An exploratory study into the implementation of safety management systems of Malaysian contractors in processing plants

This item was submitted to Loughborough University's Institutional Repository by the/an author.

Additional Information:

- A Doctoral Thesis. Submitted in partial fulfillment of the requirements for the award of Doctor of Philosophy of Loughborough University.

Metadata Record: https://dspace.lboro.ac.uk/2134/6595

Publisher: © Norfaridatul Akmaliah Othman

Please cite the published version.
This item was submitted to Loughborough’s Institutional Repository (https://dspace.lboro.ac.uk/) by the author and is made available under the following Creative Commons Licence conditions.

For the full text of this licence, please go to: http://creativecommons.org/licenses/by-nc-nd/2.5/
AN EXPLORATORY STUDY INTO THE IMPLEMENTATION OF SAFETY MANAGEMENT SYSTEMS OF MALAYSIAN CONTRACTORS IN PROCESSING PLANTS

BY

NORFARIDATUL AKMALIAH OTHMAN

A Doctoral Thesis

submitted in partial fulfilment of the requirement

for the award of Doctoral of Philosophy of

Loughborough University

February 2010

© by Norfaridatul Akmaliah Othman, 2010
Dedicated to my late father, my mother, my husband and children for their love, sacrifices and inspiration
ACKNOWLEDGEMENT

While the list of those to whom I am deeply indebted while pursuing the research study and writing up this thesis would be endless and extend from the UK to Malaysia, mentioning them here is just scant recognition of their contribution. I would like to thank my supervisors Dr Samir Dani and Professor Neil Burns for their continuous guidance, advice, assistance and support, which made it possible for me to bring this thesis to completion. I am indebted to them for their source of ideas, motivation and inspiration to enable me to complete the research study successfully.

My sincere thanks are also extended to Mr Alizan, M. Mahathir, Mr Kamaruzaman, Mr Andrew and Mr Rizal for allowing me to conduct interviews as well as providing me with the essential materials and current information about the safety management system of contractors in Malaysia.

Above all, I must thank my husband Shairan Abdul Shukor for his love, sacrifice, inspiration, understanding, patience, encouragement and support during the long episode of this research study. I am very grateful for his invaluable advice, contribution and help; only he knows the true depth of my indebtedness. Loving appreciation is also due to my children, Mohd Safuan, Puteri Norshafiqah and Norjannah Shafiyah, who are my true source of motivation and inspiration; and to my mother, brothers, sisters and in-laws back home in Malaysia for continuing to lend their support, advice and prayers. Finally, special thanks and appreciation go to Norhidayah Othman, Norhalimah Idris, Adam Jait, Mimi Hafiza Jun, Aryani Ahmad Latiffi and Atiah Sidek for their contribution, and all my friends here in the UK and in Malaysia, who have supported, motivated and inspired me in different ways during the course of the research study. This thesis would not have been possible without your encouragement and assistance.
ABSTRACT

The accident rate in the Malaysian construction industry is among the highest compared to other developing countries. The Malaysian government has recommended the self-regulation of safety management systems (SMS) for construction projects with the hope of improving the situation; however, the readiness of the local contractors to implement this is questionable.

There are many issues involved in implementing SMS. Failures are still common despite advances in the SMS approach. Little has been written on the views of contractors in processing plants about the issue they have with SMS implementation. Therefore, an investigation of SMS implementation can help to identify the problems encountered by contractors.

This research sought to develop a theory not only about what the issues are, from the contractors’ perspective, but also how these issues appear in and may affect the outcomes of SMS implementation. In Stage One, the researcher explores the existence and availability of SMS among Malaysian contractors working in processing plants through the distribution of a survey questionnaire. In Stage Two, the researcher explores the issue and underlying problems of SMS implementation in depth through semi-structured interviews with 13 respondents. An adapted grounded theory analysis, following the original Glaser and Strauss (1967) philosophy, was used to analyse the data extracted from the interviews.

