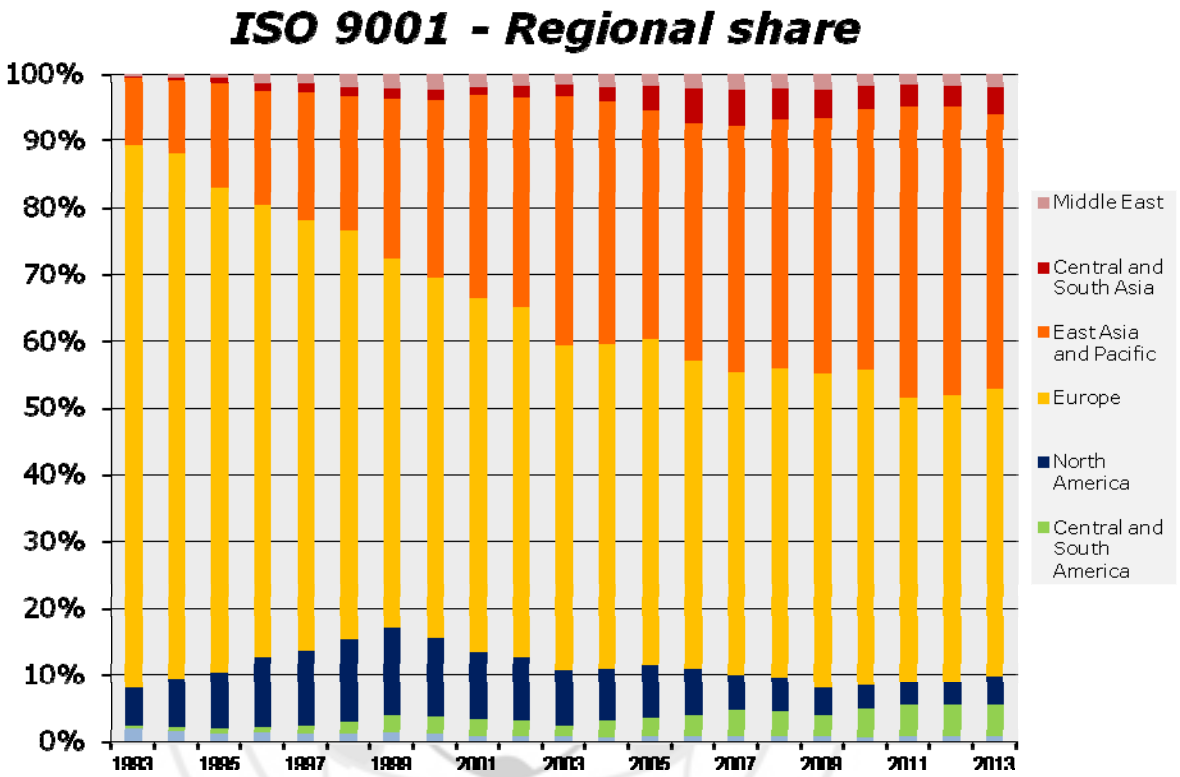


Figure 2. 2 Regional share of ISO9001 (ISO 2013)

In addition, the ISO survey also indicated that Asian market still leads the way in 2013, dominated by China and, to a smaller extent, Japan, while Europe comes a close second, headed predominantly by Italy and Germany. This phenomenon can be seen from Figure 2.2, Asia dominated the market only from recent 3 years. From the year of 1993 to 2010, Europe leads the market in ISO9001. From early 1993 to 2002, the number of ISO9001 certificates issued was far greater than that of Asia, it was only from 2003 to 2010, the numbers between Europe and Asia became closer and closer,

than from 2010 onwards, that were recent 3 years, the situation turned upside down. Figure 2.2 shows a clear increasing trend for Asia but a decreasing trend for Europe.

However, Figure 2.2 shows only the number of certificates issued in all sectors which could give a picture of ISO9001 implementation rate in the world but could not truly reflected the real situation in construction industries. The worldwide ISO9001 registration trend in construction industry will be shown in Figure 2.3.

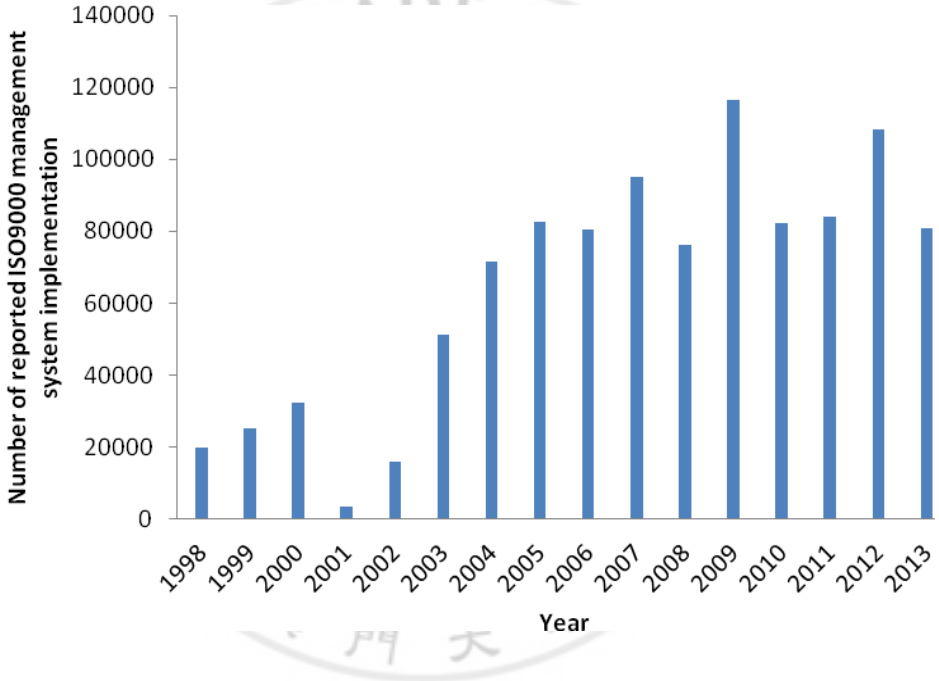


Figure 2. 3 ISO9001 implementation worldwide trend in construction industry. (ISO 2013)

From Figure 2.3, a clear trend could not be seen. From year 2003 to 2007, the trend was increasing. However, for other years, the numbers of ISO9001 registration were fluctuating. ISO survey reported that in 2013, construction industry was one of the top five industrial sectors for ISO9001 certificates, which was ranked at the third

position, with 80920 certificates issued. The other top four sectors were *"basic metal and fabricated metal products"*, *"electrical and optical equipment"*, *"wholesale and retail trade"*; *"repair of motor vehicle, machinery and equipment"*, which listed in ranking order. In 2012, construction industry was also one of the top five industrial sectors for ISO 9001 certificates, however, it was ranked at second position, with 108396 certificates issued, a switch position with electrical and optical equipment industry, indicated a drop from 2012 to 2013.

2.1.2 ISO14001 Implementation Worldwide Trend

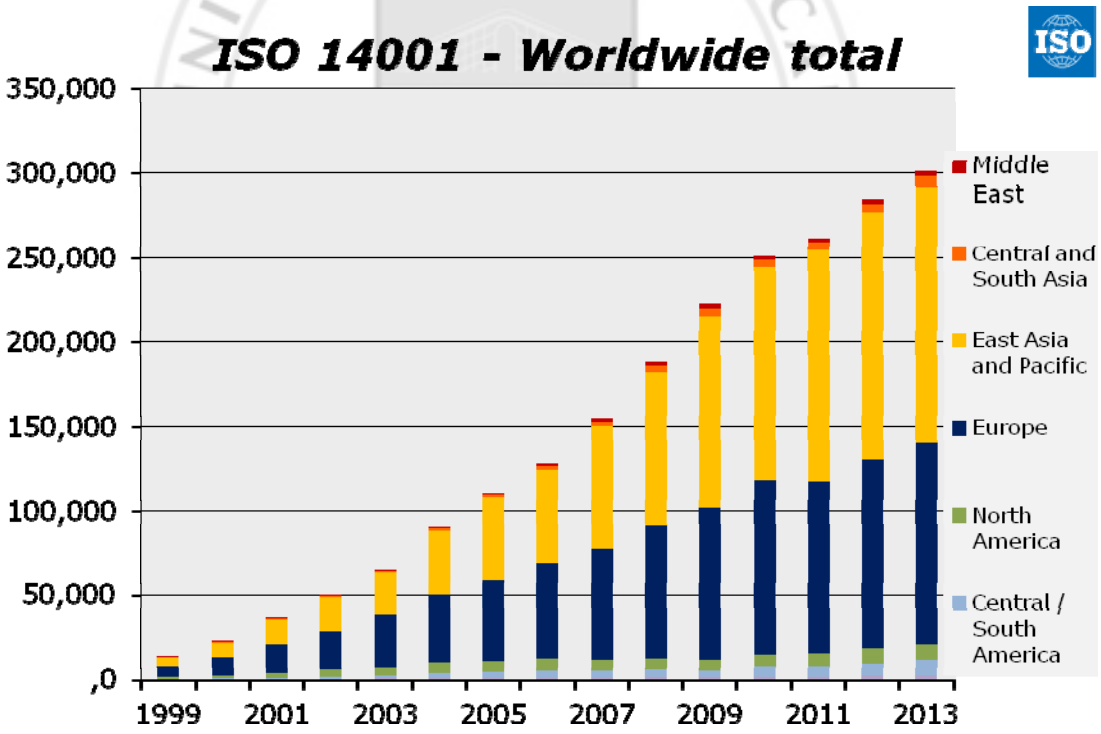


Figure 2. 4 The number of ISO 14001 certificates issued each year worldwide. (ISO 2013)

From Figure 2.4, it shows the number of ISO14001 certificates issued from year

1993 to 2003 in all sectors worldwide. It is observed that the overall trend for ISO14001 implementation is continually increased from 1999 to 2013. This indicated that the awareness and concern about environmental management have been increased. ISO survey reported that underscoring world environmental concerns, ISO14001 for environmental management records a 20% increase in several regions in which China is the lead for number of certificates issued and up to the end of December 2013, a growth of 6% (+16993) ISO14001 certificates had been issued in 171 countries, four more than in 2012.

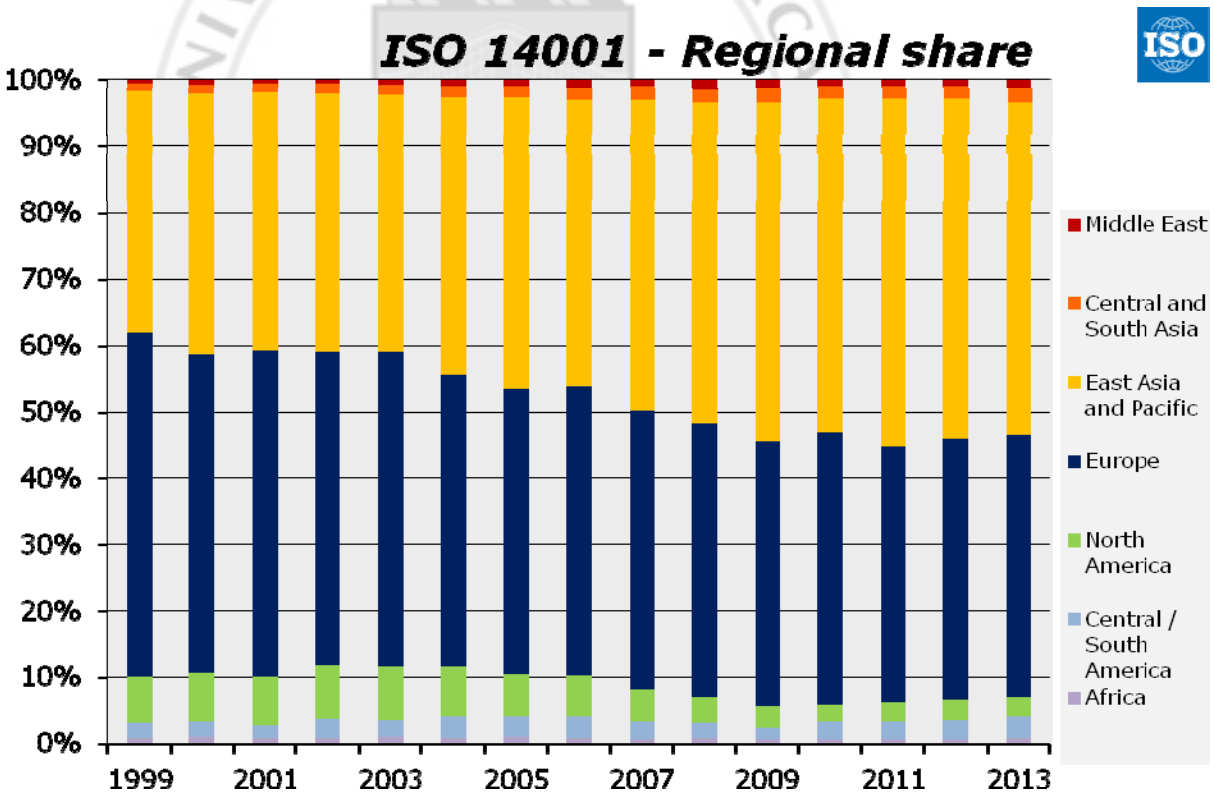


Figure 2. 5 Regional share of ISO14001 (ISO 2013)

From Figure 2.5, the largest contribution to the total number of ISO14000 certificates issued each year was East Asia and Europe. In early 1999 to 2004, the

percentages between these two regions are similar, but the number of certificates issued in Europe is slightly bigger. Started from 2005 onwards, the situation reversed; the number of ISO14000 certificates issued in East Asia overtook that of in Europe. In 2013, ISO reported that the top three countries for the total number of certificates issued were China, Italy and Japan, in which China and Japan are in East Asia. Figure 2.5 shows the trend for all sectors, which cannot truly indicated the situation in construction industry, thus, a figure of ISO14001 implementation worldwide trend for construction industry is shown in Figure 2.6:

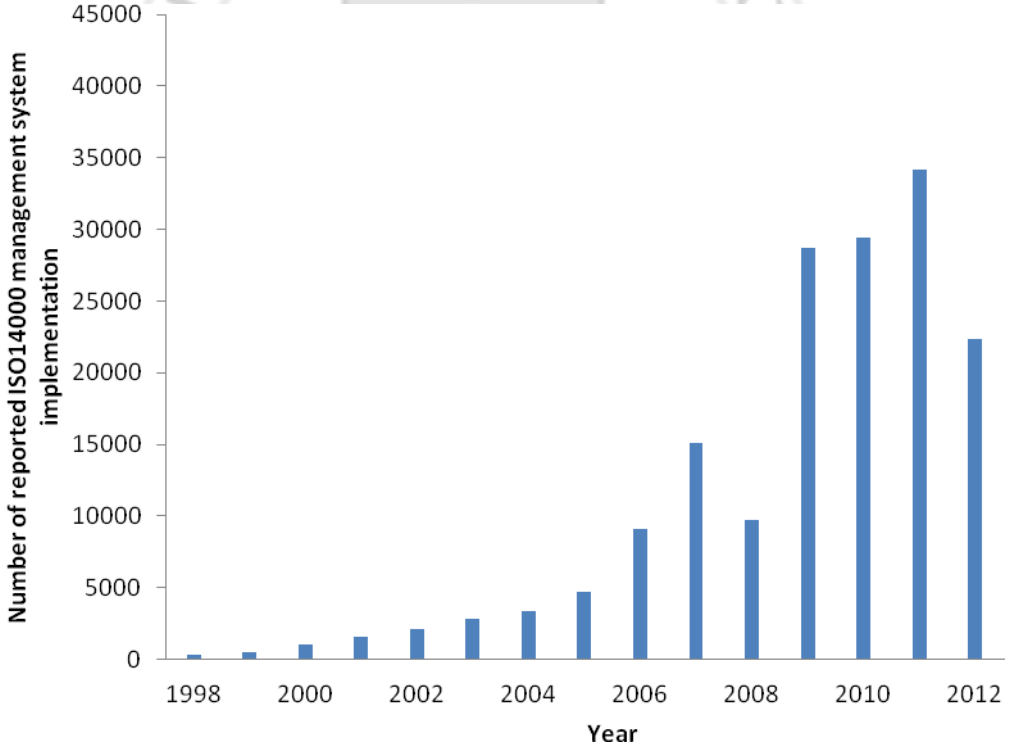


Figure 2. 6 ISO14000 implementation worldwide trend in construction industry. (ISO 2013)

From Figure 2.6, an increasing trend of ISO14000 certificates registration can be

seen, except the years of 2008 and 2012. This indicated that a raise of awareness in environmental issue in construction industry. ISO survey reported that in 2013, construction industry was one of the top five industrial sectors for ISO14001 certificates, which was ranked at the first position, with 40430 certificates issued. The other top four sectors were *"basic metal and fabricated metal products"*, *"electrical and optical equipment"*, *"wholesale and retail trade"*, *"repairs of motor vehicle, rubber and plastic products"* which listed in ranking order. In 2012, construction industry was also ranked at first with 22317 certificates issued, while the other four top industries were ranked the same as 2013. This indicated an increase of ISO14000 certificates registration from 2012 to 2013.

2.1.3 OHSAS18000 Implementation Worldwide Trend

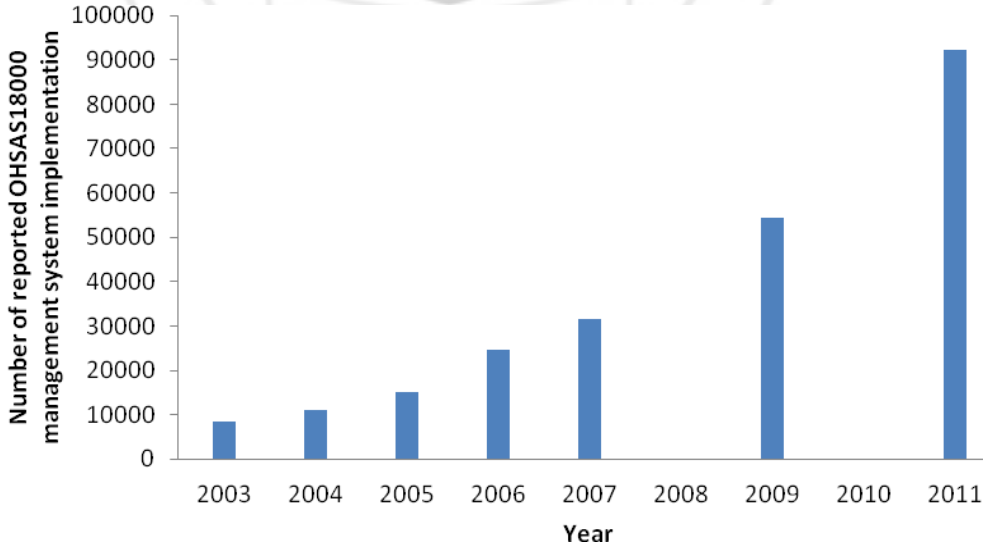


Figure 2. 7 The number of ISO18001 certificates issued each year worldwide.

(OHSAS survey 2011)

From Figure 2.7, it shows the number of ISO18001 certificates issued in all sectors from year 2003 to 2011, unlike ISO, the OHSAS Project Group started setting up this survey only from 2003, besides, the OHSAS Project Group mentioned that they was unable to obtain data from the year 2008 and 2010. As a result, a trend cannot be seen. In Figure 2.7, with two years' data missing, an estimated increasing trend can be guessed. However, the data from recent years were not published by OHSAS Project Group, recent OHSAS18000 management system implementation status cannot be seen or estimated. As a result, the author can only focus on past years data for OHSAS18001. Among three management system that discussed in this research, OHSAS18001 is the least popular, with the smallest number of certificates reported each year. However, OHSAS18001 increased trend was the most obvious, with no fluctuation in between each year (ignorance of the missing year). This phenomenon may due to the increase awareness and concern on safety in all sectors over the world, especially on workman safety. Such a system can help an organization develop risk prevention activities in a structured and coordinated manner, integrated with all day-to-day activities and decisions. Nevertheless, construction remains a high risk industry, accounted for the highest number of fatal work injuries of any industry sector.

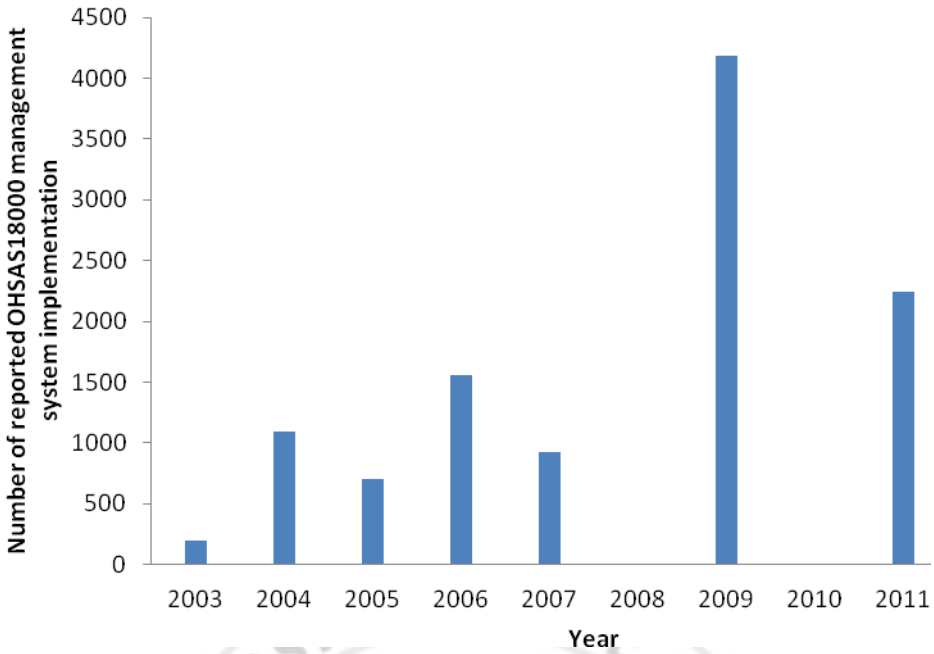


Figure 2. 8 The number of ISO18001 certificates issued each year in construction industry. (OHSAS survey 2011)

Figure 2.8 shows the number of ISO18001 certificates issued in construction industry from year 2003 to 2011. From the survey reported by the OHSAS Project Group, a number of contributors reported different kinds of certificate, thus, the total number of certificates in each sectors include all kind of reported certificates. OHSAS Project Group only extracted out the total number of OHSAS1800 each year (with both version of 18001:1999 and 18001: 2007) but not for each sector. As a result, the research extracted manually and produced the Figure 2.8. No obvious trend can be seen from the graph, with two yeas' data missing and fluctuation number, the implementation of ISO18001 is very unstable; this may not reveal the real situation and can only be used as reference.

2.2 Macau's Implementation Trend of ISO-Based and OHSAS-Based Management Systems

In early Macau construction industry, management system was not that popular, only few contractor firms would have management systems, mostly quality management system ISO9001, environmental management system ISO14000 and safety management system OHSAS18001 would be comparatively less. In 2007, Macau Productivity and Technology Transfer Center (CPTTM) established a management system promotion plan, aims at encouraging Macau industry to implement these management systems. Macau registration firms can approach CPTTM for management system information and can even apply subsidies to implement these management systems. The manager from the Quality Department (interviewee A) said that in early 1997, firms who applied sponsor for management system were mostly manufacturing industry, only few contractors, and mainly large firms, would have the management system certifications. Besides, there are no laws or requirement from Macau Government or any construction institutes that required contractors to obtain the management system certificates, as a result, management systems in Macau are not highly promoted or well-known. Interviewee A also mentioned that from 1997 up to now, the number of firms applied subsidies in implementing these management systems in Macau are more or less the same, more

than ten certificated were reported each year. In addition, Interview A pointed out that in construction sectors, small contractor firms became more and more active to inform CPTTM about the management systems application. Figure2.9 to Figure 2.14 are the graphs that show the number of reported management systems in Macau and Macau construction industry each year.

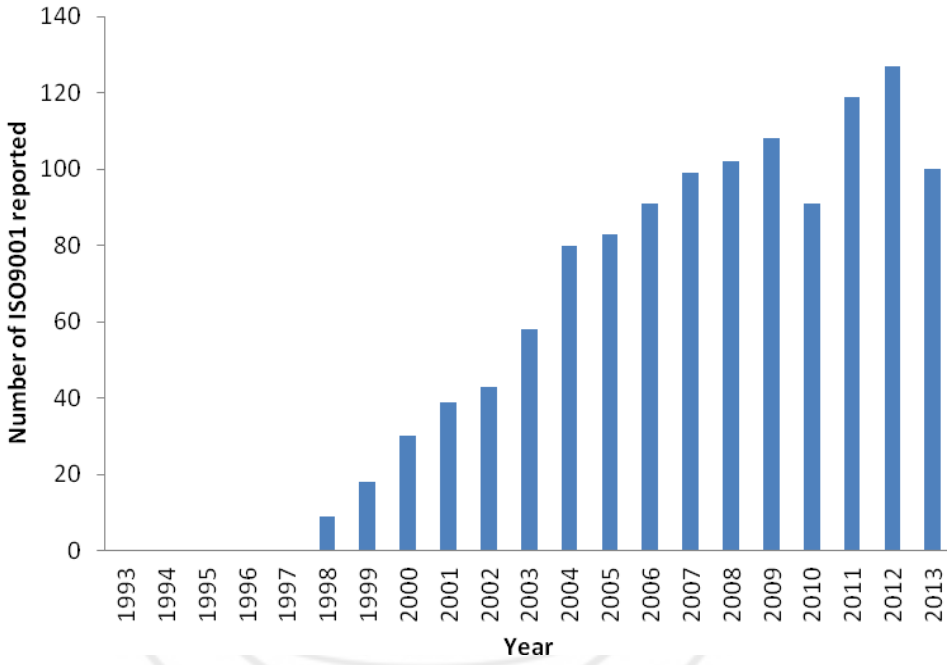


Figure 2. 9 The number of ISO 9001 certificates issued each year in Macau. (ISO 2013)

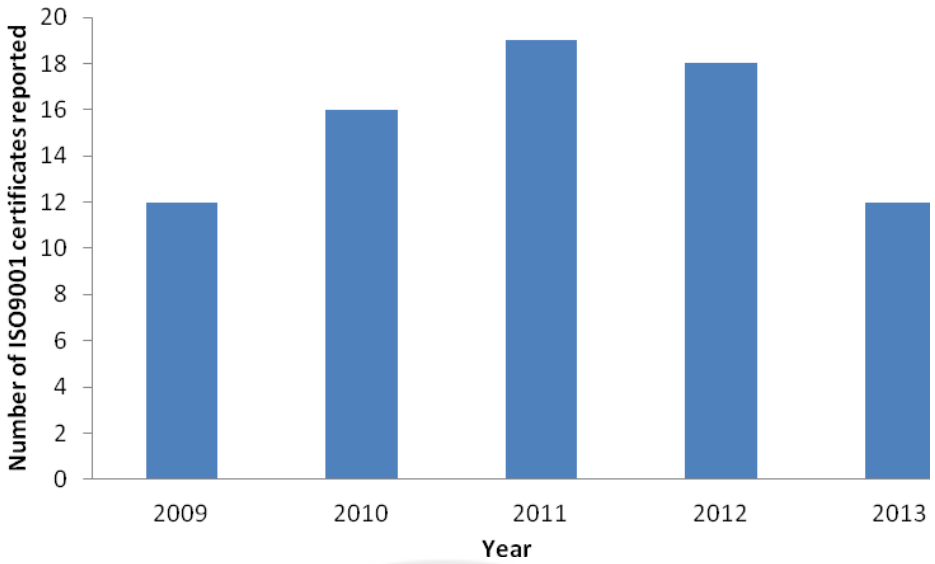


Figure 2. 10 The number of ISO 9001 certificates issued each year in the Macau construction industry. (ISO 2013)

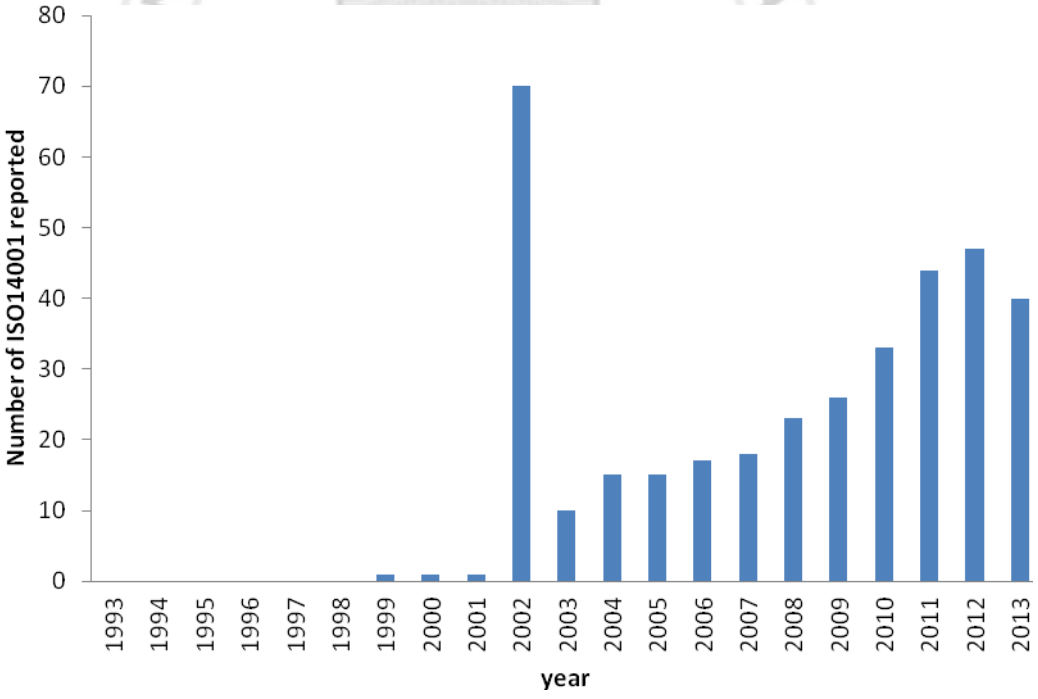


Figure 2. 11 The number of ISO 14001 certificates issued each year in Macau. (ISO 2013)

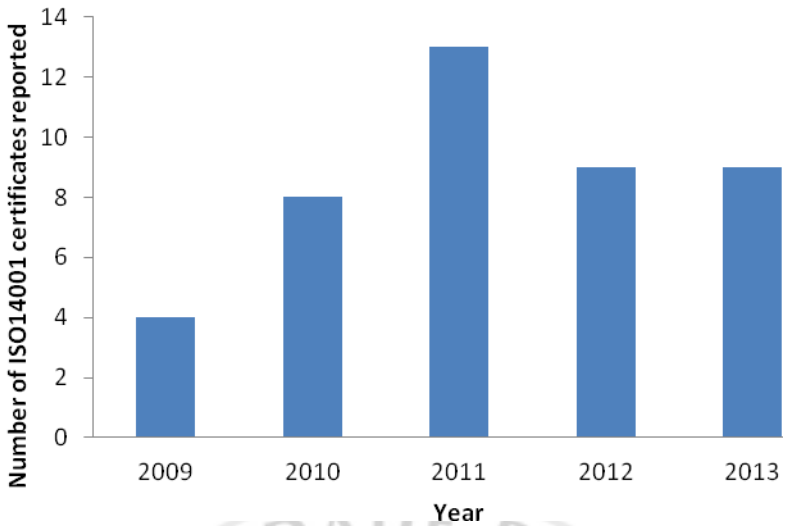


Figure 2. 12 The number of ISO 14001 certificates issued each year in the Macau construction industry. (ISO 2013)

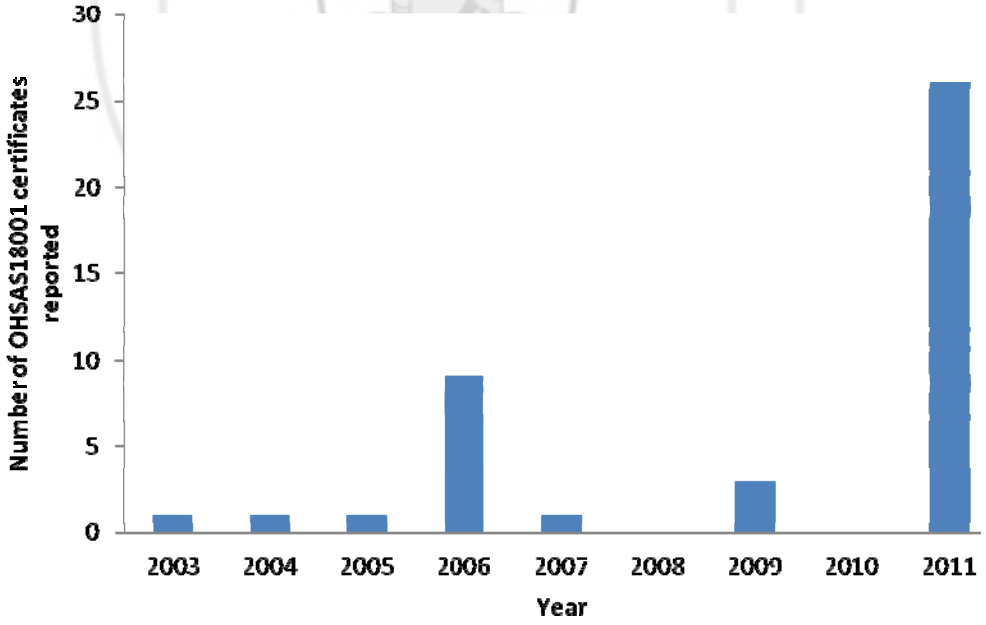


Figure 2. 13 The number of OHSAS18001 certificates issued each year in Macau. (OHSAS Project Group 2011)

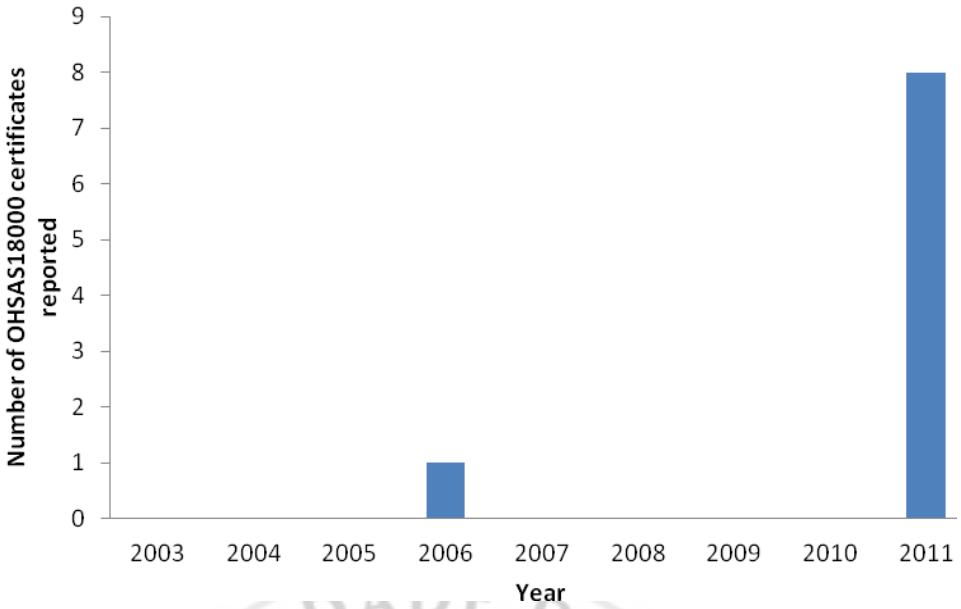


Figure 2. 14 The number of OHSAS18001 certificates issued in the Macau construction industry. (OHSAS Project 2011)

From Figure 2.9 and Figure 2.11, the implementation data of ISO9001 and ISO14001 management systems from Macau's firms was recorded only at the year of 1998 and 1999 respectively, which was five to six years behind other Asian countries, for examples, China, Singapore and Hong Kong started recording the number of implementation for ISO9001 in 1993. However, Macau's management systems situation indeed follows the world situation, in which ISO9001 remains the most popular from the past to present (Figure 2.9) and with OHSAS18001 the least popular (Figure 2.13). From Figure 2.9 and Figure 2.11, the ISO-based management systems provide an increase trend except one or two years of fluctuation, which matches the world trend. The Quality Department management from CPTTM (Interviewee A)

mentioned that the increase number of registration for ISO14001 may due to the promotion of the Direcção dos Serviços de Protecção Ambiental (DSPA) in Macau. For OHSAS18001, two years of data, 2008 and 2010 were reported to be missed by the OHSAS Project Group, the data from OHSAS was only provided for reference. In Figure 2.13, focusing on the most recent recorded year by the project group, which was 2011, a dramatic increase from 2009, about 80% was recorded. As there was some inconsistency with Macau Government's data. DSPA reported a total of 18 firms which obtained ISO14001 in the year of 2007 in all sectors and three ISO14001 were obtained by construction firms (DSPA 2007), in contract, only one certificate in all sector and zero in construction industry were recorded by OHSAS Project Group in 2007 from Figure 2.13 and Figure 2.14 respectively. Macau's trend for OHSAS18001 remained the same for early years from 2003 to 2007, and increased in recent year.

For the construction industry in Macau, the industrial data for ISO9001 and ISO14001 were available only at year 2009. From Figure 2.10 and Figure 2.12, the trend for both ISO-management systems were the same, with an increase from 2009 to 2011 and a drop afterwards. The drop for recent years may due to the withdrawal of firms; an investigation of the reasons will be shown in the later part of the research. For OHSAS18001, there is no registration for early year from 2003 to 2011. From Figure 2.14, with only one or two registration in between year, but for 2011, there is a

sudden increase for safety management system. The small portion of OHSAS18001 implementation does not mean Macau construction industry does not concern about safety, other than OSHAS18001, Macau Government has set up law to require people who enter the site must have the Macau safety cards. In order to have the safety card, applicants need to apply training course and pass the test provided by the Labour Affairs Bureau.

2.3 Review on Management Systems

Construction is considered to be one of the most dangerous industries around the world (Kines *et al.* 2007). Traditionally, quality and safety are two important elements in construction industry. As a mean to assuring quality by contractors, quality management system ISO9001 standards have actively been promoted in construction industry in many countries. Countries such as Singapore and Hong Kong, have even set ISO9001 standard as a prerequisite before they are qualified to bid for public sector projects (Low *et al*. 2003). Quality management system (QMS) certified to ISO9000 standards are now a normal feature in the construction industry in many countries. In recent years, due to the pollution and hazards created by construction activities, the construction industry also faced public pressure on environmental protection. In order to improve these situations, more and more construction firms have implemented ISO14001 for environmental management.

ISO9001 aims at promoting the quality of goods and services provided by different industries and was first developed on the basis of the U.K quality management system standard BS5750. In manufacturing and services sectors on an international scale, ISO9000 has already become the basis development of quality management system for assuring quality (Moatazed-Keivani *et al.* 1999). In 1988, ISO9000 was announced to be compulsory for all contractors under Hong Kong Housing Authority(HKHA), and this requirement was officially enforced in 1993. Since HKHA has mandated its contractors to be ISO9000 certified, ISO9000 is a gateway for contractors before they can bid a project. From that onwards, ISO9001 was adopted by many construction and consultant as quality assurance system (Chan and Tam 2000). Besides, in many countries' government such as Sweden and Singapore have imposed a compulsory laws for contractors and consultants in construction industry to implement ISO9001 certificate (Low and Lim 2000). In Singapore, ISO9000 certification scheme was launched in 1988, at that time, the adoption of ISO9000 was mostly from manufacturing industry in Singapore (Lam *et al.* 1994; Soh 1998). However, nowadays, it is normal for contractors or consultants, either in the public or private sectors, to have the ISO9001 management system certificates. Previous studies conducted by different researchers (Chin 2003; Low 2003; Tam 2001) outline a group of significant benefits from ISO9000 management,

such as "*improve quality system"*, *"improved customer satisfaction"*, *"continuous improvement"*, *"standard processes"*, *"structured documentation procedures and better control", "reduced costs"*, *"reduced wastages"*, *"reduced rework"*, *"less conflicts, claims and disputes" and "enhanced consistency and better image"*. These are all the advantages and benefits after ISO9000 implementation, however, the first steps to obtain the benefits is to implement.

Success Factors For Implementation ISO9000 in Hong Kong Construction Industry

Based on literature review and previous study (Choi and Chin 2001), *"top management commitment"*, *"human resource aspects and organizational changes"* are the main factors influencing of ISO9000 in the Hong Kong construction industry.

Top Management Commitment

Sun (2000) proposed that a genuine commitment, is important and necessary in order to implement ISO9000 successfully, helping to create effectual leadership, plan for an effective strategy for quality and human resources. Implementation of management system cannot exist without the commitment of the top management; it is a critical factor for implement ISO9000 management system successfully.

Human Resources

Human factor plays an important role in successful ISO9000 implementation, for

example, training and education of the employees enhance quality of an organization (Burati *et al. 1991*), sufficient training and education may even reduce the accidents rate in construction industry. More than that, Tam and Ho (2000) point out that the conscience of employees is an important factor in upgrading the quality of Hong Kong construction industry. Employee involvement and commitment can be affected by reward system, reward can be in many forms other than monetary terms, this help to improve the employees' satisfaction and staff morale can be boosted. Salary is not always the driving commitment for work, working environment and staffs' relationship are also important factors.

Integrated Management System for Safety, Environmental and Quality

Nowadays, ISO9001 for quality management, ISO14001 for environmental management and OHSAS18001for OHS management are widely accepted, (Low & Tan 2005) pointed out that integrated management system (IMS) has become a hot topic in construction industry. IMS is increasingly desirable and feasible to these three management systems into one. Zeng *et al.* (2007) found that companies who operate multiple parallel management system (each management system operate individually) are difficult to manage and have some major problems such as increase in complexity of internal management, lowering management efficiency, cultural incompatibility, hostility from employee, and increase in management costs. Internal and external

factors that affected the implementation of an IMS were also examined by Zeng *et al.* (2007). Internal factors include: "*human resources*", "*organizational structure*", "*company culture*", "*understanding and perception*". The external factors include: "*technical guidance"*, "*certification bodies*", "*stakeholders and customers*" and "*the institutional synergy model"*. It is believed that duplication of effort and resources can be reduced by implementing an IMS. Zeng *et al.* (2007) suggested integrating OHSAS18001 with ISO9001 due to the similarity and compatibility of these two management systems. This integration is able to lead individuals to become more responsible for working safely in hazard work place. Besides, by using a case study in China, Zeng *et al.* (2007) found that for achieving continuous improvement in implementing an IMS, manage and control risks of OHS are essential.

Originality and value in Macau

This is the first time to conduct such a study of quality management systems in the construction industry in Macau. Management system in Macau is not that popular, this research provides useful and practical insights to local contractors for reference. Helping local contractors to aware of the management system and the world situation by providing a picture of current management system status in Macau, a further trend of the management system implementation rate will also be given.

CHAPTER 3 METHODOLOGY

In order to find out the management system status in Macau, local contractors' point of view are used to forecast the future trend of ISO 9001 quality management system, ISO14001 environmental management system and OHSAS180001 management system. Factors and reasons affecting local contractors to implement management system and the benefits after management system implementation are analyzed. For the situation and background of each contractor firms, there would not be exactly the same, thus, this difference influencing their choices of implementation. Due to the unpopularity of management systems in the Macau construction industry, it is an interesting topic to find out the reason of lagging behind compared to other regions.