The findings of this research appear to show that many obstacles encountered by contractors are interlinked, including cultural factors, working conditions and the organisational process. These factors have formed the underlying root causes of ineffective SMS implementation: the misperception of safety responsibility is responsible for the poor communication and training during the SMS implementation process. The findings were then plotted into a model.
It is hoped that the findings of this research will lead to effective SMS implementation. The result of this study will be of particular interest to the stakeholder and policymaker. A series of practical recommendations are presented at the end of the thesis.
### TABLE OF CONTENTS

Dedication.................................................................i  
Acknowledgement.....................................................ii  
Abstract...........................................................................iii  
Table of Contents.............................................................v  
List of Figures.................................................................viii  
List of Tables.....................................................................ix  
Glossary.............................................................................x  
Abbreviations.....................................................................xiii  

**Chapter 1: Introduction** ......................................................... 1  
1.0 Introduction............................................................................ 1  
1.1 Research Background.......................................................... 1  
1.2 Problem Statement............................................................. 2  
1.3 Research Aim and Objectives.............................................. 7  
1.4 Research Questions........................................................... 8  
1.5 Research Scope and Limitation......................................... 9  
1.6 Significance of the Study.................................................... 9  
1.7 The Organisation of the Thesis.......................................... 10  
1.8 Conclusions.......................................................................... 13  

**Chapter 2: Literature Review** .................................................. 14  
2.0 Introduction.......................................................................... 14  
2.1 Safety Management Systems (SMS)................................. 14  
2.1.1 The Background of SMS............................................... 14  
2.1.2 Elements of SMS....................................................... 19  
2.2 Contractors’ Safety............................................................. 26  
2.2.1 Contractors in Processing Plants................................. 26  
2.2.2 Safety Responsibility of Contractors........................... 29  
2.2.3 Factors Affecting Contractor’s Safety......................... 33  
2.3 Approaches to Effective SMS Implementation................ 39  
2.4 SMS Implementation and The Environment.................... 42  
2.5 Conclusions.......................................................................... 48  

**Chapter 3: Malaysian Safety Background** .................................. 51  
3.0 Introduction.......................................................................... 51  
3.1 Malaysian Safety Law and Regulations............................ 51  
3.2 The Government and Private Agencies’ Role in Promoting Safety  55  
3.3 The Development of Processing Plants............................ 62  
3.4 Contractors’ Involvement in Processing Plants.................. 64  
3.5 The Construction Environment and Safety Challenges....... 66  
3.6 Construction Safety Policy............................................... 70  
3.7 Are Malaysian Safety Management Systems Any Better?..... 73  
3.8 Conclusions.......................................................................... 76
Chapter 6: Discussion of the Findings

6.2.1.2 Management Commitment and Participation ....................................................... 141
6.2.1.3 Individual Involvement and Behaviour ................................................................. 145
6.2.2 Theme 2: Resource Constriction ........................................................................... 149
6.2.2.1 Financial Constraints ............................................................................................. 149
6.2.2.2 Manpower Constraints ........................................................................................... 153
6.2.3 Theme 3: Working Conditions .............................................................................. 159
6.2.4 Theme 4: Communication Issues .......................................................................... 163
6.2.5 Theme 5: Training Issues ....................................................................................... 165
6.3 Discussion of the Findings ..................................................................................... 167
6.4 Limitations and Constraints ................................................................................... 171
6.5 Conclusions ............................................................................................................ 171

Chapter 7: Discussion of Key Findings ............................................................................ 173

7.0 Introduction ............................................................................................................ 173
7.1 Summary of Findings ............................................................................................. 174
7.2 Reliance Culture of SMS (Theme 1) ..................................................................... 177
7.3 The Uncertainty of Organic Types of Organisation (Theme 3) ........................... 181
7.4 Disintegration and Inconsistency of Organisation Processes (Theme 1,2,4,5) .... 183
7.5 Model Development: Misperception of Safety Responsibility ............................ 192
7.6 Industry Validation ................................................................................................ 200
7.7 Conclusions ............................................................................................................ 202

Chapter 8: Conclusions ..................................................................................................... 203

8.0 Introduction ............................................................................................................ 203
8.1 Summary of Findings and Main Conclusions ....................................................... 203
8.2 Achievement of the Research Aim and Objectives .............................................. 204
8.2.1 Fulfilment of the First Objective ........................................................................... 204
8.2.2 Fulfilment of the Second Objective ...................................................................... 205
8.2.3 Fulfilment of the Third Objective ........................................................................ 206
8.2.4 Fulfilment of the Fourth Objective ...................................................................... 207
8.3 Research Contributions To Knowledge and Practitioners .................................... 207
8.4 Limitations and Recommendations for Future Research ...................................... 211
8.5 Concluding Remarks and Recommendations ....................................................... 212

References ............................................................................................................................. 214

Appendixes ........................................................................................................................... 240
**LIST OF FIGURES**

<table>
<thead>
<tr>
<th>Number</th>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Figure 1.1: Fatal occupational accidents by sector in 2008</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Figure 1.2: Total number of industrial accidents, including fatalities,</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2004-2008</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Figure 1.3: Thesis layout</td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>Figure 2.1: Successful health and safety management (HSG65)</td>
<td>20</td>
</tr>
<tr>
<td>5.</td>
<td>Figure 2.2: The continuous improvement model of safety management</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>systems</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Figure 2.3: Elements of successful SMS</td>
<td>22</td>
</tr>
<tr>
<td>7.</td>
<td>Figure 2.4: Main elements of the safety management systems</td>
<td>23</td>
</tr>
<tr>
<td>8.</td>
<td>Figure 2.5: Occupational safety and health management systems</td>
<td>23</td>
</tr>
<tr>
<td>9.</td>
<td>Figure 2.6: A contingency approach to effective SMS</td>
<td>47</td>
</tr>
<tr>
<td>10.</td>
<td>Figure 3.1: Ministry of human resource’s administrative system</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>in Malaysia</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Figure 3.2: OSH activities in Malaysia</td>
<td>62</td>
</tr>
<tr>
<td>12.</td>
<td>Figure 4.1: The research design process</td>
<td>83</td>
</tr>
<tr>
<td>13.</td>
<td>Figure 5.1: Safety policy</td>
<td>117</td>
</tr>
<tr>
<td>14.</td>
<td>Figure 5.2: Organising</td>
<td>118</td>
</tr>
<tr>
<td>15.</td>
<td>Figure 5.3: Planning and monitoring</td>
<td>119</td>
</tr>
<tr>
<td>16.</td>
<td>Figure 5.4: Safety audit</td>
<td>119</td>
</tr>
<tr>
<td>17.</td>
<td>Figure 5.5: Safety legislation</td>
<td>120</td>
</tr>
<tr>
<td>18.</td>
<td>Figure 5.6: Safety information and satisfaction</td>
<td>121</td>
</tr>
<tr>
<td>19.</td>
<td>Figure 5.7: Safety training</td>
<td>121</td>
</tr>
<tr>
<td>20.</td>
<td>Figure 5.8: Obstacles to SMS implementation (percentage)</td>
<td>122</td>
</tr>
<tr>
<td>21.</td>
<td>Figure 5.9: Research questions about the effective SMS implementation</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>of Malaysian contractors working in processing plants</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Figure 6.1: Broad themes</td>
<td>135</td>
</tr>
<tr>
<td>23.</td>
<td>Figure 7.1: Detailed research process</td>
<td>176</td>
</tr>
<tr>
<td>24.</td>
<td>Figure 7.2: Barriers to SMS implementation experienced by contractors</td>
<td>193</td>
</tr>
<tr>
<td>25.</td>
<td>Figure 7.3: Misperception mismatch tool</td>
<td>194</td>
</tr>
<tr>
<td>26.</td>
<td>Figure 7.4: Approach to effective SMS implementation</td>
<td>198</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Number</th>
<th>Table 1.1: Recent example of accident involving contractors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Table 1.1: Recent example of accident involving contractors</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Table 2.1: Organisational external environment</td>
<td>45</td>
</tr>
<tr>
<td>3.</td>
<td>Table 2.2: Organisational internal environment</td>
<td>46</td>
</tr>
<tr>
<td>4.</td>
<td>Table 3.1: Grade categories</td>
<td>58</td>
</tr>
<tr>
<td>5.</td>
<td>Table 3.2: Number of contractors by Grade, 2001-June 2007</td>
<td>66</td>
</tr>
<tr>
<td>6.</td>
<td>Table 3.3: Enhancement of OSH under CIMP</td>
<td>73</td>
</tr>
<tr>
<td>7.</td>
<td>Table 4.1: Six sources of evidence: strengths and weaknesses</td>
<td>81</td>
</tr>
<tr>
<td>8.</td>
<td>Table 5.1: Explanation of question content</td>
<td>105</td>
</tr>
<tr>
<td>9.</td>
<td>Table 5.2: Number of questionnaires distributed and returned</td>
<td>112</td>
</tr>
<tr>
<td>10.</td>
<td>Table 5.3: Position within the company</td>
<td>113</td>
</tr>
<tr>
<td>11.</td>
<td>Table 5.4: Place of work</td>
<td>114</td>
</tr>
<tr>
<td>12.</td>
<td>Table 5.5: Grade of company</td>
<td>114</td>
</tr>
<tr>
<td>13.</td>
<td>Table 5.6: Type of contractor</td>
<td>115</td>
</tr>
<tr>
<td>14.</td>
<td>Table 5.7: Type of project</td>
<td>115</td>
</tr>
<tr>
<td>15.</td>
<td>Table 5.8: Number of employees</td>
<td>116</td>
</tr>
<tr>
<td>16.</td>
<td>Table 6.1: Background of the respondents</td>
<td>132</td>
</tr>
<tr>
<td>17.</td>
<td>Table 6.2: Main findings as categories and themes</td>
<td>133</td>
</tr>
</tbody>
</table>
**GLOSSARY**