In order to analyze and find out the status of management system implementation for contractors in Macau, data and information are required to obtain from local contractors and foreign contractors that invested in Macau and have a branch company located in Macau (which will be stated as foreign-based contractors in this study). A questionnaire-based survey was conducted and copies are delivered to local and foreign-based contractors in person. Prior to preparing the questionnaire, a review of the past paper was carried out. The whole process of survey, from initial target search to final data analysis, include the following stages, detail and further explanation of

the process and procedure will be elaborated below:

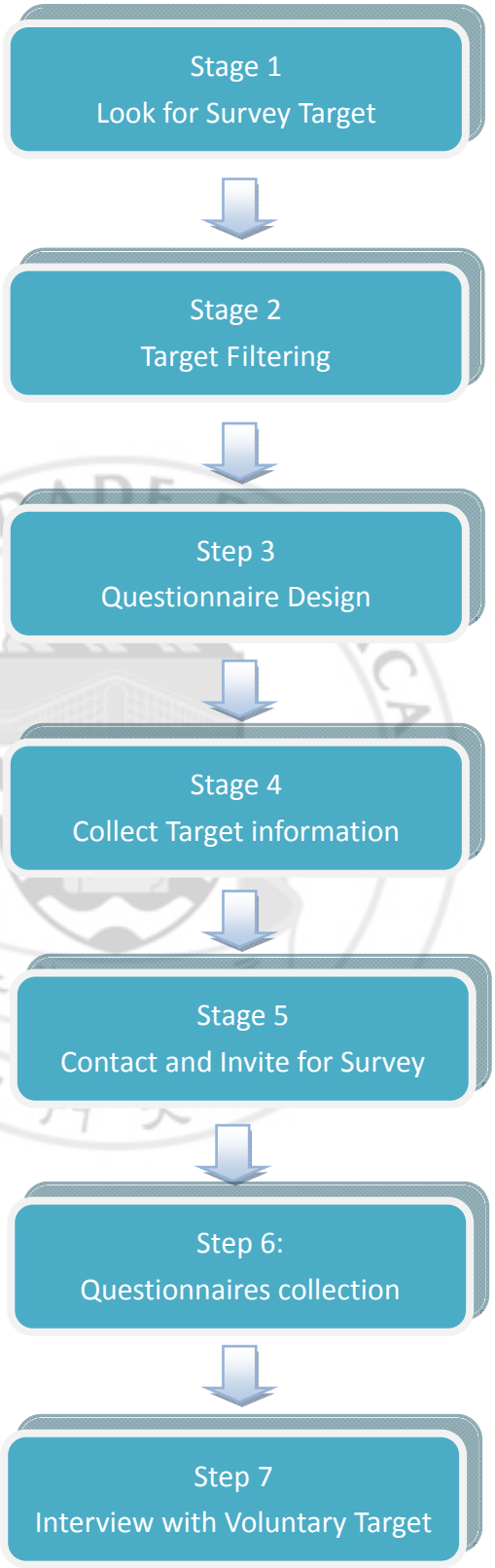


Figure 3. 1 Flow of work

Stage 1 --- Look for Survey Target

The view towards management system for each firm would be different, a few firms cannot represent as a whole. In order to do a more accurate research, this research include not just local contractors but also other foreign-based contractors. Besides, this research focus only on contractors. In Macau, Yellow Book and Phone Book contains all companies in all sectors that have registered. However, a search from these two books is quite time consuming, moreover, this may not give a complete contractor list.

In order to produce a list of contractors in a shorter time, two lists were drawn respectively, one from Macau Construction Association and the other from DSSOPT (Land, Public Works and Transport Bureau of the Macao SAR). The list from Macau Construction Association contains contractor-based companies, consultants, decoration companies, material suppliers, electronic engineering, fire network engineering whoever who paid a registration fee to register as a member, in a total of 281 companies. While the list from DSSOPT contains a complete list of registered contractors that have submitted tender for government projects started from year 2009 and is open for public. Although not all the companies are appropriate for the research target, the list has already been deduced to construction industry, in this way, it is time saving than searching in Yellow Book and Phone Page.

Finally, a list of contractors was extracted mainly from these two sources and a total of 69 contractor entries from Macau Construction Association. For DSSOPT, there are total 135 projects from 2009 to 2014, the number of contractors that have submitted tender is uncountable.

Stage2 --- Target Filtering

After obtaining a list of contractors, it is important to search for the active contractors in Macau, active refers to firms which are having project at least two years before the research process 2014-2015. Contractors that have projects within two years 2012-2013 before the research process are considered as active. As previous stage has mentioned, the list from DSSOPT webpage contains contractors that submitted tender recorded from 1999, which was more than 10 years ago, was out of the active year range for this research. As a result, filtering is needed and the number of contractors were awarded government projects from 2012 to 2014 is 13 and are all counted as active. On the other hand, the number of contractors which submitted a tender for government projects in 2012-2014 was extracted, with a total of 40 and the operation status is unknown. However, in between the two lists from DSSOPT and Macau Construction Association, there are some contractors that are overlapping with each other. As a result, after filtering, a total of 74 contractors which operation status is unknown. Phone calls were made by the author to confirm the operation state of

each company. As a result, a total of 63 contractors are confirmed to be active, the rest are either inactive, wrong phone number or without response. However, this number does not represent the total number of active contractors in Macau, some contractors that does not registry in Macau Construction Association and DSSOPT and cannot be found in details. A complete list of active contractors in this study can be found in Appendix B.

Stage 3 --- Questionnaire Design

This questionnaire design in a way that aims at gather information for analyzing different criteria that are forecast to have difference reasons and expectations for management system implementation by local and foreign-based contractors. In order to cope with different languages used by the respondents, questionnaires in both Chinese and English questionnaires were prepared. The design of the questionnaire was divided into the following sections.

1) Basic information of the company and respondent

In order to find out the background of contractors, it is important to know, for example, the number of staffs, years of establishment, average annual revenue and types of projects handled by contractors. With all these information, comparisons of background between local and foreign-based contractors with or without management systems can be made. Besides, knowing the position of the respondent provides the

author a better picture of the truthfulness of the information. The main focus on this study is about management systems registration in the construction industry, a QA/QC manager as a respondent is more persuasive that a front desk staff.

2) Information about management system of the company

This part is the main concern in designing the questionnaire, two sets of questions were prepared for different respond. If the contractors obtain different management system certificates, it is important to know also the valid period. From the valid period, the author can know about the current management system status of that company, either redrawn from management system implementation or continue the implementation.

3) Rated criteria for reasons and expectation of management system implementation by the contractors

This part is for respondents of contractors that replied having management system implementation in the second part. The criteria of reasons before and outcomes after each management system implementation was rated as one to five, representing the degree of endorsement of each statement.

4) Rated criteria for reasons for not implementing management systems and the expectation if consider for later implementation

This part is for respondents of contractors that replied not having management

system implementation in the second part. It is interesting to know the reasons for local contractors not having management system implementation as management systems are actually very basic requirement in other regions' construction industry. For some contractors that will consider to implement management systems in coming five years were asked about the expectation of management system implementation.

As mentioned in Section 1.3 that the response rate is expected not to be very high. In order to increase the respond rate and provides a comfortable and confidential condition to all respondents, the author has emphasized at the opening of the questionnaire that all information provided by the respondent will be and must be strictly kept confidential, all the information will be only use for academic research only and will be obliterated after the research has been finished. This assures the information about the company is under protection, encouraging the respondents to provide the information accurately and ultimately, hoping to increase the respond rate and accuracy of the research. A complete questionnaire can be found in Appendix A.

Stage 4 --- Collect Target Information

In stage 2, after filtering the target, and confirmed a total of 63 active contractors, the next step is to collect the information of these contractors. The only information that is known until this stage are the name and phone number of the contractors. It is necessary to obtain the address, facsimile number and email address of the companies

from Macau Construction Association website, Yellow Book or directly contact by phones, for contacting and later distribution of questionnaires purpose.

Stage 5 --- Contact and Invite for Survey

Both Chinese and English questionnaires which started with an invitation letter were sent out to each company listed in the target list in person. The date of collection was written in each questionnaire as a reminder to the respondent, avoiding no response at the end. All 63 set of questionnaires were sent out in three times, the recipient of the questionnaires was reminded that the survey is specifically designed for QA/QC department, manager is best choice for giving the most detail information.

Stage 6 --- Questionnaire Collection

Out of 63 questionnaires that have sent out to the contractors in the target list, a total of 18 questionnaires returned with a response rate of 28.7%. The result is considered to be satisfactory compare to others research return rate.

Table 3.1 – Comparison of response rate of different surveys

Previous Paper	Response Rate
George & Gu 2001	15%
The result of this study	***28.7%***
Zeng *et al.* 2003	30%
Ribeiro & Curado 2000	52%

Stage7 --- Interview with Voluntary Target

At the last part of the questionnaire, a question about whether the respondent is willing to have a short interview on this topic or not. There are three respondents out of 18 were willing to spend time to have the interview. Other than that, requests for an interview were sent to some Engineers, QA/QC manager, and professional persons by email. In total, 7 interviews were successfully done in which 3 people are from local contractors and 4 are from foreign-based contractors. The time for each interview was about 15 to 30 minutes. Three sets of questions were prepared for different groups of people: local contractors that have implemented management systems, local contractors that did not implement management system, the last group is foreign-based contractors that have implemented management system. The questions asked were mainly the interviewee's opinion towards management system in Macau construction industry in the future. A complete list of interview questions can be found in Appendix C.

CHAPTER 4 RESULTS AND DISCUSSION

4.1 Current Management System Implementation Status in the Macau Construction Industry

As mentioned in previous chapters, management systems in construction industry in regions such as Hong Kong and Singapore are a very basic requirement in tendering government projects. However, this scene cannot be seen in Macau. In order to find out the reasons of the big difference, it is important to compare the view towards management system from both local contractors and foreign-based contractors. To find out the current management system implementation status in Macau, factors that influence the local contractors' choices of management system implementation are the main concern, these data were collected from questionnaire and will be analyzed below.

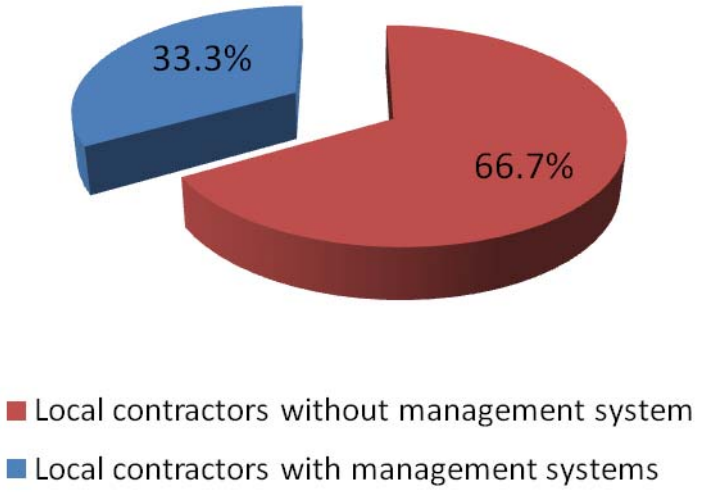


Figure 4. 1 Management system implementation proportion for local contractors

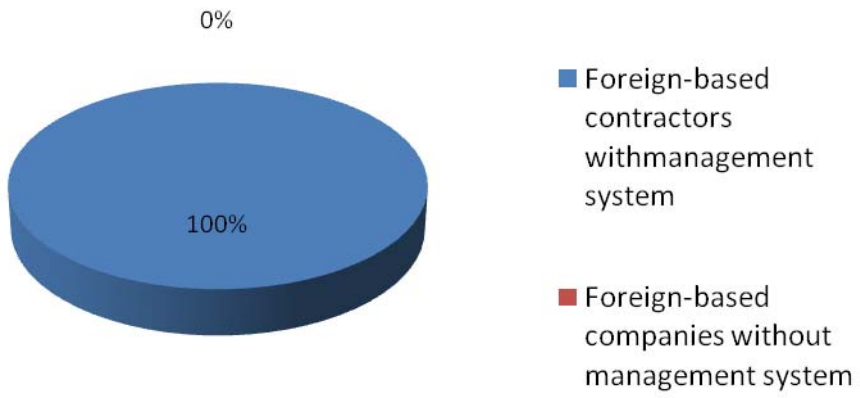


Figure 4. 2 Management system implementation proportion for foreign-based contractors

The proportions of management system implementation for local and foreign-based contractors are separated into two graphs Figure 4.1 and Figure 4.2 for easier comparison. It is found that 66.7% (Figure 4.1) of local contractors did not implement management systems, compare to 0% (Figure 4.2) of foreign-based contractors, indicating a great difference in concerning about management systems in construction industry between local and foreign regions. Only a small group of 33.3% (Figure 4.2) local contractors are with management systems. The portion of different management systems that local and foreign-based contractors have implemented will be shown in Figure 4.3. Noted that the questionnaire has been separated two sections for contractors with and without management systems, as a result, only contractors with management systems will be considered in this part.

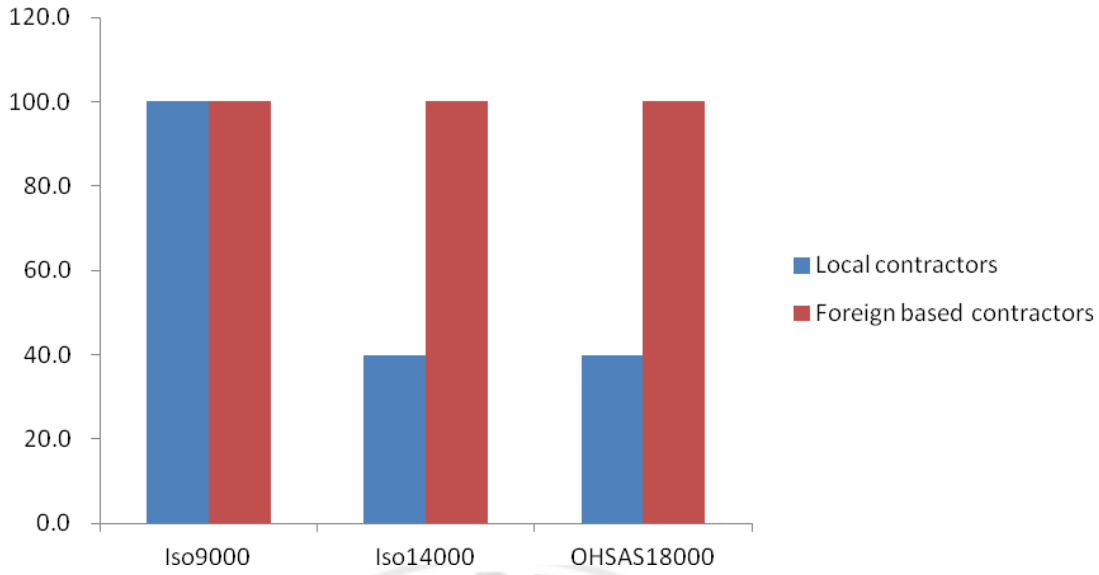


Figure 4. 3 Proportion of different management system implementation by local and foreign-based contractors

From Figure 4.3, it is clearly shown that the implementation of ISO9000 management system is the most popular, in which 100% of local and foreign-based contractors obtained the certificates. This matches the description from ISO organization "the ISO9001, as a leading standard on quality management, remains popular with an increased catchment area of 187 countries." Compare ISO9000 to ISO14000 and OHSAS18000, although the portion of environmental and safety management system implementation by local contractors is only about 40%, it is a good sign that a few local contractors started to discover the good side and importance of management systems. For foreign-based contractors, the portions of three management systems implementation are observed to be 100%. It matches the paper written even 10 years ago, stated that these three management system were basic

needs in bidding a project, raised company's competitiveness and reached to the international standard.

4.2 Comparison of Companies' Background between Local Contractors and Foreign-Based Contractors

Reasons such as Macau's companies are small, resources are less than companies in other regions, are usually given to explain the lagging of Macau's management system status in construction industry. To find out if these reasons are valid or not, a comparison of the background of local and foreign-based contractors that have implemented management systems is carried out.

4.2.1 Size of Companies

Size of companies is the first comparison element. Before the analysis, it is necessary to define the size of companies by using the number of staffs in the companies, which is one of the question asked in the company's information part of the questionnaire. 6 choices were given in the questionnaire and according to the research target region, Macau, has a smaller population and region size compared to foreign regions, the size of company will be scaled up. In an other words, a company with 40 staff will be considered as a medium size company rather a small size in China. Due to the research purpose, data are required to be standardized. The data from foreign-based contractors, which is used to compare with the data from local contractors, would also scale up for convenience. Although this may not be reflecting the real company size in foreign regions. Three company sizes were define in this

study: small, medium and big. The company size would be small if the number of staffs is less than 40; the company size would be medium if the number of staffs is between 40-80, lastly, it would be large if the number of staffs is greater than 80.

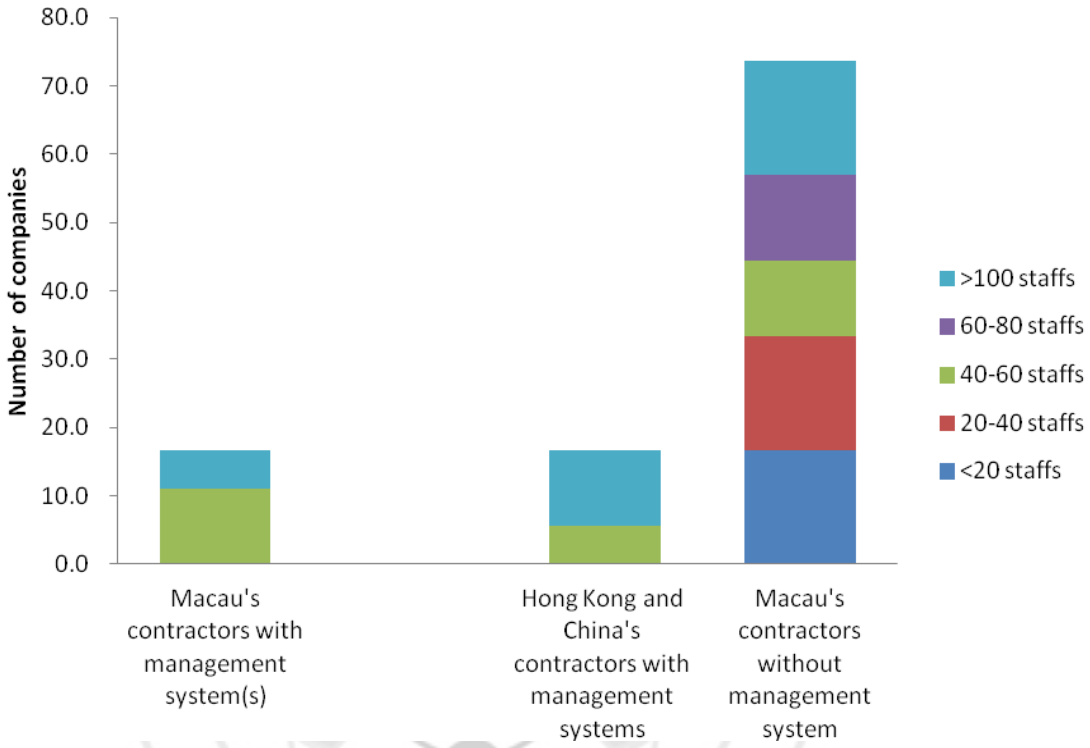


Figure 4. 4 The comparison of size of local and foreign-based contractors with or without management systems

Figure 4.4 shows the number of contractors with or without management systems, in a distribution of staffs' number. For local and foreign-based contractors that have implemented management systems, the number of staffs is between 40 to 60 and >100, which are in the medium and large size criteria. For local contractors that did not implement management systems, all 3 companies' sizes can be seen. It may be common to see a foreign-based contractor with more than100 staffs, however, it is rare

in Macau. A local contractor with more than 100 is said to be very systematic and standardize, with only a few in Macau. The common contractor companies' sizes in Macau are small and medium, it is found from Figure 4.4 that the smallest contractor company size that have implemented management systems is medium and the number is expected to be small, with only 11.1% is shown. As a result, for local contractors that with the number of staffs less than 40, it is understandable that it may be difficult for them to have additional man power and money to invest into management systems. But for local contractors that will a larger size, medium and even large size companies, the reasons for not having management systems may not be only limited resources, as there are companies with the same size implement management systems successfully.

4.2.2 Years of Establishment for the Company

Size of company may reveal part of the resources in a company, and limited resources may not be the main reason for not implementing management system by local contractors. Even though there are plenty of staffs in a company, but if it is newly establish, the company may not be mature enough to have the technique to handle these huge bunch of documentation works and may bring burden to the staffs. As a result, years of establishment for the contractor companies is another factors affecting the choices of contractor to implement management systems.

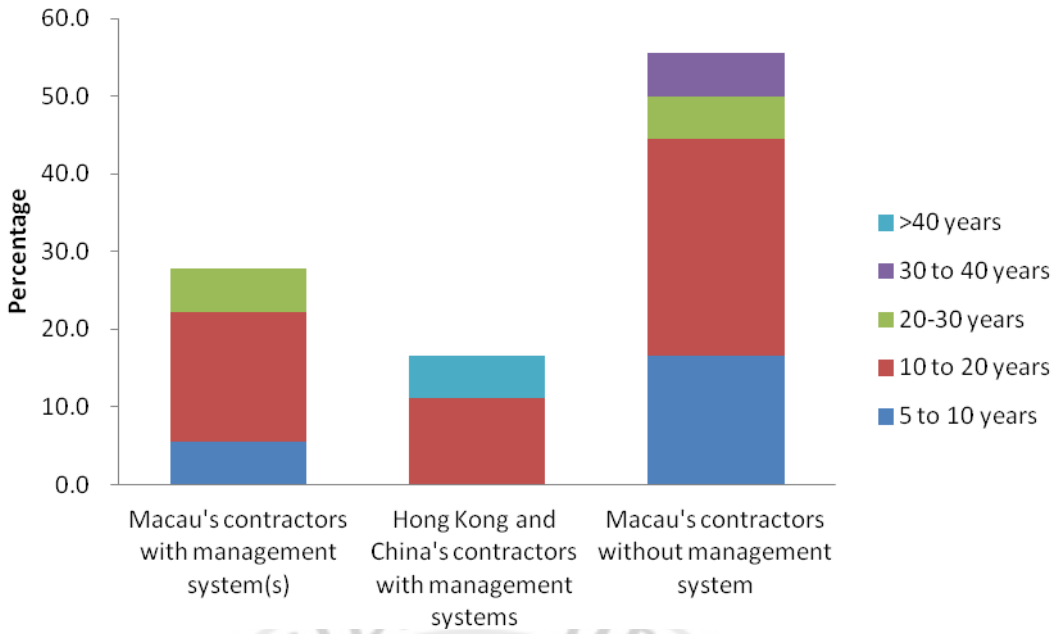


Figure 4. 5 The comparison of years of establishment of local and foreign-based contractors with or without management systems

From Figure 4.5, it is observed that there is none of the local or foreign-based contractors that is newly established, with year of establishment less than 5 years. Among the local contractors with management systems, most of these local contractors have established for 10 to 20 years and with a small amount of local contractors established for 5 to 10 years. Contractors that have established for 10 to 20 year have overcame the peak and valley period of construction industry. Although the exact time of management systems by these local and foreign-based contractors is not known, this can imply that 10 to 20 years of establishment is enough, mature, and a proper time to establish management systems. For foreign-based contractors with management systems, 10 to 20 years also is the highest proportion interval. There is a

long history of management system implementation in foreign-based contractors, thus the systems are already well-organized. Local contractors should pay more attention in construction industry in other regions. From Figure 4.5, a clear picture can be seen that there are still lots of local contractors that have established for 10 to 40 years but did not implement management systems. As a matter of fact, among them, some are a few ten years lagging behind of foreign-based contractor. The reasons for not implementing are really interesting to explore and will be discussed in Section 4.3

4.2.3 Types of Projects the Company Usually Handle

There are lots of different types of project that contractors need to handle. For example, the common types of projects in Macau are: residential building, casino and hotel, commercial building, bridges etc. The project types handled by local contractors may also affect the decision of management systems implementation. For example, the government does not require local contractors to implement management systems for public residential housing in Macau, so companies that mainly tender government jobs may put down the decision of management systems implementation. The distribution of types of projects handled by local and foreign-based contractors will be shown in Figure 4.6 to identify if types of projects handled by contractors could be one of the factor affecting the decision of management systems implementation or not.

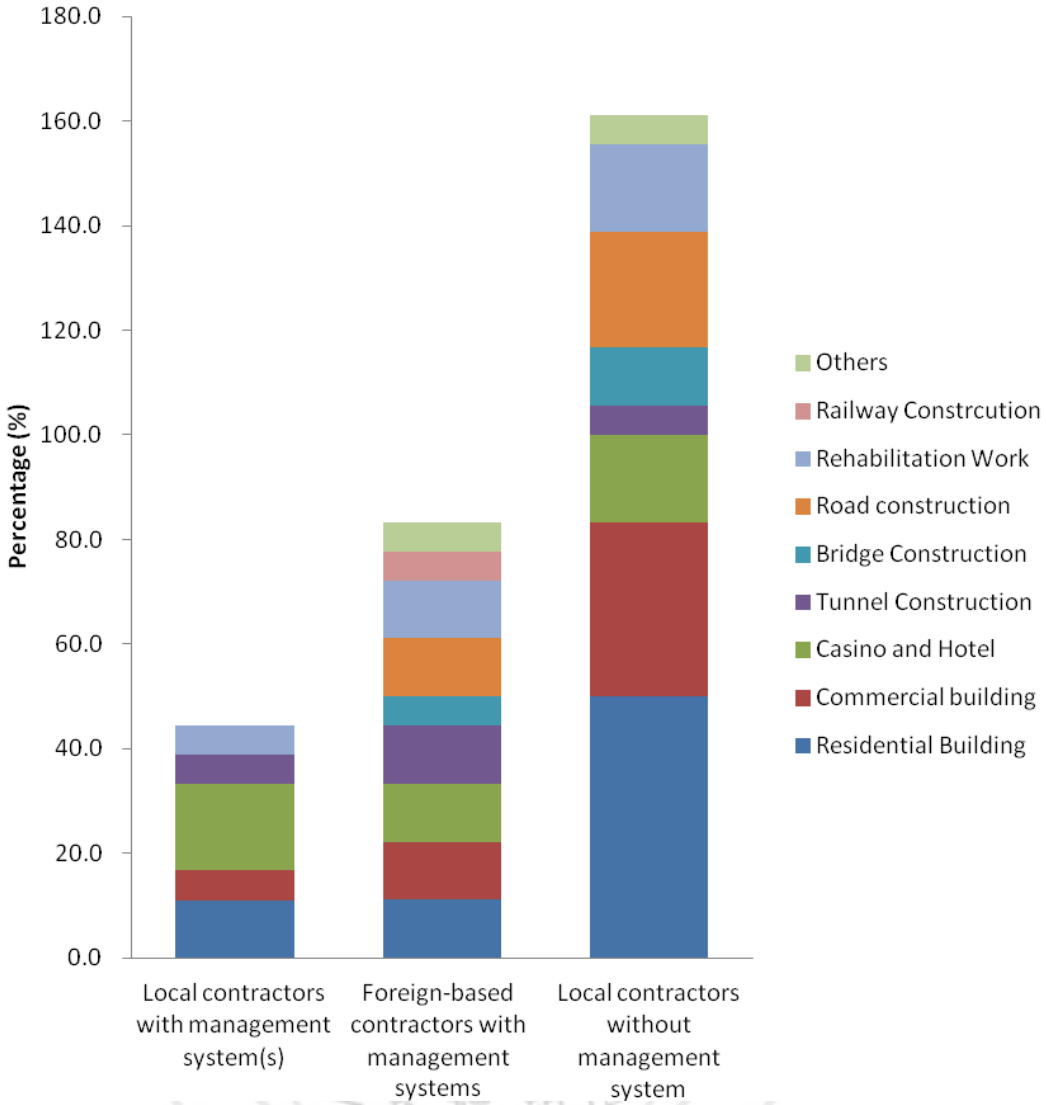


Figure 4. 6 The comparison of types of projects handled by local and foreign-based contractors with or without management systems

It is not surprising to see from Figure 4.6 that for foreign-based contractors, no matter what types of projects these companies handle, management systems are necessary. The types of projects shown in Figure 4.6 also have different kinds of client, either private or public, public usually to the government. Although only government projects in Hong Kong are set to be compulsory, clients from private projects also

view management systems as an important issue. Unlike Hong Kong, there is no law or requirement to bound the contractors to implement management systems in Macau. In general, residential building is the main type of projects handled by local contractors. Among those local contractors without management systems, residential building also ranked number. This may be due to the different requirements that caused by clients. However, it is interesting to see from Figure 4.6 that the types of projects handled by local contractors with management systems are mostly casino and hotel. One of the reasons can be because of the main contractors are mostly foreign-based contractors. Management systems in these regions are a compulsory issue, there is a possibility that only if local contractors that have management systems could have chance to be selected as subcontractors. The other reason may be due to the views from client, if clients are from foreign regions and have no idea about the local contractors' standard, as a result, management system is one of the criteria that the clients can assess the company.

4.3 Comparison of Reasons and Outcomes of Management System Implementation by Local and Foreign-Based Contractors

4.3.1 Elaboration of Different Reasons

Based on literature reviews together with observation of Macau construction industry, 15 reasons for management system implementation were designed in the questionnaire. All reasons will be elaborated below before analyzing the results from the collected data.

1) Enhance company reputation

As management systems in Macau construction industry are not as common as regions such as Hong Kong and China. The implementation of these management systems makes the local contractors different from others. The local contractors who have implemented management systems can register in CPTTM and require to put the company's name on the management system registration webpage in construction field thus may have one more channel to promote the company and raise companies' reputation.

2) Enhance workers' quality, environmental and safety consciousness,

There are rules and regulations that the company needs to follow during the implementation and maintenance of the management systems. As a result, workers and staffs that did not know the flow of work in management system before may start

to know and understand the regulation that management systems required. This help to raise the staffs and workers' awareness in the aspect of quality, environmental and safety. Especially for the workers who work in the site, management system regulation not only require them to follow, but also provides a chance for workers to understand the importance of management system implementation. What and how to do in the field can provide them a safe and health working environment; what and how to do to provide good quality of work thus providing a good quality outcome of the product. These all are valuable experience and teaching that management systems provide.

3) Client's preference and demands

Client is the one who starts the project, he is also the one who brings up the idea in his mind to architect. Architect, project manager or construction teams are all under the client and would need to fulfill the needs and requirements of the client. Management system is one of the demands for some clients. Client may require that the teams that work for him must have the management systems, otherwise, companies without management system would not be considered. This situation is very common in Hong Kong in bidding government projects, management systems just like a entrance ticket, without this ticket, there is no chance for the company to bid the project.

4) Lower cost and enhance business

It seems contradictory to mention that implement management systems can lower cost of a company as additional money such as employing consultant, additional labour cost and implementation fee. However, for some companies, management system is really a good way in lower cost as management systems standardize internal operation, improve communication between departments thus raise staffs and workers' working efficiency. As a result, time is one of the important elements in construction, time is money, saving time can help business run more smoothly and thus can enhance business.

5) Give confident to the customers

The clients for each type of project are different. If the client is a foreign investor and have no idea about the background of the local contractors, management systems is one of the assessment that can be directly gotten by the clients. For contractors that have implemented management systems, this assures that this company can reach certain international standard, giving confident to the clients.

6) Easier to bid a project

In Macau, although there are no requirement for local contractors to implement management system, for some clients, management systems one of the criteria that can add bonus, thus increasing the chance for bidding a project.

7) Ensure the company can meet international standard

One of the reasons for contractors to implement management system may be aimed at raising companies' internal standard. This may only be the requirement from the boss of the company aims at improving internal quality and to meet international standard.

8) Increase competitiveness

Management systems in Macau construction industry is not as common as other regions. Implementing management systems would make the company be different compared to other local contractors. Thus during open competitive bidding process, management systems may be one of the outstanding points thus raising the competitiveness of the company.

9) Improve working efficiency

Management system standardizes internal documental operation, it is easier for staffs to find the drawing or document that they need easier. The transition of work did not require much time to take over as the system of documentation is easy to handle. However, the increase of documentation may also increase the burden of staffs, thus having pros and cons depends on the situation of the companies.

10) Standardized internal management system

There is a set of documentation standard required for companies who have implemented management systems to follow. All formats of forms, documents, all

types of paper works are standardized, provides a neat and orderly internal management systems, avoiding the mistakes brought from unclearness of works did by different people by different styling.

11) See the potential of management system implementation in the Macau construction industry in the future

Companies who concern more on long run may think that management systems have potential for management system implementation in Macau construction field in the future. Potential here refers to the trend that more local contractors will adopt management systems in the future.

12) Government's preference

This is the government's view towards management system. For governments in different regions, the requirement and preference are different. The statement of government's preference as a choice for reasons for management systems implementation may help to reflect the government view and policy towards management systems in Macau and other regions' construction industry.

13) Pressure from competitors

The pressure here refers to the competitive pressure, which means that the contractors implement management systems only because the other contractors but not for the companies' own view.

14) Have subsidies in establishing these systems

In Macau, local contractors can apply subsidies for management systems implementation from CPTTM. Other than monetary subsidy, CPTTM also provides training courses to local contractors that would like to implement management systems but do not familiar with the procedure of implementation.

15) Have chance to bid international projects

Due to the large amount of foreign investment in Macau, contractors who wants to have chance to bid these kinds of international projects would be needed to implement management systems. One way is to increase competitiveness; the other way may be the requirement from invested clients.

4.3.2 Difference in Reasons for ISO9000 Implementation between Local and Foreign-Based Contractors

In Section 4.1, it has been mentioned that quality management system ISO9000 leads the way in construction industry. Out of the total questionnaires received from local contractors, more than 30% have implemented ISO9000. However, it is fascinating to find that ISO9000 would be implemented alone by local contractors. Normally, foreign-based contractors would implement ISO9000, ISO14000 and OHSAS18000 together as a whole to save more time and resources. What expectation and reasons for both the local and foreign-based contractors would like to get from

management systems will be compared and will then be shown in detail in this chapter. From the returned questionnaires, both local and foreign-based contractors with or without management systems participated in filling the questionnaires, the questions that these two types of contractors required to fill are different. As a result, the plot of figures in this chapter would only use the data from contractors with management systems.

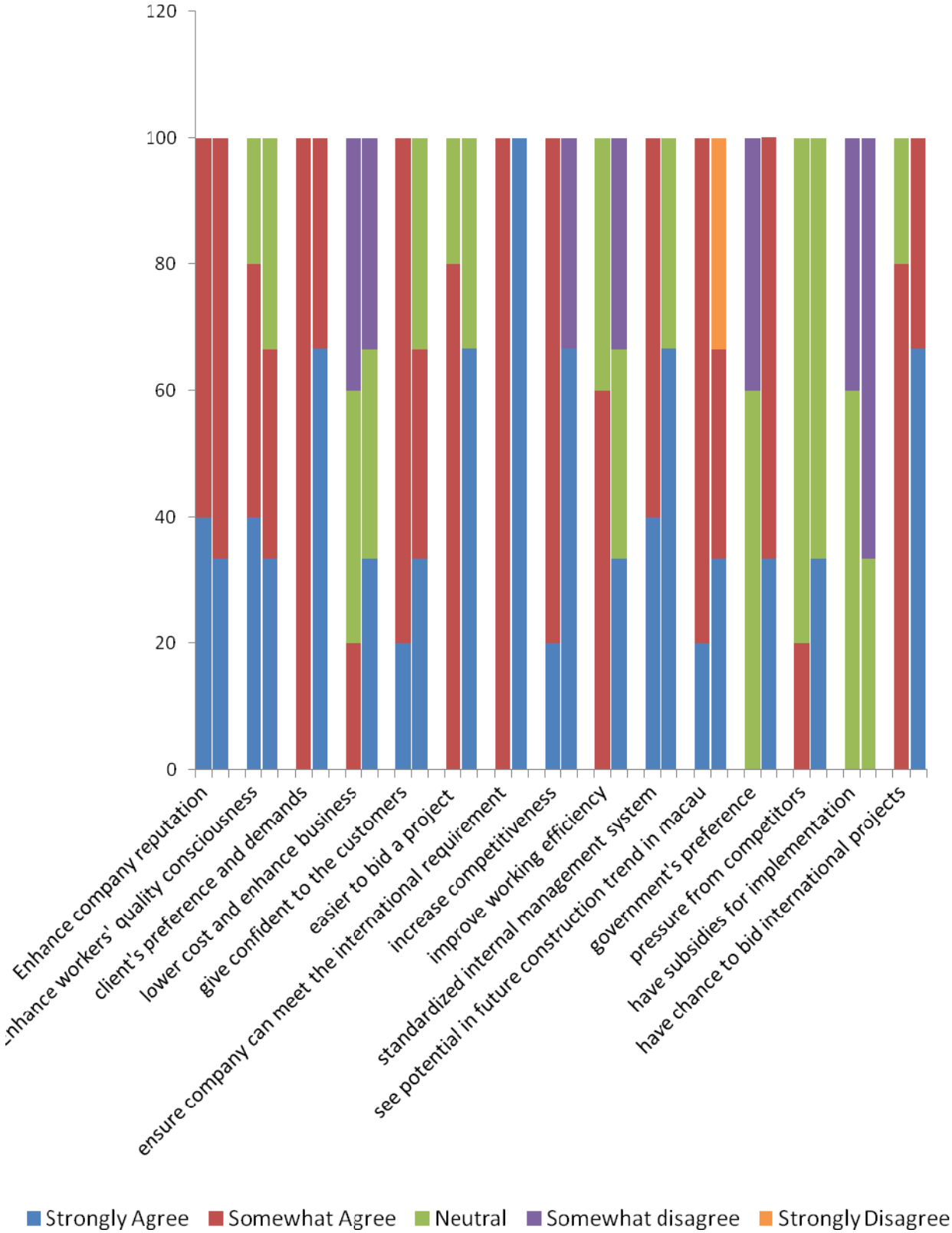


Figure 4. 7 Reasons for ISO9000 management system implementation

This graph Figure 4.7 shows the reasons for ISO9000 management system implementation between local and foreign-based contractors. The left hand side of each group of data of each statement would be the reasons for ISO9000 management system by the local contractors, whereas the right hand side bar is from foreign-based contractors. Among local contractors certified to management systems, most reasons fall on the category of agreement and neutral, except "*lower cost and enhance business*", "*government's preference*" and "*having subsidies for implementation*", in which disagreement appears. However, among foreign-based contractors with management systems, the data is more extreme compared to the data from local contractors, for the same reasons, there are strongly agreement and strongly disagreement. Although there are much fluctuation for the data from foreign-based contractors, it is found that the data of both local and foreign-based contractors are quite consistent. Taking somewhat agree and strongly agree to be one category as agreement and somewhat disagree and strongly agree to be another category as disagreement. In this way, statements with contradictory response from local and foreign-based contractors would only be: "*increase competitiveness*", "*improve working efficiency*", "*see potential in management system trend in Macau construction industry in the future"* and "*governments' preference*". The difference for these 4 points can be explained due to the different nature of the based companies.

1) Increase competitiveness

From Figure 4.7, among local contractors with management systems, there are 20% and 80% of strongly agree and somewhat agree respectively for this statement. On the other hand, 66.7% and 33.5 % of strongly agree and somewhat disagree occur in data from foreign-based contractors. The data collected for foreign-based contractors are from Hong Kong and China in which management systems are a basic requirement to tender projects. Most proportion of foreign-based contractors obtain management systems, thus obtaining management system would not be considered as more outstanding. On the other hand, management system implementation by local contractors are not so common compared to Hong Kong ,as a result, management systems may help in raising competitiveness. Base on the fact that management systems are well accepted and common in foreign-based contractors from regions such as Hong Kong, disagreement of this statement does not really mean management systems are not helpful in increasing competitiveness of the company.

2) Improved working efficiency

There are 60% and 40% of the respondents chose "*somewhat agree*" and "*neutral*" for local contractors' data, the results are quite positive, falling on the side of "*agreement*". In contrast to local contractors' data, the result from foreign-based contractors fall on the categories: "*strongly agree*", "*neutral*" and "*somewhat*

disagree". For this statement, working efficiency is more controlled by companies but not by the implemented management systems itself. A proper management system would provide a company with optimal result, however, in another way, a bad management in a company would even mess up and slow down the efficient. Management system itself is a tool helping company to operate smoothly and functionally. The regulations and rules for ISO9000, ISO14000 and OHSAS18000 are the same for all companies, as a result, other management strategies or techniques, such as workforce allocation, derived impact on a companies' working efficiency. Consequently, the distribution portion in different categories may due to the management techniques in a company, bringing different opinions on this statement.

3) See potential in management systems trend in Macau construction industry in the future

To see whether management systems has any potential in Macau construction industry in the future, it is a very subject opinion. For local contractors, 20% stated "*strongly agree*" and 80% stated "*somewhat agree*", the result is towards positive side. This implied that management system would be more common and necessary in Macau construction industry in the future, similar to that in Hong Kong. For foreign-based contractors' data, the result is evenly distributed on the categories of "*strongly agree*", "*neutral*" and "*somewhat disagree*", different points of view towards

management system in Macau construction industry in the future can be seen. However, seeing the data from both local and foreign-based contractors as a whole, the trend for management system implementation in Macau construction industry in the future is seen and estimated to be optimistic.

4) Governments' preference

It is not surprising to see the contrast of the data from local and foreign-based contractors. 60% of "*neutral*" and 40% of "*somewhat disagree*" are found from local contractors' data whereas 33.3% of "*strongly agree*" and 66.7% of "*somewhat agree*" are found from foreign-based contractors' data. As mentioned a few times before, foreign-based contractors who tender government projects in regions such as Hong Kong must need to implement management systems, as a result, foreign-based contractors may see this as one of the main reasons to implement management systems. Different from foreign-based contractors, the result for local contractors is towards the negative side, indicating the less importance of this statement thus meaning no or not much requirements of management systems from the government.

4.3.3 Difference in Reasons for ISO14000 and OHSAS18000 Implementation between Local and Foreign-Based Contractors

ISO14000 and OHSAS18000 would be discussed together as the data of these two management systems are the same. Unlike ISO9000, these two management

systems established later, the point of view towards them by local and foreign-based contractors would also be different from ISO9000. Only few local contractors implemented these two management systems, which are much less popular than ISO9000. Different from local contractors, foreign-based contractors usually implemented a set of three management systems as a whole to save time and money as ISO14000 and OHSAS18000 are developed based on ISO9000, the regulation and rules are also made upon ISO9000. A comparison of reasons for ISO14000 and OHSAS18000 implementation between local and foreign-based contractors will be investigated in Figure 4.8.