**Accidents**: An accident is defined as an incident occurring to an employee on the site that results in personal injury. Accidents occurring off-site involving employees and also visitors are excluded. Non-specific incidents or events are included, for example exposure to chemical substances over a period of time. “…an unintentional event that causes harm to people, property or environment” (Roland and Moriarty, 1983 – as cited in Kuusisto, 2000).

**Clients**: Clients (also known as owners) refer to the organisation for which a construction service is being provided.

**Construction**: The carrying out of any building, civil engineering or engineering construction works, including any of the following:
- The construction alteration, conversion, fitting out, commissioning, renovation, repair, upkeep, redecoration or other maintenance, decommissioning, demolition or dismantling of a structure;
- The preparation for an intended structure, including site clearance, exploration, investigation (but not site survey) and excavation and laying or installing the foundations of the structure;
- The assembly of prefabricated elements to form a structure or the disassembly of prefabricated elements which, immediately before such disassembly, form a structure;
- The removal of a structure or part of a structure or of any product or waste resulting from demolition or dismantling of a structure or from disassembly of prefabricated elements which, immediately before such disassembly, formed a structure; and
- The installation, commissioning, maintenance, repair or removal of mechanical, electrical, gas, compressed air, hydraulic, telecommunications, computer or similar services which are normally fixed within or to a structure (European Construction Institute, 1995).

**Contractors**: Contractors include subcontractors and may also be known as works, specialist, trade or nominated contractors. Contractors have safety, health and environmental responsibilities for their own employees and others’ (Hubbard and Neil, 1985).

**Employees**: Employees refer to all workers on the site irrespective of status. It covers both operatives and staff.

**Hazards**: A source or situation that has the potential for causing injury or ill health to people, damage to property, damage to the environment, or a combination of these (Maxwell, 2004).

**Incident**: Any unplanned event that has the potential to lead to an accident and involve injury, ill health, damage or other loss (Maxwell, 2004).

**Major accidents**: A major accident is defined as a fatality or an accident causing an injury which resulted in more than three consecutive days of absence, excluding the day of the accident and any Sunday.
**Operatives/Contract workers:** Operatives/contract workers refer to hourly-paid employees. These are mainly manual workers of all types found normally on large construction sites, including tradesmen who had served an apprenticeship, such as electricians and fitters; other skilled operatives, such as crane drivers and scaffolders, who had acquired skills through other training schemes; and semi-skilled and unskilled workers, such as banks men, piling hands, trade labourers and general labourers.

**Processing Plant:** Refers to a petrochemical plant, which is a facility where products of petrochemicals are made. Petrochemicals are products produced from hydrocarbon-based raw materials such as oil or gas, which are referred to as feedstocks. The trade in petrochemicals is international and involves large sums of money (www.wisegeek.com).

**Risk:** The combination of the expected frequency (events/year) and consequence (effect/event) of a single accident or a group of accidents (as cited in Kuusisto, 2000).

**Safety:** A state in which the risk of harm to persons or damage to property is under a predetermined condition with an acceptable minimum level (Maxwell, 2004).

**Safety Management:** This term is actually used for convenience and for brevity, and wherever it is used it should be taken to refer to occupational health and safety management. This also includes the environment. Safety management is concerned with and achieved by all techniques which promote the subject. In addition, safety management is also concerned with influencing human behaviour and with limiting the opportunities for mistakes to be made which would result in harm or loss (Husin and Adnan, 2008).

**Safety Management System:** A part of a general management system which includes the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the accident prevention policy.

**Safety Management System Implementation:** A safety management programme includes details of the everyday strategies that will be used to control risks (OHSAS 18001).

**Safety Policy:** A management definition of the safety and health related actions to be followed in the work organisation (Petersen, 1989, as cited in Kuusisto, 2000).

**Safety Programme:** The term “safety system” is also used. A set of policies, procedures and practices designed to ensure that barriers to incidents are in place, in use and effective (as cited in Kuusisto, 2000).

**Safety Review:** An inspection of a plant or process unit, drawings, procedures, emergency plans and/or management systems etc., often by a team and usually problem-solving in nature (as cited in Kuusisto, 2000).

**Site Workers:** All employees of the consulting engineers and all the main contractors and their subcontractors working on the site are included in the study. Where statistics for the total labour force of all the employers on the site are given collectively, these are all referred to as site workers.
Staff: Staff refers to weekly- and monthly-paid employees. Examples of staff are engineers, foremen and specialist staff, such as surveyors, working in the same locations as the site workers and operatives/contract workers. Office personnel engaged in, for example, managerial, clerical, secretarial and accountancy work also count as staff.

Working Conditions: The employee’s experience of the quality of the work environment, usually with special emphasis on health and safety (as cited in Kuusisto, 2000).

Working Environment: The physical, mental (psychological) and social environment where the employees work.

Structure: The formal mechanisms and systems of the organisation that are designed to channel behaviour toward organisational goals and fulfil member needs (examples of these include job description, job evaluation system, organisation structure, policies, selection systems, control systems and reward systems) (Balzarova et al., 2006).

Environment: The external conditions with which the organisation must deal including its market, customers, technology, stockholders, government regulations and the social culture and values in which it operates (Balzarova et al., 2006).
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIDB</td>
<td>Construction Industry Development Board (in Malaysia)</td>
</tr>
<tr>
<td>DOSH</td>
<td>Department of Safety and Health (in Malaysia)</td>
</tr>
<tr>
<td>HAZOP</td>
<td>Hazard and Operability Analysis</td>
</tr>
<tr>
<td>HSE</td>
<td>Health and Safety Executive</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organisation</td>
</tr>
<tr>
<td>MOHR</td>
<td>Ministry of Human Resource (in Malaysia)</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute of Safety and Health (in Malaysia)</td>
</tr>
<tr>
<td>OHSAS</td>
<td>Occupational Health &amp; Safety Advisory Services</td>
</tr>
<tr>
<td>OSH</td>
<td>Occupational Safety and Health</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Act (in Malaysia)</td>
</tr>
<tr>
<td>PETRONAS</td>
<td>Petroleum National (in Malaysia)</td>
</tr>
<tr>
<td>SMS</td>
<td>Safety Management Systems</td>
</tr>
<tr>
<td>TQM</td>
<td>Total Quality Management</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standard Organisation</td>
</tr>
</tbody>
</table>
CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter introduces the background to the study, including the challenges faced by Malaysian contractors working in processing plants, the need for a sound safety management system (SMS) and the motivation for researching this field. The research aim, objectives and scope of research are also discussed. The organisation of the thesis is included at the end of this chapter.