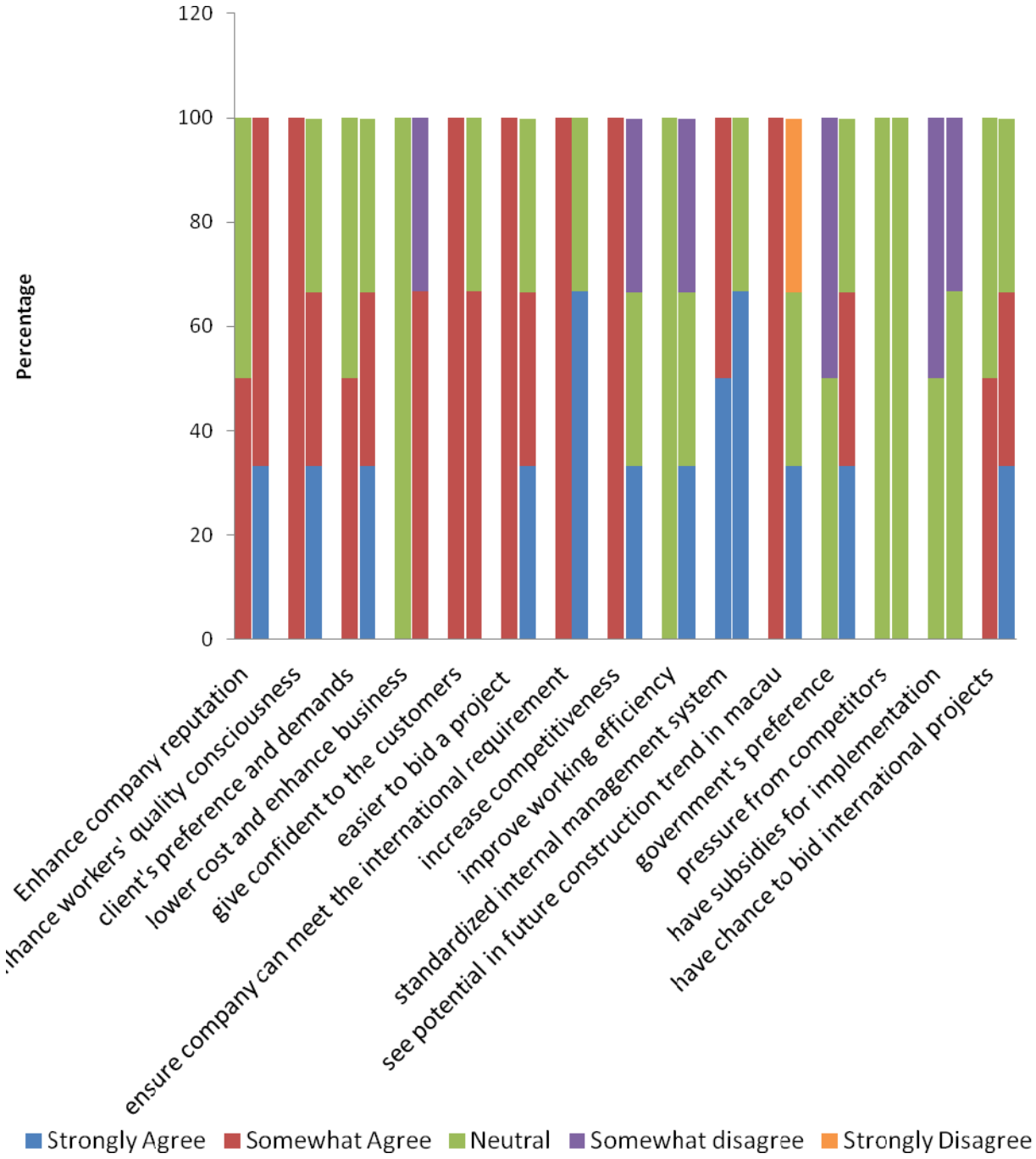


Figure 4. 8 Reasons for ISO14000 and OHSAS18000 management systems implementation between local and foreign-based contractors

The information of each bar of each statement would be also defined as Figure 4.7 in which the left hand side is the reasons for ISO14000 and OHSAS18000

implementation by local contractors and the right hand side bar would be for foreign-based contractors. First of all, focusing on the local contractors' data in Figure4.8, the percentage for each statement is large, half or 100%. As the number of companies that have implemented ISO14000 and OHSAS18000 management systems from the collected questionnaires is very small, although this few number of contractors could not represent the rest as a whole, the data is only for reference. Following the same rule that set in ISO9000, somewhat agree to strongly agree will considered as agreement and somewhat disagree and strongly disagree together will be considered as disagreement. The data from local and foreign-based contractors are almost the same, except "*lower cost and enhance business*", "*increase competitiveness*", "*improve working efficiency*", "*see potential in trend of management system implementation in Macau construction industry in the future"* and "*government's preference*" which are also the same reasons appeared in ISO9000 with inconsistent between local and foreign-based contractors, but with an additional difference on lower cost and enhance business. For this reason, it is similar to the explanation of "*improve working efficiency*" discussed in Section4.3.2. Good management techniques in a company will generate optimal outcome from management systems, thus increasing efficiency in work, saving more time to transfer message from one department to another, easier to keep track the progress of work.

These all advantages can be obtained only from a proper manage of management systems, thus lower cost in the long run and business would be enhanced.

Due to the few number of local contractors implemented these two management in Macau, it is pointless to focus on analyzing the reasons that are related to companies' business, it is more meaningful to analyze the sources that may guide them to implement, clients.

Clients for private projects and government are two common clients for any types of projects. It is interesting to observe that in Figure 4.8, the proportions of 5 categories for "*private clients"* and "*government's preferences*" are different in Macau. 50% of somewhat agree and neutral for "*private clients' preference*" but 50% of neutral and somewhat disagree for "*government's preference*". This shows that private clients are more concern of management systems than the government in local construction projects. Big contrast to local contractors' data, both "*clients preference*" and "*government preferences*" for foreign-based contractors' data fall on the categories of strongly agree and somewhat agree, indicating the importance of management systems in other regions.

4.3.4 Comparison of expectations and outcomes of ISO9000 between Local and Foreign-Based Contractors

Only knowing the expectation of management system implementation by

contractors is not enough. The expectation rated are the outcomes that the contractors would like to reach after implementation of management systems. It is important to find out if the outcome after meet the expectation before management system implementation or not, this is a very useful reference for contractors without management systems. The rating of the expectations for management system implementation is different for both local and foreign-based contractors, the outcome will also be forecast to be different. As a result, a comparison of expectation before and outcome after management system implementation for both local and foreign-based will be discussed.

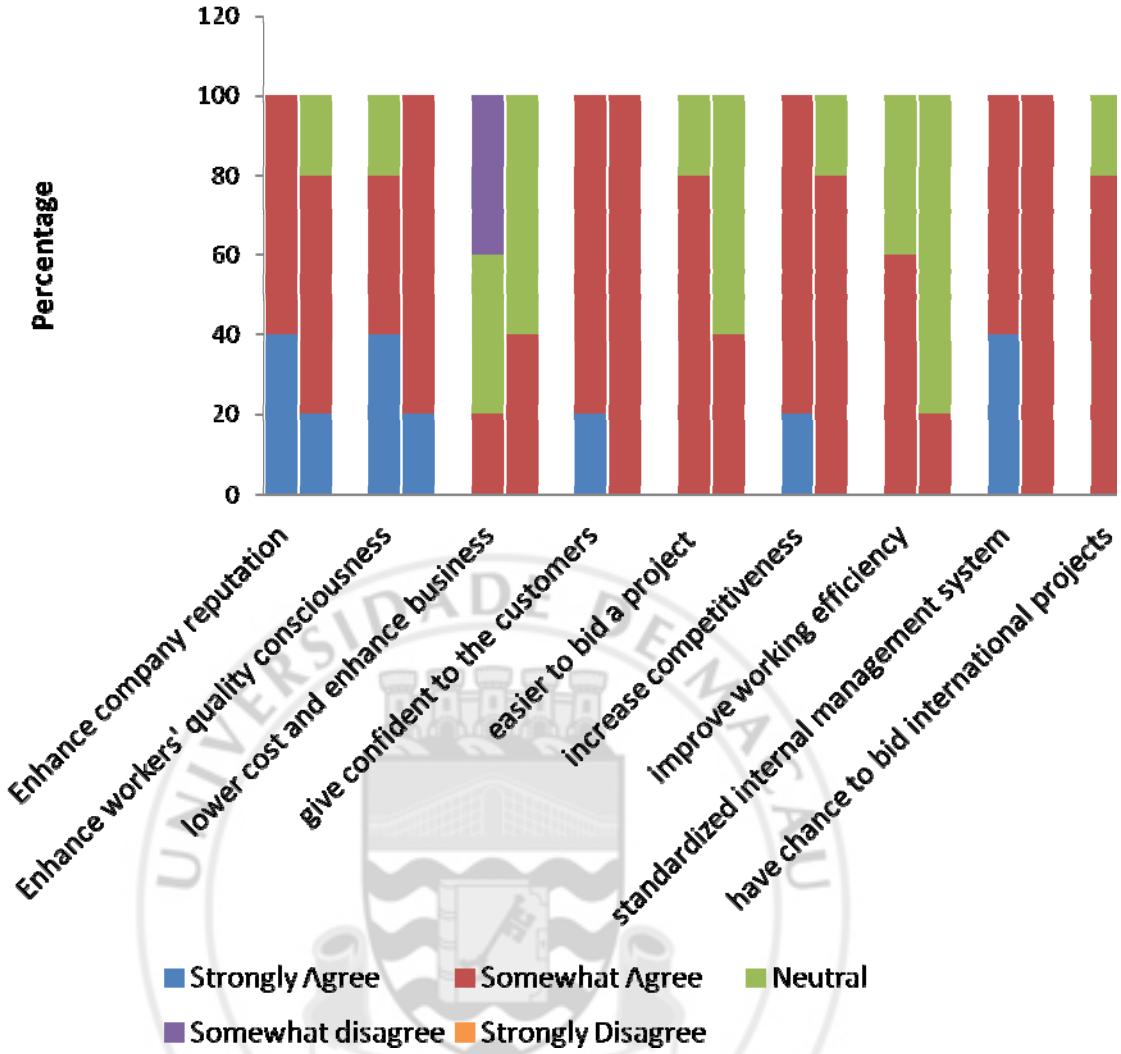


Figure 4. 9 The comparison of expectations and outcomes for ISO9000 management system implementation by local contractors

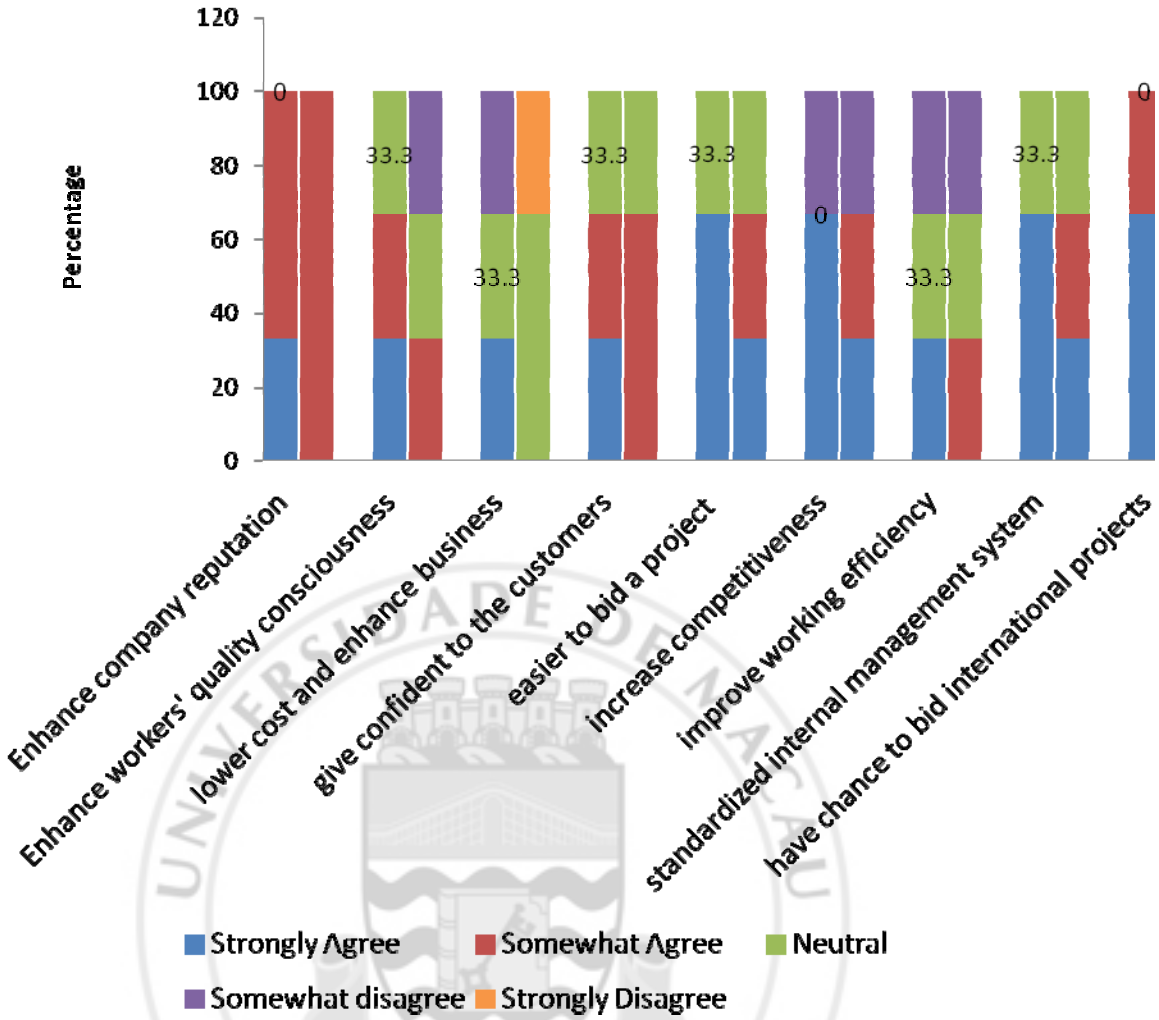


Figure 4. 10 The comparison of expectations and outcomes for ISO9000 management system implementation by foreign-based contractors

From the statement of different expectations, not all statement would have an outcome, such as client's preference and government preference. 9 statements in total are considered as having outcomes, statements with no outcome will not be shown in Figure 4.9 and Figure 4.10. The left bar of each statement represents the reasons for ISO9000 implementation, and the right bar represents the outcome. From Figure 4.9, it is quite disappointing that, out of 9 outcomes, 7 of them do not meet the expectation

Including "*enhance company reputation*", "*give confident to the customers*", "*easier to bid a project*", "*increase competitiveness*", "*improve working efficiency*", "*standardized internal management system*" and "*having chance to bid international projects*". However, there is only a slightly decrease in these statement and outcomes are still within the agreement side. For example, for enhancing company reputation, 20% of local contractors rated from strongly agree to somewhat agree and 20% rated down from somewhat agree to neutral. Positive result can be seen from Figure 4.9 for statements "*enhance workers' quality consciousness*" and "*lower cost and enhance business*", in which outcomes meet the expectations. There is a slightly increase for "*enhance workers' quality consciousness*" but a great increase for "*lower cost and enhance business*" with 40% somewhat disagree, 40% neutral and 20% somewhat agree for expectation but with 60% neutral and 40% somewhat agree as the outcome, a shift from disagreement to agreement side. Through management systems implementation, staffs and workers can have the chance to learn and know the importance of quality in construction industry through training and courses. Raising their consciousness in this aspect can reduce defect, waste and hazards, and at the end, providing a comfortable and safe environment to works and staffs, reducing cost for the company.

For foreign-based contractors, the outcomes observed to be worse than the local

contractors' data. In Figure 4.10, 8 statements of outcome fail to meet the expectation, great shift can be seen from "*enhance workers' quality consciousness"* and "*lower cost and enhance business*". For expectation of "*enhance workers' quality consciousness",* 33.3% was rated for strongly agree, somewhat agree and neutral respectively, however, 33.3% was rated for somewhat agree, neutral and somewhat disagree respectively for outcome. A shift from agreement to disagreement side. For expectation of "*lower cost and enhance business",* 33.3% was rated as strongly agree, neutral and strongly disagree respectively, however, a great shift of outcome to 33.3% somewhat disagree to 66.7% neutral.

Although the result contains error, which no matter how this study did in a careful and attentive, could not be avoided. There are still reasons to explain for the above situation of the failure in meeting the expectations.

1) Too high expectation

It is understandable that for contractors first started the implementation of management systems, advantages gained through the implementation would always be considered first. As a result, higher expectation may be set by the contractors. The slightly decrease of the outcome does not truly refer to the failure in management systems, there is possibility that contractors set the expectation too high at the beginning of the implementation of management systems.

2) Management techniques

As mentioned before, optimistic outcomes such as "*enhance workers' quality, environmental and quality consciousness*", "*improve working efficiency*" require together with a proper management technique such as resources allocation. Different companies would have a different management strategy, whether or not the implementation of a particular management system will be successful depends on individual company. As a result, an improper management strategy cannot bring advantages but even disadvantages to a company. Reallocation and review of past experience are necessary for improvement, otherwise, on one side, the advantages from management systems could not be exhibited, on the other side, a waste of resources.

3) Long term effect

The outcomes after management systems implementation cannot expected to be high at the beginning as staffs and workers need to adapt to the new systems. A sudden change of work may cause burden to them. Besides, advantages such as lower cost, enhance company reputation and enhance working efficiency are long term effect. A few years started for management system may not give the outcomes that the companies expected. Years of experience are required during the route to success.

4.3.5 Comparison of Expectation and Outcome of ISO14000 and OHSAS18000 for local and Foreign-Based Contractors

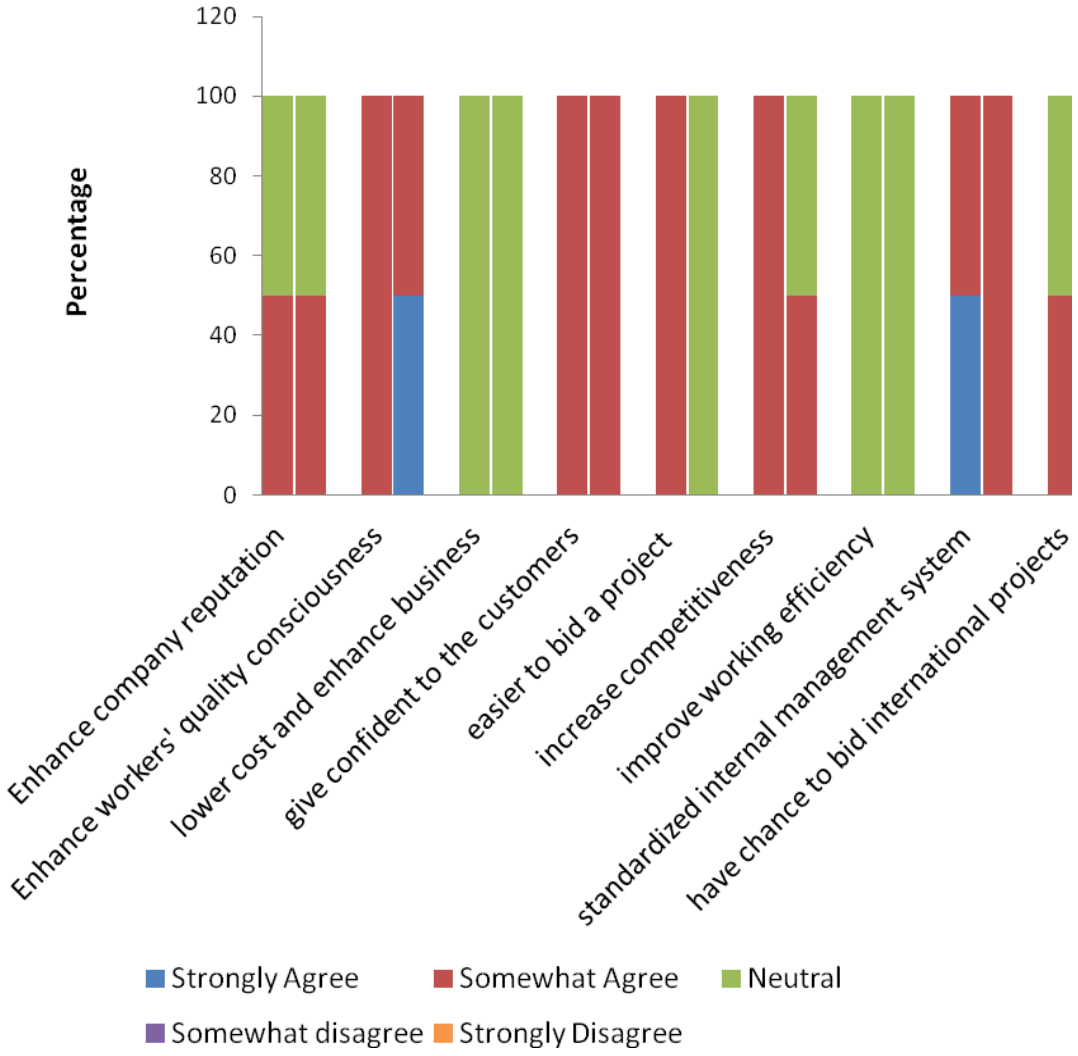


Figure 4. 11 Comparison of expectations and outcomes of ISO14000 and OHSAS18000 implementation by local contractors

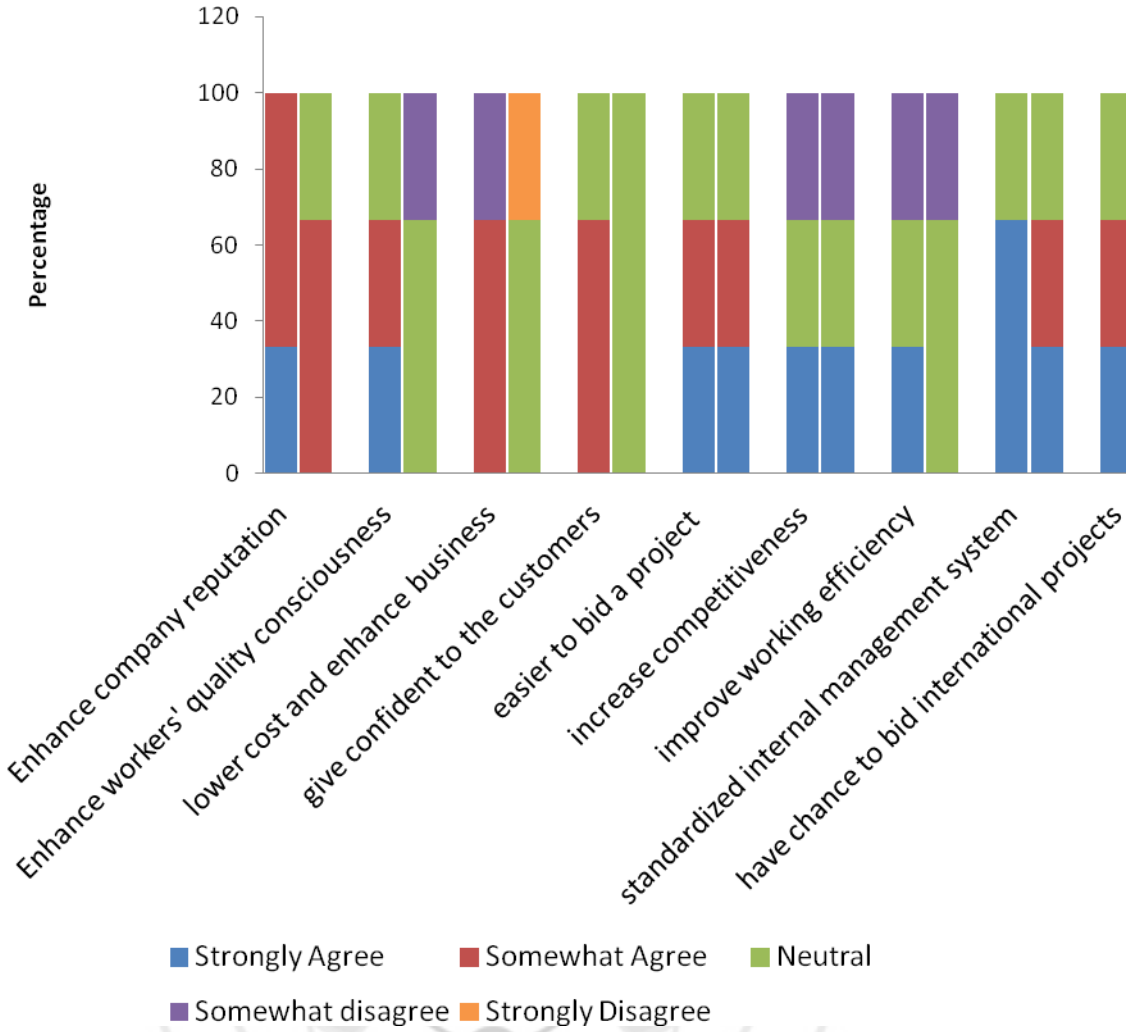


Figure 4. 12 Comparison of expectations and outcomes of ISO14000 and OHSAS18000 by foreign-based contractors

Same as the graphs that are shown in Section4.3.4, the bar shows on the left and right of each statement are the expectation before and outcomes after the implementation of ISO14000 and OHSAS18000. Different from ISO9000, there is no change in the proportion of 5 criteria for quite a number of statements for local contractors' data For example, from Figure 4.11, the outcomes for "*enhance company reputation*", "*lower cost and enhance business*", "*give confident to customers"* and

"*improve working efficiency*", are exactly the same as the expectation, indicating that outcomes can meet the expectation. For other statements, there is only a slight shift within the same agreement or disagreement side.