1.1 Research Background

Safety Management Systems (SMS) have emerged from the “industrial accident causation theories” introduced by H. W. Heinrich in 1931, and function as comprehensive, integrated systems for managing safety. The principal aim of SMS is to impede the causation process that leads to accidents and incidents (Booth and Lee, 1995). SMS is fundamental to successful accident prevention (Grayham and Rosario, 1997), and has become a matter for concern in recent years (Hale et al., 1997).

A series of catastrophic incidents have occurred in the past (Hale et al., 1997; Kirchsteiger, 2002; Mitchison and Papadakis, 1999; Summers, 2007), which led to the development of safety regulations (Gun, 1993; Hale et al., 1997) and emphasised the need for SMS (Osborne, 1993). These major incidents involved Flixborough (1974), Seveso (1976), Mexico City (1984), Bhopal (1984), Chernobyl (1987) and Piper Alpha (1988) (Summers, 2007; Santos-Reyes and Beard, 2008).

Since then, SMS is used widely in various industries as an accident prevention mechanism. In the processing plant industry, the possibility of fire, explosions and toxic emissions is frequent, which could potentially kill a large number of people, including employees, processing plant contractors and the population, as well as causing catastrophic damage to the environment (Huat, 1997; Fernandez-Muniz et al., 2007). As a result, the use of SMS in processing plants is more extensive, and is where the
development and publication of safety standards or guidelines and good engineering practices started (Knegtering, 2002).

SMS is also essential in the construction industry. Many safety regulations have been enacted due to the distinctive nature of construction processes (Kartam, 2000; Fang et al., 2004). As an organic type of organisation (Wilson, 1989), construction projects offer a flexible working environment. Construction involves human interaction and complex activity and aligns individual objectives into one process, which is always difficult in practice, especially for large projects. Projects are complex in nature, as they involve technical, procedural, organisational and human elements in an integrated manner (Ruuska and Vartiainen, 2003). This complexity clearly demands SMS for the efficiency and effectiveness of accident prevention mechanisms.

Past studies have discovered that the successful implementation of SMS can help to prevent accidents in the construction industry (Baxendale and Jones, 2000; Wilson and Koehn, 2000; Tam et al., 2001; Hinze and Gambatese, 2003). However, the use of SMS reached a plateau. Despite adopting SMS, contractors remain poor in the implementation of safety on worksites. Many researchers have noted substantial failures in the implementation of SMS, and several attempts have been made to escalate its continuous improvement. However, little in the literature addresses implementation failure in the context of contractors working in processing plants. In addition, previous approaches to achieving safety improvements within a SMS framework do not address the contingency factors (external and internal environmental factors) involved in its implementation.

To effectively impact SMS at construction worksites, it becomes necessary to look at the systemic issues and problems of contractors during its development and implementation. This research addresses SMS implementation issues in terms of the contingency factors that can affect its outcomes.

1.2 Problem Statement

In recent years, the Malaysian economy and infrastructure development have significantly and rapidly increased due to the petrochemical industry. The Malaysian government has invested in petrochemical related infrastructure in specially designated zones to support
the industry, for instance Gebeng and Kertih on the east coast of Peninsular Malaysia and Tanjung Langsat in the south of Peninsular Malaysia. Investment in infrastructure has been extensive throughout the region, for instance Liquid Natural Gas (LNG) processing plants, trains, pipelines, refineries and shipyards (Ayache and Berthamet, 2004).

The growth of petrochemical processing plants (hereafter referred to as processing plants) has benefited various industries, especially the construction industry. The construction industry plays a major role in processing plants, as many construction activities are carried out to meet the high demands of development. One important role of the construction industry is to provide civil and mechanical maintenance tasks.

A processing plant is a huge and complex workplace (Bahrin et al., 2004). Thus the use of contractors for maintenance tasks in processing plants is necessary to cope with the large scale of work and engineering problems (Mueller et al., 1996). Contractors play a significant role during maintenance tasks due to the amount of work to be accomplished in a short period of time (Duffuaa, 2004). Other reasons for using contractors include: experience and professionalism; specialization in certain areas; productivity, cost and efficiency (Duffuaa, 2004; Lenahan, 2006).

Despite its important contribution to processing plant development, the construction industry is still saddled with serious safety problems. For instance, there have been 700 negligence cases in the construction industry since 2002, which include high-profile incidents (Basri and Kumar, 2006; The Star, 2006). The construction industry continues to contribute towards the high fatal accident rate in Malaysia, as illustrated in Figure 1.1 (Kong, 2001; Berita Harian, 2007; MOHR, 2008).
Some recent examples of fatal accidents involving contractors are shown in Table 1.1.

### Table 1.1: Recent examples of accidents involving contractors (Source: DOSH, 2008)

<table>
<thead>
<tr>
<th>NO</th>
<th>DATE/LOCATION</th>
<th>INCIDENT</th>
<th>CONSEQUENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>29/04/07 Selangor</td>
<td>Small fire while grinding and welding a tank.</td>
<td>1 fatality</td>
</tr>
<tr>
<td>2.</td>
<td>19/04/07 Sabah</td>
<td>Tank explosion during painting work.</td>
<td>3 fatalities</td>
</tr>
<tr>
<td>3.</td>
<td>14/04/07 Selangor</td>
<td>Fall from sixth floor while loading concrete.</td>
<td>1 fatality</td>
</tr>
<tr>
<td>4.</td>
<td>02/04/07 Selangor</td>
<td>Fall from tenth floor during plastering work.</td>
<td>1 fatality</td>
</tr>
<tr>
<td>5.</td>
<td>28/03/07 Melaka</td>
<td>Fall from scaffold.</td>
<td>1 fatality</td>
</tr>
<tr>
<td>6.</td>
<td>12/03/07 Kuala Lumpur</td>
<td>Fall from seventh floor while fixing a gondola.</td>
<td>1 fatality</td>
</tr>
<tr>
<td>7.</td>
<td>08/03/07 Selangor</td>
<td>Asphyxiation in a confined space.</td>
<td>3 fatalities</td>
</tr>
</tbody>
</table>

Apart from the complexity of working in processing plants, contractors face a greater risk during maintenance tasks (Kim et al., 2002). Contractors could be exposed to a number of inevitable hazards: large numbers of workers, mostly employed by the contractors, who
are unfamiliar with the plant in a confined space; the presence of hazardous materials; a large number of tasks performed under high pressure, in all weathers and often all the time (Ahmadun et al., 2003). The number of workers involved in a processing plant maintenance shutdown can be anywhere between 700 and 3000 at peak time (Ahmadun et al., 2003).

Due to the hazards and risks present in processing plants, the clients set high safety requirements and effective approaches to monitor and control the safety of contractors (Jannadi and Bu-Khamsin, 2000). However, accidents among contractors still happen (Kong, 2001; Mohd Salleh, 2002; New Straits Times, 2002; Shaluf and Ahmadun, 2006; Zainudin et al., 2006). Fatalities and injuries are commonplace among contractors due to the heavy physical activities necessary during maintenance tasks and the presence of a large number of workers (Hale et al., 1998; Ahmadun et al., 2003; Duffuaa and Daya, 2004). The number of accidents involving contractors is often more than five times higher than those involving the processing plants’ own personnel (as cited in Hale et al., 1998).