For foreign-based contractors, Figure 4.12, the statements in which outcome is the as expectation are totally different from the statements obtained from local contractors' data. The statements are "*easier to bid a project*", "*increase competitiveness and having chance to bid international projects*". But for other statements from foreign-based contractors' data, only slight shift can be seen. It is interesting to find that for the statements with the same portion of rating for expectation and outcome in foreign-based contractors' data, there would be a slightly decrease of outcome for the same reason from local contractors' data. It also applies on the other way that when the statement with same portion of rating for expectation and outcome in foreign-based contractors, there would be a slightly decrease of outcomes for the same reason in the local contractors' data. It is hard to compare with these inconsistency due to the insufficiency of data. However, there are two statements, with one having a slightly decrease of outcome in both local and foreign-based data, another one having a diverge way, the outcome for local contractor's data is slightly increased while slightly decreased for that of foreign-based contractors. They are "*standardize internal management system*" and "*enhance workers' environmental and*

safety consciousness" respectively.

1) Enhancing workers' environmental and safety consciousness

It is quite surprising that the outcomes for "*enhancing workers' environmental and safety consciousness"* meet the expectation for local contractors but not for foreign-based contractors. As the years of implementation of ISO14000 and OHSAS18000 by foreign-based contractors are longer than that of local contractors, workers and staffs from foreign-based contractors should be more familiar and knowledgeable than the local staffs due to the longer contact time with these two types of management systems.

2) To standardize internal management systems

For this statement, the outcomes from both local and foreign-based contractors' data are not strong enough to meet the expectation. ISO14000 and OHSAS18000 are actually developed based on ISO9000; the documentation work is also similar to ISO9000. As a result, positive outcome for this statement is forecast, however, many other internal and external reasons may affect the result.

4.4 Contractors without Management Systems Implementation

4.4.1 Reasons for Local Contractors Not Implement Management Systems

In Section 4.1, it shows that from the total number of questionnaires received, 55.6% of contractors did not implement management systems. Besides, these 55.6% are all local contractor companies. In Section 4.3, reasons for local and foreign-based contractors to implement different types of management systems have been investigated. However, the number of local contractors that did not implement management systems is far greater than the number of local contractors with management systems. It is important to understand the reasons behind of not having implementation, the difficulties and limitation that prevent these local contractors from implementing management systems. Figure 4.13 will show the portion of different reasons for local contractors not having management systems implementation. Noted that local contractors without management systems will only be considered in this section.

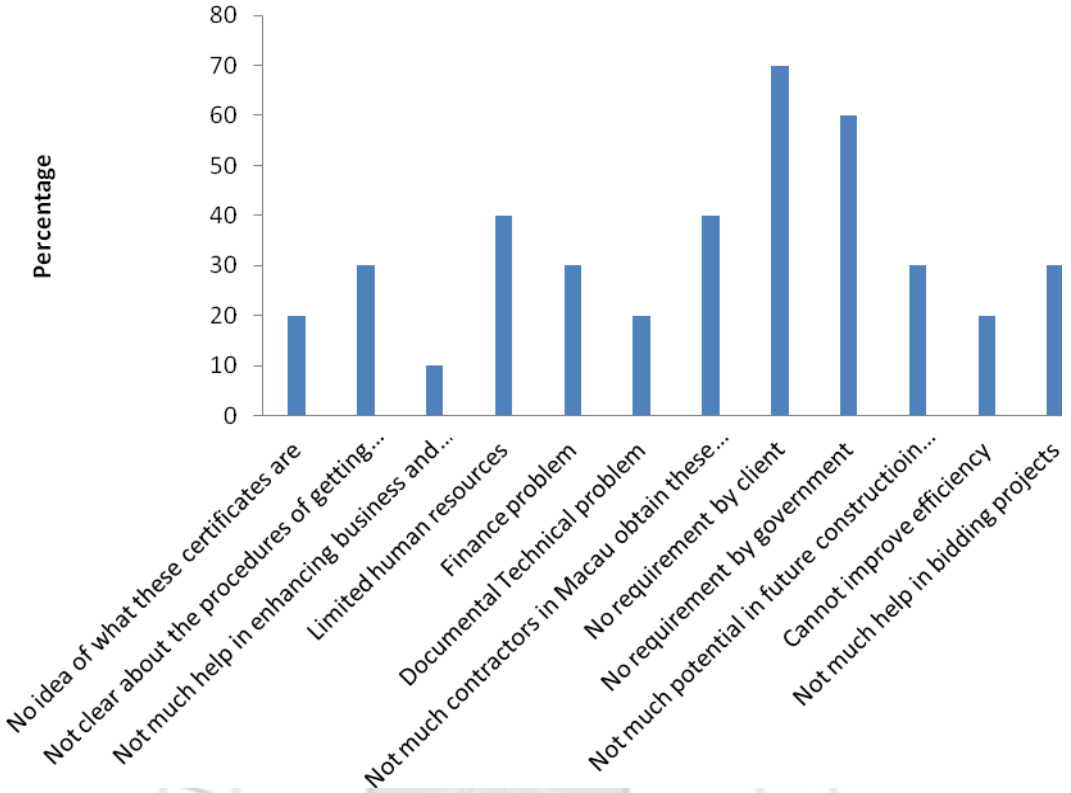


Figure 4. 13 Proportion of different reasons for local contractors not implement management systems

Assumptions are made in Section 4.4.1 that the reasons for not implement ISO9000, ISO14000 and OHSAS18000are the same. As a result, these three management systems would be grouped together as one management system, providing only one graph to analysis the reasons for local contractors not having management system implementation. The top 4 reasons for not implementing management systems can be seen from Figure 4.13, they are: "*no requirement by client*", with 70% of agreement of the statement, "*no requirement by the government*", with 60% of agreement, and lastly "limited resources" and "not much contractors in

Macau obtained management system", both with 40% of agreement. The other reasons are ranged from having agreement of 10 to 30%. The top 4 reasons will be further elaborate:

1) and 2) No requirement by client and the government

Clients, no matter private or public, are always the first concern in a project. Contractors need to satisfy clients with their works, need to follow the requirements set by the clients. As a result, client is a very powerful influencing factor that affect the choices of local contractor to implement management systems or not. If client does not require contractors that work for him to have management system, it is seldom for contractors companies to do extra work. Refer back to Section 4.2.3, the common types of projects that local contractors without management systems need to handle are commercial and residential building, implying the unconcern for management systems by the clients of these two types of project. Nevertheless, residential and commercial building composed of the biggest proportion in Macau construction industry, in another word, if the clients of projects with the biggest proportion do not require management systems, it is not surprising that most local contractors did not implement management systems. The quickest way to boost the popularity of management systems can be started from the requirement of the clients. If the clients add bonus for contractors with management systems during the tendering process, it is

a good way to raise contractors' awareness in management systems.

3) Limited resources

Limited resources is one of the characteristics of a company, resources here refers to the human resources, the facilities in a company etc. Resources cannot be added or subtracted randomly; each company has its own nature and is difficult to change immediately. However, contractors can make good use of the limited resources, a proper arrangement of the resources allows the company to save money and reduce waste. In reality, it is understandable that with limited work force, it is hard for small companies to provide an additional team for management systems. As a result, for a company with about 20 staffs, even how good the workforces are allocated, management systems may be failed. Management systems may not be applicable in all sizes of contractors in Macau.

4) Not much contractors in Macau obtained management system

It has been mentioned in the first point that clients' requirement is the main factor that affects the choice of management systems implementation. As most clients in Macau do not require management system in the tendering process, thus implying most local contractors would not have the incentive to implement management systems. Under this free-to-choose atmosphere in the aspect of management systems in construction industry, not much contractors would willing to invest extra money to

implement management systems. Without pressure, there won't be improvement in the aspect of management systems.

Base on reasons mentioned above, it can be seen that local contractors are rather passive. From Figure 4.12, only 20% of local contractors did not know about what these management systems are, financial and documental technical problems are also not the main concern. Besides, only 30% of contractor believes that management systems do not help much in bidding projects and have no potential in future construction industry. The image of management systems to local contractors is actually not that negative. From the local contractors in this survey, only 10 to 30 percent of contractors think that management systems cannot help in enhancing business, still a great proportion of local contractors aware the advantages of management systems. Local contractors are lacking activeness, however, they cannot be blamed as they are nurtured in the unpressurized construction industry in which management systems is not an important issue. Due to the complexity and additional work from management systems, local contractors would rather sit still and remain constant.

4.4.2 Consideration of Management System Implementation for Local Contractors

To see how many local contractors having the incentive to start a new

management system, Figure 4.14 shows the percentage of local contractor without management systems but are considering to implement in the coming five years.

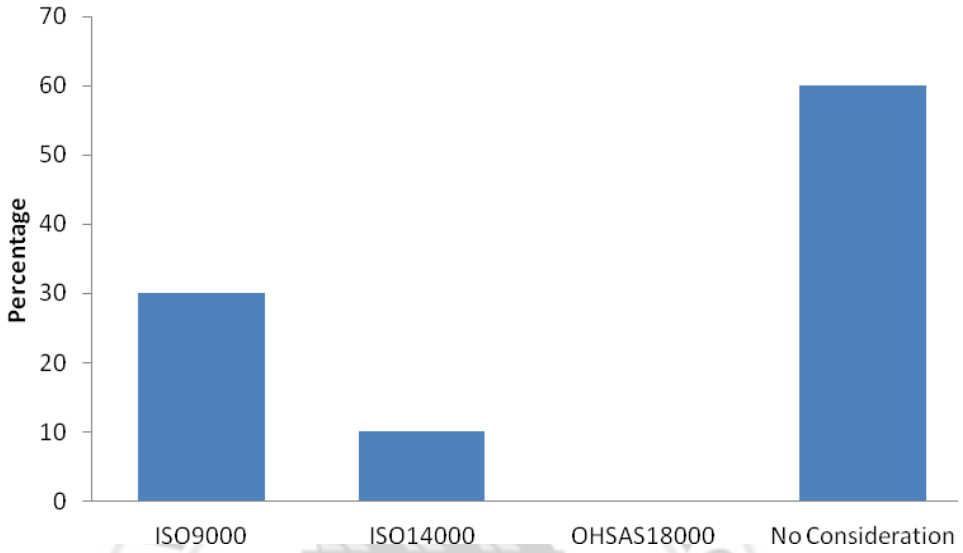


Figure 4. 14 Consideration of each management system implementation by local contractors in the coming 5 years

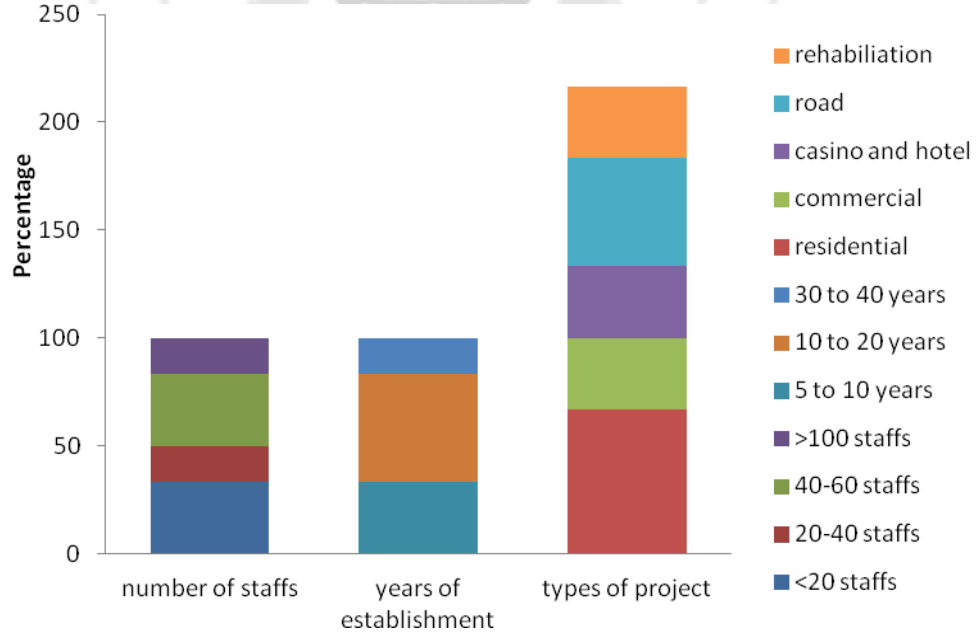


Figure 4. 15 Background of local contractors that have no incentive to implement management systems

From Figure 4.14, there are still 60% of local contractors have no incentive to implement management systems in the coming five years, implying they could not see the need of management systems at least five years under the types of projects they handled in Macau construction industry. More than half of the local contractors that did not implement managements would consider management systems in the future is unnecessary. Among these local contractors, half of them are with small company size that are less than 40 staffs, for this kind of companies, it has been mentioned before that limited resources may be the main blockage for them. However, 30% and 20% of local contractors are in the size of medium and large respectively, resources may not be the main problem for them, the refuse of management implementation may mainly due to the clients' preference. From the bar that shows the types of project the local in handled, residential stills remain the largest proportion, secondly is the road construction, indicating that the contractors under these types of project are confident that their clients do not concern much about management systems in the coming years. These reasons are only analyzed through graphs and as a reference for local contractors, there must be other reasons that affect the choice of local contractors to implement management systems have not been investigated.

From Figure 4.14, a total of 40% of local contractors would consider for management systems implementation in which 30% would implement ISO9000 and

10% would implement ISO14000. There are no local contractors consider implementing ISO4000, in another words, no local contractors would consider three management systems together as a whole. ISO9000 remains the most popular and common in Macau and in other regions. ISO14000 is only pop-up in recent years that people are more concern on environmental issue. For OHSAS18000, which is about safety and is one of the important issues in construction industry, with no local contractors consider to implement. The reason may be the promotion of safety training in Macau; the Macau SAR Government required all people who entered into the site must need to have a safety card. To get this safety card, workers or staffs need to attend a complete set of safety courses provided by the government, after that, a test would be given, people who pass the test can get the safety card. The safety card needs to be renewed every 5 years by attending additional training courses. As a result, the government has already promoted safety, local contractors may not consider OHSAS18000 as important and to avoid duplication of similar things, however, OHSAS18000 is a management system, which is totally different from the government regulation.

4.4.3 Reasons and Expectations for the Consideration of Management System Implementation by the Local Contractors

Since ISO9000 and ISO14000 are considered to be implemented by the local

contractors, only the reasons and expectation for these two management systems implementation will be discussed. For Figure 4.16 and Figure 4.17, the denominator would be the total number of each management systems that contractors are considered to be implemented.

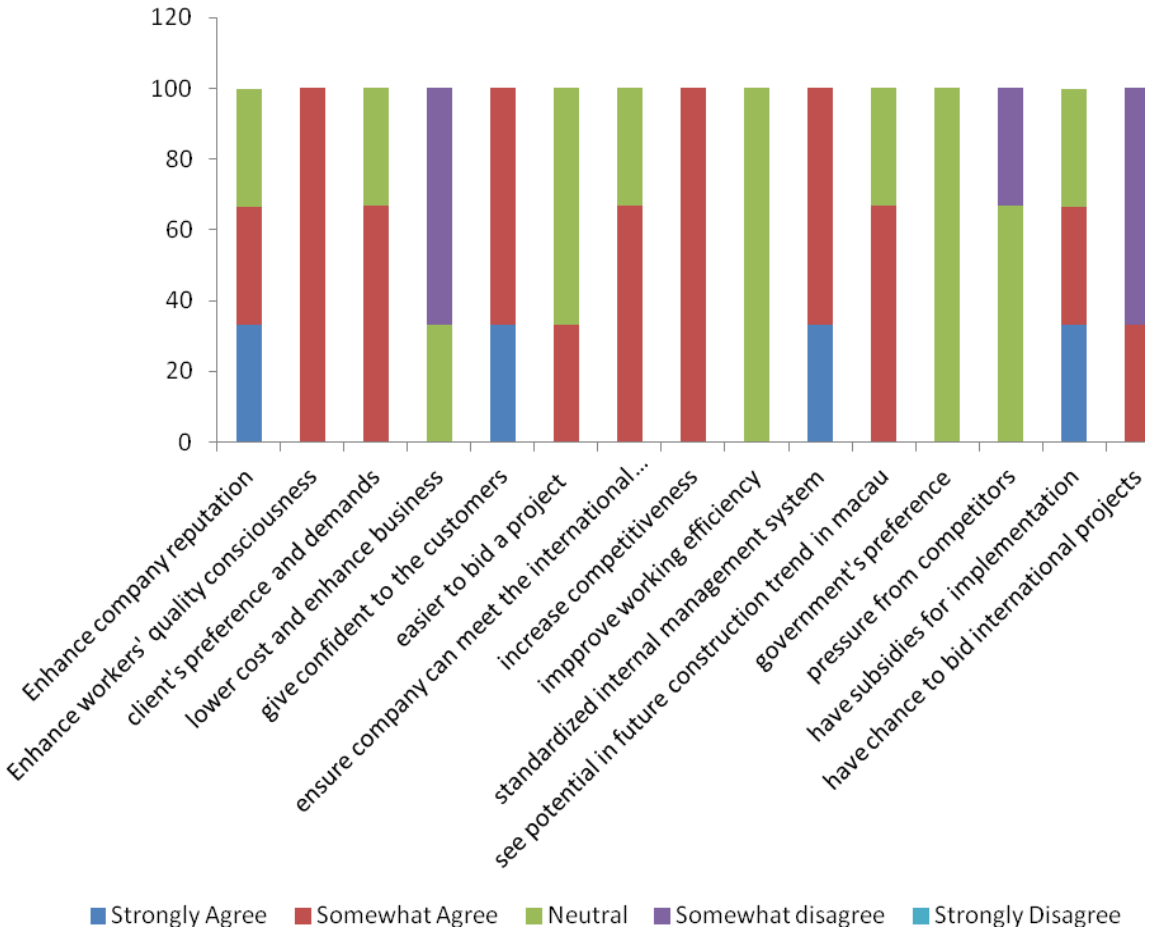


Figure 4. 16 The reasons and expectations for ISO9000 implementation that are considered by local contractors.

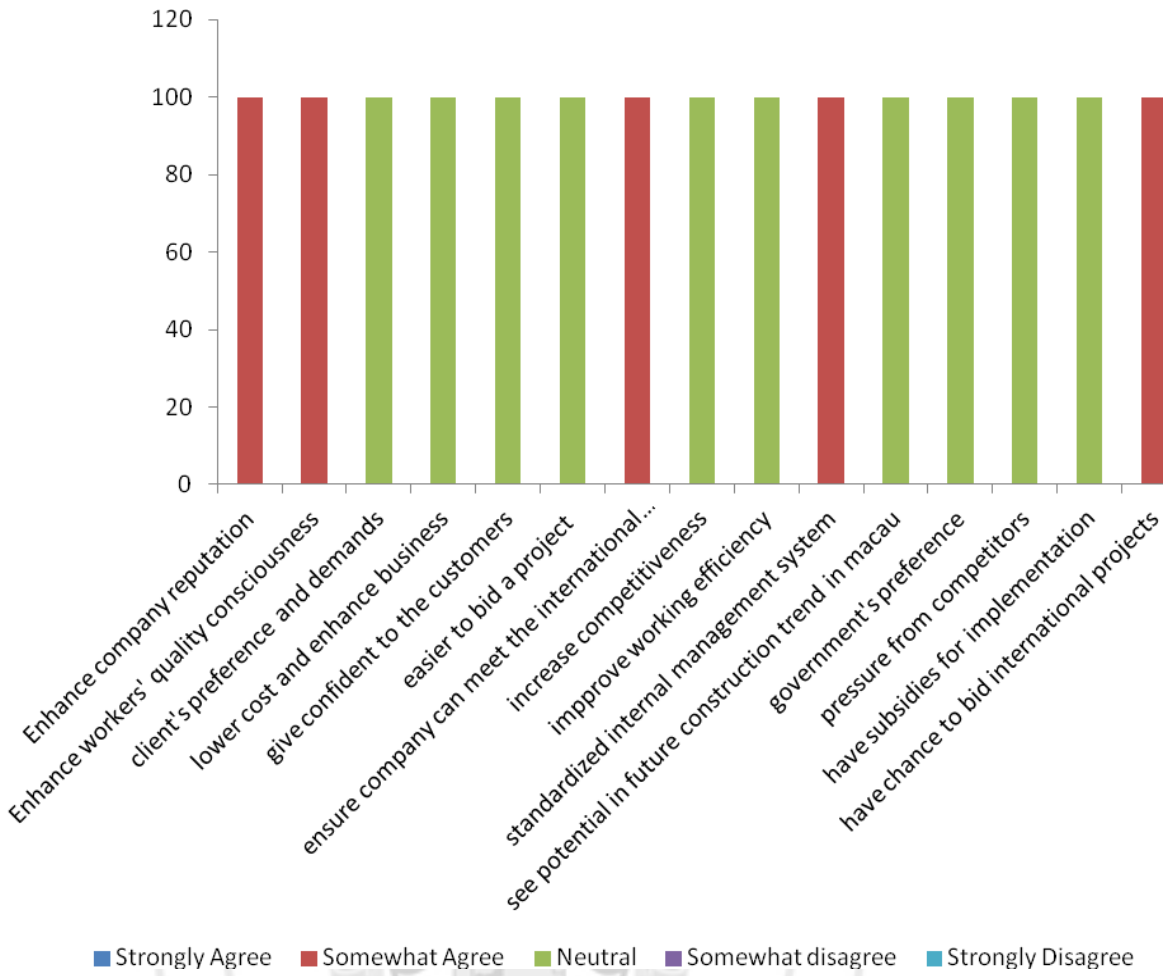


Figure 4. 17 The reasons and expectation for ISO14000 implementation that are considered by local contractors.

From Figure 4.16, there are strongly agree choices for the statement "*enhance company reputation*", "*give confident to the customers*", "*standardized internal management systems*" and "*have subsidies for implementation*". The reasons for the first three statements are similar to that of the local contractors with management systems. However, it is the first time to appear strongly agree choice on the statement of having subsidies for implementation. This may due to the small company size of these contractors, thus having limited resources and subsidies is helpful for their

implementation. For the statements, "*giving confident to the customer*", "*pressure from competitors"* and "*having chance to bid international projects*", there are disagreement on these statement. The reasons for that actually have already explained, the clients from the project types these contractors handled may not highly concern for management systems, as a result, they will have disagreement on the statement of giving confident to the customer. Secondly, the management system atmosphere in Macau construction industry is said to be unpressurized, meaning not much contractors have implemented management systems, thus having no pressure from competitors. Lastly, for the statement of "*having chance to bid international projects*", disagreement appeared mainly due to the clients that mostly faced. If the clients of these local contractors without managements are usually not concern about management systems, they are mostly local clients, thus having less chance to bid international projects. For the other statements of reason and expectation, the criteria are range from neutral and somewhat agree, implying a quite optimistic view towards ISO9000 by these local contractors.

For ISO14000, from Figure 4.17, only 10% of contractor considered implementing, the data is so few that cannot be used to analysis. Besides, out of 15 statements, 10 of them are of the criteria of neutral, it is hard to tell the expectation from this limitation of data.

4.5 Interview with Professions in the Society

Questions that were asked in the questionnaire are mostly very general; the most common way is giving a list of choices for the participants to choose. However, the choices are limited and may not give as detail as possible. Interview is another way to compensate the weak points of questionnaires. A short interview, 15 to 30 minutes allow the research to get information a few times more than what can get from a questionnaire. Nevertheless, valuable opinions can be obtained from the interviewee, helping the research have a better understanding of the real situation. After the collection of the questionnaires, 7 interviews were made. The interviewees are in the positions of Quality Assurance Manager, Safety Assistance Manager, Member of Legislative Council, Human Resources etc. These interviewees are representing the contractors that they worked in, both local and foreign-based, with or without management systems, some are representing the society, depending on the position during the interview.

4.5.1 Interview with Representatives from Foreign-Based Contractors

Interview with representatives from foreign-based contractors can provide different views on management systems between foreign regions and Macau. Basic information about management systems and their opinions towards management systems were asked.

The Quality Assurance Manager (Interviewee B) mentioned that the preparation time for management systems depends on the size of the company, the larger the size, the longer it takes. It is because due to the complexity of departments for large companies, more time is needed for communication between departments. Besides, setting up ISO14000 and OHSAS18000 are easier than ISO9000 as ISO9000 is an universal set, environmental and safety are only part of quality management systems. Interviewee B also indicated the advantages and disadvantages of management system. He said that if a management system is well organized and perfectly made, this will benefit in all detail aspects in the company, example such as easier in finding document. For disadvantages, staffs cannot adapt to the new management system due to the change of management and increase in documentation works. On the other hand, a Safety Assistant Manager (Interviewee C) talked about another advantage that the management of different sites is improved. For example, if a company has 4 sites, the management system of each site need to be well organized as the auditor that came to assess the work will randomly choose one site to check, the failure to meet the requirement will lost the chance of obtaining management certificates. Interview B and Interviewee C from two different companies also pointed out the ignorance of management systems in tendering government projects. However, interviewee C said that for some private project, such as casino and hotel, management systems are

required. But for some local private projects, other than ISO9000 is more common, ISO14000 and OHSAS18000 are said to be useless in biding local private or public projects. This situation is totally different from Hong Kong that ISO9000, ISO14000 and OHSAS18000 are not only useful, but a requirement in tendering process. These two managers also agree that Macau should follow Hong Kong and China in the aspect of management systems in the future. They stated that having management systems implementation is a trend. On one hand, the Interviewee C proposed that the implementation of management systems raised the cost of the project, although the amount is not big, it is big enough to see the comparison with other contractors without management systems. On the other hand, Interviewee B said that there is a need for local contractors to improve their management systems, especially for Government projects, they are quite slow. However, Interviewee replenished that due to the small company size in Macau, if these companies have a well-organized internal management system, management systems may be unnecessary. Of course, it is better to implement as it is a claim of international standard.

Interviewee B also indicated the benefits that brought to the local contractors due to the foreign investment. He stated that foreign-based contractors would usually be the main contractors for invested projects. For such big projects, the main contractors need to subcontract works to the local contractors. Under this relationship, the local

contractors need to follow the requirement from the main contractors. As management systems are compulsory for foreign-based contractors, there is a chance for the local to know about management systems and learn the good from it without any fee. Local contractors who find management systems beneficial and profit making would start the internal management system or implement management systems on their own with no additional cost of setting new documents on their own as they have already learnt from the main contractors.

4.5.2 Interview with Representatives from Local Contractors with Management Systems and Member of Legislative Council

In Macau, not many local contractors would have management systems. It is interesting to know more about the reasons behind the implementation and their opinion towards management systems in Macau construction industry in the future. Among the 7 interviews, there is one local contractor implemented only ISO9000, a represent from Human Resources (Interviewee D) mentioned that during the implementation process, there is no consideration of implementing other management systems. He stated that ISO9000 is more familiar and is more applicable in certain areas. Besides, because of the large amount of foreign investment with new management techniques in recent years, it is necessary for the company to implement ISO9000 to increase competitiveness. Nevertheless, he reported some advantages

from management systems such as broaden the sight and knowledge of the staffs, help them understand that management systems is a long term requirement that must have to pass through. Secondly, it is easier to communicate with the main contractor as management system implementation allows them to understand the reasons of doing all the extra documentation; as a result, it is much easier to take over the job. He also commented on the future management systems status that it is impossible for all the local contractors to implement management systems. However, the government can impose policy such as setting management systems as a requirement in tendering government projects or projects with tender price higher than a certain amount. For private projects, he said that the necessity of management systems implementation really depends on the project types and the demands from clients. As a matter of fact, following the global trend, management systems are necessary in the future; their company will also consider the implementation of ISO14000 and OHSAS18000 in the coming years.

Aside from representatives of contractors, a member of legislative council (Interviewee E) also participated in an interview. He mentioned about the history time, in 1995, one of his companies would like to start the management systems implementation. However, even all the documentation was prepared, without seeing further support from the government financially and technically, the whole

implementation was put on hold. Only in 1997, before the handover of Macau, the Portuguese Government at that time started the subsidize policy on management systems implementation. He indicated that the government providing subsidies in another word is providing support and agreement on management systems. However, he stressed that management systems at that time, even until now, cannot bring profit to the company; there is no advantage in tendering government projects. The main reason for him to implement management systems is self and social responsibilities. He thought that management systems are good to the society, good to the construction industry so he implemented. He claimed that a responsible government should provide a supportive environment to local companies in order to enhance local business. The past ten years were the golden period in construction industry. He indicated that this period was supposed to be the prosperous time and the government has working on issues such as promoting management systems. However, all are stopped and disrupted because of the corruption by a government employee. That's why only until now, the government has proposed the professional accreditation policy. Interviewee E mentioned that it is necessary for the government to speed up the promotion and policy setting. Furthermore, he pointed out an important issue that companies with management system does not mean the company are perfect and with no problems. The outcome is depended on the act of people, all regulation and rules are set for

human, only if human take everyone's responsibility, the best outcome can be occur.

4.5.3 Interview with Representatives from Local Contractor without Management Systems

A project manager (Interviewee F) reported that although the company did not implement any management systems, the internal management systems followed the one from Hong Kong contractors, which is actually the ISO system. As a result, he claimed that their companies are welcome for any requirement from the government or clients. In Macau, he said that there are no pressure from other contractors as most of the local contractors did not implement management systems, other than ISO9000, which is more common and important compared to other management systems. However, he stated that if a company wants to be in step with the international, management systems are required. However, at this moment, it is unnecessary. Questioning on him about the future management trend, he said that together with the flow, management system in the future must be necessary. The government can start the requirement through tendering process by adding extra credits, in order to enhance the quality assurance of a company, ensuring the companies are up to standard so that they could handle the project.

CHAPTER 5 CONCLUSION

Management system of a company is usually one of the criteria used by clients or government in reviewing tenders in regions like Hong Kong. However, Macau is lagging behind Hong Kong in this aspect for more than 10 years. Using small size project as a reason to explain this phenomenon is no longer acceptable. In recent years, quite a number of foreign contractors set up branches in Macau. These contractors are mostly main contractors of large projects such as casinos and hotels. As a result, all these valuable and luxury projects will only go into foreign-based contractors' hands, local contractors could only be the subcontractors. If local contractors would like to expand and to be in step with the international trend, there is a need for local contractors to speed up and catch up with foreign contractors, as what a member of Legislative Council (Interview E) has mentioned "The construction industry in Macau has missed the Golden Ten Years." There must be some attraction and advantages resulted from the implementation of management system so that foreign-based contractors are enthusiastic in obtaining these management systems.

In this study, a questionnaire with 2 parts was designed for local and foreign-based contractors with or without management systems. The questionnaire was sent out to a list of targeted contractors that have been selected through the information from CPTTM and DSSOPT web pages. A total of 63 questionnaires were

sent out to the target respondents with a total of 18 returned questionnaires. The response rate is about 30% in which the result is considered to be quite satisfactory. Data and result were collected mainly for investigating the expectation for local and foreign-based contractors to implement management systems. It was found that the ratings of expectations for ISO9000 implementation by local and foreign-based were similar and fell more on the side of agreement. Example includes "*enhance business"* and *"enhance workers' quality consciousness"* for *ISO9000*. For the expectations of ISO14000 and OHSAS1800, the expectation from foreign-based contractors was higher. The outcome for each management system would also be analyzed for checking with any inconsistency with the expectation. It was found that the result was quite disappointing that almost all the outcome for each statement failed to meet the expectation. Reasons such as overestimation of the expectation of management systems implementation, difference in management strategies used by companies and long term effect were suggested.

Together with the data from interviews, a summary of benefits in implementation of management systems would be listed below. However, not all local contractors can reap the same benefits due to different kinds of external factors such as management strategies and techniques in individual company.

1) Better control in documentation

The management systems provide a set of standardized forms, avoiding the differences in format or style of documentation handled in different departments. Besides, a proper and well-organized system is provided for transfer of documents, saving lots of time for searching documents and drawings. Taking over of work would also be easier due to standardized documentation procedures.

2) Increase awareness of the importance of management systems

Although additional documentation works are required, there must be a transition period for a company to go through. During the process, the staffs and workers may understand the necessity and reasons behind management systems, thus knowing the importance of upgrading one's own value and knowledge.

3) Better communication

For those local contractors without management systems working for those foreign-based contractors as subcontractors, there could be a burden especially in the aspect of documentation requirement. Only through training and the implementation process, the true value of management systems would be realized. True knowledge can be learned. Communication would be easier only when two parties understanding the information that are discussed, thus work flow will be more smooth and success.

From all the interviews, a common understanding, "Management Systems are necessary in the future" can be seen. However, reflecting to the reality, there are many

reasons that discourage local contractors to get into the increasing trend of management system implementation in Macau construction industry in the future. Some suggestions were raised by the author for improvement.

1) No requirement from client

The requirement from clients was found to be the number 1 reason influencing the choices of management systems implementation by the local contractors. The unconcerned attitude of clients, mostly private client of residential and commercial building and the public client, the government, generate a free-to-choose environment in the implementation of management systems. Without the requirement from clients as a push, it is seldom for local contractor to spend more resources and to do extra work; this is true and is the reality. From what the member of the legislative council has mentioned, "A responsible government has the obligation to generate an environment to the local contractors in order to enhance the local construction industry." This environment refers to the environment of helping local contractors to implement management systems, especially the small and medium companies. This would need to be promoted and fully supported by the government.

However, as what most interviewees have mentioned, "It is impossible for all local contractors to have a sudden change of environment; the most effective way is to start management systems implementation through government tendering." The future

trend on management systems depend mostly on the government policy. If improvement are hoped to be seen in the future, it is necessary for the government to set up regulations, as what the interviewees have been mentioned. At first stage, the government can carry out an additional marking scheme in tendering government projects. In one way, acting as a bonus to attract local contractors to implement management systems, on the other hand, raise the local contractors' awareness and consciousness towards management systems. A few years later, the government can make it a mandatory requirement for local contractors that tender government projects, as what the other regions such as Hong Kong, China and Singapore has done.

2) Attitude towards management system implementation

The promotion of management systems is important. However, the understanding of society responsibility towards management is also significant. The member of the Legislative Council mentioned that "If a company implements management systems only because of the subsidies, it is a failure in a society." The implementation of management systems is based on the necessity and social responsibility towards the construction and the society. If a company implements management systems out of a push from clients, the management systems could not be well developed. Even though for later years, most contractors have implemented management systems, it does not mean that the quality, environmental and safety aspects of all local contractors will be

improved. The outcomes depend on individual's attitude, thus education and training are important to upgrading the quality and knowledge of human. As a result, on one hand, the government works on and promotes the management systems issue. On the other hand, each person needs to have the sense of society responsibility in order to maximum the benefits of management systems.

3) Limited resources

From the analysis of companies' background in previous chapters, it was found that small size companies, with less than 40 staffs, limited resources is the main reason that prevents them from management systems implementation. This is a special phenomenon in Macau due to the geography location. Small size companies may not have extra resource for management systems implementation. However, it is still possible for them to develop a well-organized internal management system. As one project manager has mentioned in the interview, "There is also exchange of knowledge in construction industry, the local can learn from the invested foreign-based main contractors." Small contractors will usually under big contractors, since the resources available of small contractors cannot be as much as those of the big contractor; they can still learn the good from them. The government could also send some professions that are from Hong Kong or China to train them on the aspect of management. An interviewee has mentioned that "If a well management system is

implemented in these small local contractors, international standard implementation would be unnecessary to them." However, the statement is only valid before the government making any changes on the regulation on management systems. If the government takes the suggestion from the interviewees and set up an additional marking scheme in tendering public projects in the initial stage, there are still choices for this group of small local contractors to consider in setting up management systems. Once the "transition period" ends and the Macau SAR Government follows what the governments from other regions have been doing and make the implementation of management system a mandatory requirement in tendering government projects, the only choices for them would only be quitting out the public project market or having management system implementation. As a result, limited resource can no longer be a reason for this group of local contractors not to implement management systems. If there is a well-developed management technique and system of job allocation in a company, "*small company size*" would not be a factor affecting the successfulness in management system implementation. In this way, the transition period is rather the best time for these small size contractors to improve and to set up a well-organized management system. Even though a compulsory management system regulation is really imposed by the government in the future, this group of small size contractors would not be eliminated immediately.

The research targets in this study include foreign-based regions such as Hong Kong and China. Due to the similar culture pattern, data of these regions were used to compare but were only for reference as the findings may not be truly applicable. Besides, the target contractors in this studies composed of small, medium and large sizes, which are also defined based on the condition in Macau.

Recommendations for Future Research

In this study, the questionnaire was designed to have respondents that are in the position of Quality Assurance or Quality Control Manager in contractor companies. However, due to the small company's size of local contractors, there may not be any QA/QC department; as a result, the respondents would be persons such as the front desk staffs or staffs from Human Resources. There is a possibility that these staffs are unclear about management systems thus causing an effect to the accuracy of the result. In order to increase the accuracy for the questionnaire, it is suggested in the future research, a confirmation of QA/QC department of a company can be also added during the target searching period, it is even better to ask for the contact of the project manager (this will not be easier based on personal experience).

The focus on this study is mainly on contractors, however, based on the result analysis, it was found that clients' push is a main driving force for local contractors to or not to implement management systems. As a result, the points of view from the

clients' perspective (which is not one of the scopes in this study due to limited time) is also valuable to investigate in the future study.

The analysis of the current data can only be provided to review and compare relatively, the reasons and expectation before the management systems implementation are supposed to be unchanged, neglecting the possibility or error that occur in which the choice of reasons and expectation before management systems implementation would be affected due to the duration of time and may have the chance of forgotten. The opinions on the outcome after management systems implementation could be different, it would be appropriate to suggest for further research to keep tracking of a same group of response target for a longer time, a change of attitudes could then be analyzed. The survey results now can be used for later comparison on outcome of management systems. A future studies can also be focused on the group of local contractors that are considering the management systems implementation, a periodical survey can be carried out so that the results could be compared and evaluated on the influence of management systems in local contractors, eventually, an even later trend, advantages, disadvantages and the influence of management systems to be able to identify in details.

REFERENCE

Journal, conference paper and newspaper:

Burati, J. L. et al. (1999). ‘‘Quality management in construction industry.’’ J. Constr. Eng. Manage., Vol. 117 No.2, pp.341–359.

Chan, A. P. C., and Tam, C. M. (2000). ‘‘Factors affecting the quality of building projects in Hong Kong.’’ Int. J. Qual. Reliab. Manage., Vol. 17 No.4/5, pp.423–441.

Chin, K. and Choi, T. (2003). Construction in Hong Kong: Success Factors for ISO9000 Implementation. Journal of Construction Engineering and Management, Vol.129 No.6, pp.599-609.

Choi, T. W., and Chin, K. S. (2001). ‘‘A study of ISO9000 implementation and quality management practices in Hong Kong Constructionindustry.’’ Asian J. Qual., Vol.2 No.2, pp.1–23.

Kines, P., Spangenberg, S., & Dyreborg, J. (2007). Prioritizing occupational injury prevention in the construction industry:injury severity or absence? Journal of Safety Research, Vol.38 No.1, pp.53-58.

Low, S. P. and Chin, Y. P. (2003). Integrating ISO9001 and OHSAS18001 for Construction. Journal of Construction Engineering and Management, Vol.129 No.3, pp.338-347.

Low, S. P., and Lim, R. B. L. (2000). ‘‘Quality system QS 9000 for construction: Is the industry in Singapore ready?.’’ J. Const. Res., 1, pp.19–31

Low, S. P. & Tan, J. H. K. (2005). Integrated ISO 9001 quality management system and ISO 14001 environmental management system for contractors. Journal of Construction Engineering and Management, ASCE, Vol.131 No.11, pp.1241-1244.

Moatazed-Keivani, R., et al. (1999) ‘‘ISO9000 standards: perceptions and experiences in the UK construction industry.’’ Constr. Manage. Econom., 17, pp.107–119.

OFORI, G. and GANG, G. (2001). ISO 9000 certification of Singapore construction enterprises: its costs and benefits and its role in the development of the industry. Eng, Const and Arch Man, Vol.8 No.2, pp.145-157.

Sun, H. (2000). ‘‘Total quality management, ISO9000 certification and performance improvement.’’ Int. J. Qual. Reliab. Manage., Vol.17 No.2, pp.168–179

Tam, C. M., and Ho, C. S. (2000). ‘‘Quest for continuous quality improvement for public housing construction in Hong Kong.’’ Constr.Manage. Econom., 18, pp.437–446.

Zeng S. X., Shi, J. J. & Lou, G. X. (2007). A synergetic model for implementing an integrated management system: an empirical study in China. Journal of Cleaner Production, Vol.15 No.18, pp.1760-1767.

Online Materials:

Anon,(2015)."今年 1 月至 9 月澳門特區中征得 127 億美元博彩稅"Available at: http://www.macaunews.com.mo/content/view/3011/13/lang,simplified_chinese/ [Accessed 10 Dec. 2014].

Iso.org, (2015). ISO - International Organization for Standardization. [online] Available at: http://www.iso.org/iso/home.html [Accessed 20 Dec. 2014].

Iso.org, (2015), ISO Executive Summary, Available at: http://www.iso.org/iso/iso_survey_executive-summary.pdf?v2013 [Accessed 20 Dec. 2014].

Tong, K. (2015), *澳門生產力暨科技轉移中心*, Available at: http://cms.cpttm.org.mo:8080/index.php?lang=zh [Accessed 25 Sep. 2014].

澳門特別行政區 - 環境保護局 (2007), 澳門環境狀況報, Available at: http://www.dspa.gov.mo [Accessed 16 Jan. 2015].

勞工事務局. (2015), 建築業職安卡, Available at: http://www.dsal.gov.mo/chinese/introduction.htm [Accessed 30 Oct. 2014].

APPENDIX A – QUESTIONNAIRES

SURVEY QUESTIONNAIRE

Greetings!

I am a year 4 civil engineering student who study in the University of Macau and is now conducting a study on "Necessity and Trend for local contractors in setting up safety, quality and environmental management system in Macau". In connection with this, I constructed a questionnaire to gather information for my study. Your participation in the study is very important, without it, the study will not be complete as it should be. Please kindly fill up the questionnaire with honesty and feel assured that your information will be kept confidential. Thank you very much for you time and kind response to my request. Please leave your contact below, if you are interested in my study, I will supply you with the results.

Sincerely,

Lydia, Leong Si Un

The Researcher

University of Macau -- Civil Engineering

Personal contact (optional)

Company name: _____

Name: _____

Mobile: _____

e-mail: _____

PART I Answer the following questions by putting a check mark on the blank before the choices or fill in the answer.

1. Your position in the company_____.

2. Where is the base company?

□ Macau □ Hong Kong □ China □ Foreign country

3. Number of staffs in the company in Macau.

□ < 20 □ 20 - 40 □ 40 - 60 □ 60 - 80 □ 80 - 100 □ >100

4. Years of establishment for the company in Macau.

□ < 5 years □ 5 - 10 years □ 10 - 20 years □ 20 - 30 years
□ 30 - 40 years □ > 40 years

5. What is the recent five years average annual revenue of the company in Macau?
□ <50 million □ 50 million – 100 million □ 100 million – 500 million
□ 500 million – 1 billion □ 1 billon – 3 billion □ 3 billion – 5 billion
□ > 5 billion

6. Any construction projects in 2013-2014?
□ Yes □ No

7. What types of project(s) the company in Macau usually handle? (Multi Selection)
□ Residential building □ Road Construction □ Commercial building
□ Tunnel Construction □ Casino and Hotel □ Rehabilitation Work
□ Bridge Construction □ Railway Construction □ Others _____

8. Does the company in Macau obtain any quality, safety or environmental management system certificates, e.g. ISO9000 (quality management system).
□ Yes □No
**If YES, jump to question 9, if NO, jump to question 14.*

9. What type of management system certificates does the company in Macau obtain and their valid date (e.g. valid to 2013) ? (Multi Selection)
□ ISO9000 (qulaity) valid to _____
□ ISO14000 (environmental)valid to _____
□ OHSAS18000 (safety) valid to _____
□ Others _____ valid to _____

10. Will your company in Macau continue to renew the certificates in the future?
□ Yes □ No

11. Any consideration in getting other management system certificates in the coming five years? (multi-selection)
□Yes ---------- □ISO9000 □ISO14000 □OHSAS18000 □others_____
□No

PART II *For each of the following statements, please indicate whether you:*
Strongly concern (1); Somewhat Agree (2); Neutral (3); Somewhat disagree(4);

Srtongly Disagree (5) by cycling the number in the box. An example is shown below:

e.g. If enhance company reputation is a very strong reason in setting up the ISO9000, but being neutral to ISO18000 and not a strong reason to OHSA18000, you will need to fill it in the following ways:

	ISO9000	*ISO14000*	*OHSAS18000*
1. Enhance company reputation	*(1) 2 3 4 5*	*1 2 (3) 4 5*	*1 2 3 4 (5)*

12. Reasons and expectations for getting these management system certificates.

	ISO9000	ISO14000	OHSAS18000
1. Enhance company reputation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Enhance workers' quality consciousness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Client's preference and demands	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Lower cost and enhance business	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Give confident to the customers	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Easier to bid a project	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Ensure the management systems can meet the International requirement	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. Increase competitiveness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. Improve working efficiency	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10. Standardized internal management system	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
11. See the potential in future construction trend in Macau	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
12. Government's preference	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
13. Pressure from competitors (i.e. other contractors have already obtained the certificates)	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
14. Have subsidies in establishing these systems.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
15. Have chance to bid international projects	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Others reasons:			

13. After obtaining these certificates, does the outcome meet the company's expectation?

Benefits	ISO9000	ISO14000	OHSAS18000
1. Enhance company reputation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Enhance workers' quality, environment and safety consciousness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Lower cost and enhance business	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Give confident to the customers	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Easier to bid a project	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Increase competitiveness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Improved working efficiency	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. Standardized internal management system	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. Have chance to bid international projects	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Others :			

**Please jump to Q17*

14. Reasons for not getting the management system certificates. (Multi Selection)

□ No idea of what these certificates are
□ Not clear about the procedures of obtaining these certificates
□ Not much help in enhancing business and lower cost
□ Limited human resources
□ Financial problem
□ Documental technical problem
□ Not much contractors in Macau obtain these certificates
□ No requirement by client
□ No requirement by government
□ Not much potential in future construction trend in Macau
□ Cannot improve efficiency
□ Not much help in bidding projects
□ Other_____

15. Any consideration for management system certificates registration? (multi-slelection)

□ Yes --- □ISO9000 □ISO18000 □OHSAS18000 □Others_____
□ No **If No, please jump to Q17.*

16. Reasons and expectations for obtaining the management system certificates that have chosen above (Multi Selection).

	ISO9000	ISO14000	OHSAS18000
1. Enhance company reputation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Enhance workers' quality consciousness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Client's preference and demands	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Lower cost and enhance business	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Give confident to the customers	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Easier to bid a project	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Ensure the management systems can meet the International requirement	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. Increase competitiveness	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. Improve working efficiency	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10. Standardized internal management system	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
11. See the potential in future construction trend in Macau	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
12. Government’s preference	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
13. Pressure from competitors (i.e. other contractors have already obtained the certificates)	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
14. Have subsidies in establishing these systems.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
15. Have chance to bid international projects	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Others reasons:			

17. If a short interview about 15-30 minutes is requested, are you willing to spare your time and offer your help? Your information will help a lot for my paper. If yes, please leave contact below.

□ Yes _____ □ No

問卷調查

你好!

我是澳門大學大四土木系的學生，此調查問卷是我畢業報告的一部份。由於不文化背影的不同，所以我提拱了中英兩份問卷，請選擇其中一份填寫。本調查的目的是了解澳門對質量 (ISO9000)，環境 (ISO14000)和安全(OHSAS18000) 管理體系的看法，以及對比鄰近地區的情況。此問卷收集了爲承建商工作的受訪者意見，而最終的數據分析只用於本人畢業報告。請放心，您所填寫的內容，意見或評論全爲保密，不作公開。我將於 __ 月__日到貴公司收回問卷，感謝您的協助，钬的資訊會對的的報告有很大的幫助。

Lydia,梁詩遠

研究員

澳門大學 - 土木工程

個人聯絡資料:

公司名稱: _____

姓名: _____

電話: _____

e-mail: _____

第一部份

回答以下問題並把答案填在空格內，並以「√」表示或填在橫線上。

2. 你在公司的職位_____.

2. 公司的總部位置?

☐ 澳門

☐ 香港

☐ 中國

☐ 外國

3. 澳門公司的員工人數?.

☐ < 20 ☐ 20 - 40 ☐ 40 - 60 ☐ 60 - 80

☐ 80 – 100 ☐ >100

4.公司建立了多少年?.

☐ < 5 年 ☐ 5 – 10 年 ☐ 10 - 20 年

☐ 20 - 30 年 ☐ 30 - 40 年 ☐ > 40 年

5. 公司每年平均營業額?

☐ < 五千萬　　☐ 五千萬 --- 一億　　☐ 一億 --- 五億
☐ 五億 --- 十億　　☐ 十億 --- 三十億　　☐ 三十億 --- 五十億
☐ > 五十億

6. 2013-2014 年內有沒有工程項目?
☐ 有　　☐ 沒有

7. 公司通常承接什麼類型的項目? (多選)
☐ 住宅建築　　☐ 道路建設　　☐ 商業大樓
☐ 隧道施工　　☐ 賭場和酒店　　☐ 修復項目
☐ 橋樑建設　　☐ 鐵路建設　　☐其他 _____

8. 公司是否取得任何質量，安全或環境管理體系證書，如 ISO9000 (環境管理體系證書)。
☐ 有　　☐ 沒有
***如果有，跳轉到問題 9，如果沒有，跳到問題 14**。

9. 公司有沒有獲取以下管理體系證書以及其有效日期(例如有效期到 2013 年) ? (多選)
☐ ISO9000 (質量管理體系證書) 有效期到_____
☐ ISO14000 (環境管理體系證書) 有效期到_____
☐ OHSAS18000 (安全管理體系證書) 有效期到_____
☐ 其他 _____有效期到_____

10. 公司會否選擇繼續續管理體系證書的牌照?
☐ 會　　☐ 不會

11. 公司會否考慮領取其他牌照? (多選)
☐會---- ☐ISO9000 ☐ISO14000 ☐OHSAS18000 ☐其他_____
☐不會

第二部份

對於下面每一點，請註明你的意見：
（1）非常同意（2）同意（3）一般（4）不同意（5）非常不同意。

例子如下所示:
如果提高公司的聲譽是建立 ISO9000 的主要的原因，ISO14000 是其中小部份的原因，而 OHSA18000 不是當中的原因，你需要按以下形式填寫：

	ISO9000	ISO14000	OHSAS18000
1. 提升公司信譽	*① 2 3 4 5*	*1 2 ③ 4 5*	*1 2 3 4 ⑤*

12.獲取這些管理體系證書的原因和期望.

	ISO9000	ISO14000	OHSAS18000
1.提升公司信譽	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2.加強工人的質量意識	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3.客戶的偏好和要求	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4.降低成本，提高業務	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5.令客戶對公司更有信心	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. 更容易投得工程項目	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7.確保管理體系能達到國際標準	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8.提高公司競爭力	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. 提高員工工作效率	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10.規範公司內部管理制度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
11.澳門未來建築發展趨勢的需要	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
12.政府的要求	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
13.其他建築公司也有這些管理體系	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
14. 申請這些管理體系有資助	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
15. 有投標國際項目的機會	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
其他原因:			

13. 獲得這些證書後，效果有沒有達到公司預期的?

優點	ISO9000	ISO14000	OHSAS18000
1. 增強公司信譽	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. 提高員工的素質，環境和安全意識	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. 降低成本，提高業務	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. 令客戶對公司更有信心	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. 更容易投得工程項目	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. 提高公司競爭力	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. 提高員工工作效率	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. 規範公司內部管理制度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. 有投標國際項目的機會	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
其他原因 ：			

**請跳到 Q17*

14. 以下有什麼原因令到公司不獲取管理體系證書. (多選)

□ 不知道這些証書的存在
□ 尚不清楚有關獲取這些證書的程序
□ 有限的人力資源
□ 財務問題
□ 文件上的技術問題
□ 澳門不多工程公司擁有這些證書
□ 客戶沒有這方面的要求
□ 政府沒有這方面的要求
□ 在澳門的建築界不是一個重要的條件
□ 對提高員工效率沒有成效
□ 對投標沒有太大幫助
□ 其他_____

15. 有沒有考慮申請這些證書? (多選)
□ 有 --- □ISO9000 □ISO18000 □OHSAS18000 □其他_____
□ 沒有
**如果沒有, 請跳到 Q17.*

16. 申請這些証書的原因和期望 (多選).

	ISO9000	ISO14000	OHSAS18000
1.提升公司信譽	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2.加強工人的質量意識	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3.客戶的偏好和要求	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4.降低成本，提高業務	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5.令客戶對公司更有信心	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. 更容易投得工程項目	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7.確保管理體系能達到國際標準	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8.提高公司競爭力	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9. 提高員工工作效率	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10.規範公司內部管理制度	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
11.澳門未來建築發展趨勢的需要	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
12.政府的要求	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
13.其他建築公司也有這些管理體系	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
14. 申請這些管理體系有資助	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
15. 有投標國際項目的機會	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
其他原因:			

17. 如果約 15-30 分鐘的簡短採訪要求，你是否願意抽出你的時間？你的資訊會對我的論文有很大幫助。如果願意，請在下方留下聯繫方式。

□ 是 _____ □ 不是

APPENDIX B – LIST OF COMPANIES FOR SURVEY

中德工程有限公司	中國建築工程(澳門)有限公司	禮頓建築(亞洲)有限公司
得寶建築集團有限公司	中國路橋工程有限責任公司	富域工程(澳門)有限公司
德發建業工程有限公司	中國土木工程(澳門)有限公司	新昌營造集團有限公司
美昌建築有限公司	上海建工集團(澳門)有限公司	保華建築營造有限公司
三友建築置業有限公司	振華海灣工程有限公司	瑞權工程有限公司
新興業工程有限公司	中鐵(澳門)有限公司	振耀建築有限公司
捷安建築置業有限公司	中基基礎工程有限公司	權暉建築工程有限公司
長江建築有限公司	博聯工程（澳門）有限公司	明信建築置業有限公司
利馬建築工程有限公司	精工工程(澳門)有限公司	李鎮成建築商
華建建築工程有限公司	南光工程有限公司	信誠工程
新基業工程有限公司	凱迪建築工程有限公司	偉成建築工程有限公司
大亞建築工程有限公司	珠光工程發展有限公司	敏達工程有限公司
建利工程有限公司	力寶威建築置業有限公司	新方盛建築工程有限公司
新力建設有限公司	鴻偉工程有限公司	司徒高建築工程有限公司
澳馬建築工程有限公司	吳淦記建築有限公司	華聯創基建築工程有限公司
德發建業工程有限公司	新科建築置業有限公司	通利建築置業工程有限公司
利豐建築工程有限公司	建南建築工程有限公司	利成建築工程有限公司
利榮建築工程有限公司	新鴻建工程有限公司	新紅太陽建築工程有限公司
友生建築工程有限公司	達昌建築工程有限公司	安穗建築工程有限公司

成龍工程有限公司	迪亞建築工程有限公司	海晖建築置業有限公司
新權暉建築工程有限公司	晉業拓展工程建設有限公司	建新建築工程(澳門)有限公司

APPENDIX C – INTERVIEW QUESTIONS

Questions for foreign-based contractors with management system.

1. How long have the company been implementing the quality, safety and environmental management systems respectively?
2. How long was the preparation of the implementation of the three management systems? What was the most difficult part? Financial difficult? What is the cost for the implementation?
3. What are the main advantages after implementation? Any disadvantages? What is the cost for the maintenance? High, or very small percentage of overhead?
4. Do the quality, safety and environmental aspect improve after the implementation?
5. Are the management systems helpful for bidding a project in Macau? Will the extra cost for the implementation and maintenance be considered in bidding price?
6. Any opinion towards the trend of management system implementation in Macau construction industry in the future? Is that necessary in Macau construction market.
7. How about the situation of the management systems in the company's based country? Is it a requirement from government or construction institute?

Questions for local contractors with management system.

1. How long have the company been implementing the quality, safety and environmental management systems respectively?
2. How long was the preparation of the implementation of the three management systems? What was the most difficult part?
3. What are the main advantages after implementation? Any disadvantages?
4. Do the quality, safety and environmental aspect improve after the implementation?
5. Are the management systems helpful for bidding a project in Macau? If not, why go for it? How to be competitive with the rest without any management system?
6. Any consideration to withdraw or continue the management system?
7. Any opinion towards the trend of management system implementation in Macau construction industry in the future? Is that necessary in Macau construction market Do you agree the government in Macau set management system as a requirement? Why or why not?
8. How to cover the cost of management system implementation?

Questions for local contractors without management system.

1. The main reasons for not implementing the management systems.
2. Do you agree the government in Macau set management system as a requirement?

Why or why not?

3. Any pressure from other contractors in Macau who have these management systems? Or from clients?
4. Any consideration in setting up management systems in the future?
5. Any opinion towards the trend of management system implementation in Macau construction industry in the future? Is that necessary in Macau construction market?
6. Are the management systems helpful for bidding a project in Macau?
7. Present the comments from the interviewees from above and seek for their comments.

APPENDIX D –RETURNED QUESTIONNAIRES DATA

Questionnaire Result								
No	Part I: Companies' information	(Percentage)%						
1	Where is the base company?	Macau		Hong Kong		China		Foreign
		83.3		5.6		11.1		
2	Number of staffs in the company in Macau.	<20	20-40	40-60	60-80	80-100	>100	
		16.7	16.7	27.8	0	5.6	33.3	
3	Years of establishment for the company in Macau.	< 5years	5-10years	10-20years	20-30years	30-40years	>40years	
		0	22.2	55.6	11.1	5.6	5.6	
4	What is the recent five years average annual revenue of the company in Macau. (m=million, b=billion)	<50m	50-100 million	100 – 500 million	500m - 1 billion	1 - 3 billion	3-5 billion	>5 billion
		16.7	27.8	22.2	0	5.6	5.6	11.1
5	Any construction projects in 2013-2014?	Yes				No		
		100				0		
6	What types of project(s) the company in Macau usually handle? (Multi selection)	Residential Building	Tunnel Constriction	Bridge Constructions	Road Construction	Casino and Hotel		
		72.2	22.2	16.7	33.3	44.5		
		Railway Construction	Commercial Building	Rehabilitation Work	Others			
		5.6	50	33.3	11.1			
7	Does the company in Macau obtain any quality, safety or environmental management system certificates, e.g. ISO9000 (quality management system).	YES			No			
		44.4			55.6			

The data of companies that have implemented management systems will only be considered in the following section					
8	What type of management system certificates does the company in Macau obtain and their valid date (e.g. valid to 2013)	ISO9000 (Quality)	ISO14000 (Environmental)	OHSAS18000 (Safety)	Others
		100	62.5	50	0
9	Will your company in Macau continue to	Yes		No	

	Macau continue to renew the certificates in the future?	100	0

10	Any consideration in getting other management system certificates in the coming five years? (multi-selection	Yes				No
		ISO9000	ISO4000	OHSAS18000	Others	
		0	25	25	25	37.5

Part II: The following is the rating system for each statement: Strongly concern (1); Somewhat Agree (2); Neutral (3); Somewhat disagree(4); Strongly Disagree (5)																
11	Reasons and expectation for implement management systems	ISO9000					ISO14000					OHSAS1800				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Enhance company reputation	37.5	62.5	0	0	0	20	60	20	0	0	20	60	20	0	0
	Enhance workers' quality consciousness	37.5	37.5	25	0	0	20	60	20	0	0	20	60	20	0	0
	Client's preference and demands	25	75	0	0	0	20	40	40	0	0	20	40	40	0	0
	Lower cost and enhance business	12.5	12.5	37.5	37.5	0	0	40	40	20	0	0	40	40	20	0
	Give confident to the customers	25	62.5	12.5	0	0	0	80	20	0	0	0	80	20	0	0
	Easier to bid a project	25	50	25	0	0	20	60	20	0	0	20	60	20	0	0
	Ensure the management systems can meet the International requirement	37.5	62.5	0	0	0	0	40	40	20	0	0	40	40	20	0

	Increase competitiveness	37.5	50	0	12.5	0	20	40	20	20	0	20	40	20	20	0
	Improve working efficiency	12.5	37.5	37.5	12.5	0	20	0	60	20	0	20	0	60	20	0
	Standardized internal management system	50	37.5	12.5	0	0	60	20	20	0	0	60	20	20	0	0
	See the potential in future construction trend in Macau	25	62.5	12.5	0	0	20	40	20	0	20	20	40	20	0	20
	Government's preference	12.5	25	37.5	25	0	20	40	40	20	0	20	40	40	20	0
	Pressure from competitors	12.5	12.5	75	0	0	0	0	100	0	0	0	0	100	0	0
	Have subsidies	0	0	50	50	0	0	0	60	40	0	0	0	60	40	0
	Have chance to bid international projects	25	62.5	12.5	0	0	40	20	40	0	0	40	20	40	0	0
12	After obtaining these certificates, does the outcome meet the company's expectation	ISO9000					ISO14000					OHSAS1800				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Enhance company reputation	12.5	75	12.5	0	0	0	60	40	0	0	0	60	40	0	0
	Enhance workers' quality consciousness	12.5	62.5	12.5	12.5	0	20	20	40	0	0	20	20	40	0	0
	Lower cost and enhance business	0	25	62.5	0	12.5	0	0	80	0	20	0	0	80	0	20
	Give confident to the customers	0	87.5	12.5	0	0	0	40	60	0	0	0	40	60	0	0
	Easier to bid a project	12.5	37.5	50	0	0	20	20	60	0	0	20	20	60	0	0

	Increase competitiveness	12.5	62.5	12.5	12.5	0	20	20	40	20	0	20	20	40	20	0
	Improve working efficiency	0	25	62.5	12.5	0	0	0	80	20	0	0	0	80	20	0
	Standardized internal management system	12.5	75	12.5	0	0	20	60	20	0	0	20	60	20	0	0
	Have chance to bid international projects	12.5	25	62.5	0	0	20	20	60	0	0	20	20	60	0	0

Part III

The data of companies that did not implement management systems will only be considered in the following section

14	Reasons for not getting the management system certificates. (Multi Selection)	Percentage (%)
	No idea of what these certificates are	10
	Not clear about the procedures of obtaining these certificates	30
	Not much help in enhancing business and lower cost	10
	Limited human resources	40
	Financial problem	30
	Documental technical problem	20
	Not much contractors in Macau obtain these certificates	40
	No requirement by client	70
	No requirement by government	60
	Not much potential in future construction trend in Macau	30

	Cannot improve efficiency	20			
	Not much help in bidding projects	30			
15	Any consideration for management system certificates registration? (multi-selection)	Yes			No
		ISO9000	ISO14000	OHSAS18000	60
		30	10	0	

The data of companies that have incentive to implement management systems will only be considered in the following section The following is the rating system for each statement: Strongly concern (1); Somewhat Agree (2); Neutral (3); Somewhat disagree(4); Strongly Disagree (5)																
11	Reasons and expectation for implement management systems	ISO9000					ISO14000					OHSAS1800				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Enhance company reputation	33.3	33.3	33.3	0	0	0	100	0	0	0	0	0	0	0	0
	Enhance workers' quality consciousness	100	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	Client's preference and demands	0	66.7	33.3	0	0	0	0	100	0	0	0	0	0	0	0
	Lower cost and enhance business	0	0.	33.3	66,7	0	0	0	100	0	0	0	0	0	0	0
	Give confident to the customers	33.3	66.7	0	0	0	0	0	100	0	0	0	0	0	0	0
	Easier to bid a project	0	33.3	66.7	0	0	0	0	100	0	0	0	0	0	0	0
	Ensure the management systems can meet the International requirement	0	66.7	33.3	0	0	0	100	0	0	0	0	0	0	0	0
	Increase competitiveness	0	100	0	0	0	0	0	100	0	0	0	0	0	0	0
	Improve working efficiency	0	0	100	0	0	0	0	100	0	0	0	0	0	0	0
	Standardized internal management system	33.3	66.7	0	0	0	0	100	0	0	0	0	0	0	0	0
	See the potential in future	0	66.7	33.3	0	0	0	0	100	0	0	0	0	0	0	0

	construction trend in Macau															
	Government's preference	0	0	100	0	0	0	0	100	0	0	0	0	0	0	0
	Pressure from competitors	0	0	66.7	33.3	9	0	0	100	0	0	0	0	0	0	0
	Have subsidies in establishing these systems.	33.3	33.3	33.3	0	0	0	0	100	0	0	0	0	0	0	0
	Have chance to bid international projects	0	33.3	0	66.7	66.7	0	100	0	0	0	0	0	0	0	0