Some important examples of accidents in Malaysian processing plants are the Tiram Kimia Depot Chemical explosion (1992), the Shell Bintulu explosion (1997), the Petronas Gas Berhad fire and explosion (2002), the Petronas LNG Complex Bintulu fire incident (2003), the refinery fire in West Malaysia (1999) and the Fatty Chemicals methanol blast (2006). The latest accident is the Petronas LNG Complex Bintulu gas leakage (2009) (Mohd Salleh, 2002; Ismail and Stuart, 2005; Zainudin, 2006; Shaluf and Ahmadun, 2006; Utusan Malaysia Online, 2009). According to Kong (2001), Petronas, the biggest semi-government oil and gas producer in Malaysia, experienced the worst ever group safety record, with 31 fatalities in 1998 followed by 13 and 17 fatalities in 1999 and 2000 respectively, all involving contractors. There were three fatalities and four major injuries involving contractors’ workers in the Petronas Gas Berhad explosion in 2002 (New Straits Times, 2002; Shaluf and Ahmadun, 2006), and two fatalities and two major injuries involving contractors’ workers in the Fatty Chemicals methanol blast in 2006.

The Malaysian government has introduced the Occupational Safety and Health Act (OSHA) 1994 to respond to the need to cover a wider employee base and newer hazards in the workplace (Che Man and Musri, 2005; Rampal and Nizam, 2006), which came into
force in February 1994. OSHA 1994 replaced several previous regulations, such as the Factory and Machinery Act, where employers had minimal responsibilities, even at their own organisations (Soehod and Laxman, 2007).

The OSHA 1994 is an act that provides the legislative framework to secure the health, safety and welfare of the Malaysian workforce, and has led to the introduction of SMS at enterprise level (Che Man and Musri, 2005). It covers a wider employee base and the newer hazards in the workplace that have been directly linked to workplace injuries and illness (Soehod and Laxman, 2007).

Although the regulations and guidelines in Malaysia are available, the safety conditions in the workplace are still adverse and below expectation (Fernandez et al., 2002; Rampal and Nizam, 2006; Husin et al., 2008). Industrial accidents have increased from time to time. Cruz (2006) confirms that Malaysia has failed to keep occupational fatalities low. Figure 1.2 shows the industrial accident rate, including fatalities, in Malaysia from 2004 to 2008. Even though the number of accidents and fatalities decreased in 2007, the number increased in 2008. This demonstrates that safety is still an issue in Malaysia.

![Figure 1.2: Total number of industrial accidents, including fatalities, 2004-2008](source: MOHR, 2008)

Although the OSHA 1994 is quite comprehensive and an improvement over earlier pieces of legislation, the level of awareness and practicability of such regulations within the construction industry are generally lower than expected (A. Rahim et al., 2003; Rampal
and Nizam, 2006). In addition, SMS in Malaysia is still under self-regulation without nationally applied models (Kogi, 2002). Hence the number of Malaysian companies subscribing to SMS is still small compared to the total number of industries in the country (Thye, 2001). A study by the Malaysian Trade Union Congress (MTUC) (2001) affirmed that the implementation of safety in Malaysia is poor in the workplace. Furthermore, there are currently no specific guidelines or a master plan for the implementation of SMS programmes to help the construction industry players to improve their performance (CIDB, 2008).

Industrial accidents happen mainly due to non-compliance of OSHA 1994 by employers (New Straits Times, 2002). However, in the case of contractors working in processing plants, safety is a requirement of the client. Many clients have introduced various safety approaches to improve the safety performance of contractors (Simon and Piquard, 1991; Ibrahim et al., 2002). It is compulsory to include a safety plan in the tender documentation during the bidding process (Kong, 2001). However, previous research (Fitts, 1996; Smallwood, 1998; Yule and Mearns, 2004; Abraham et al., 2004) confirms that contractors adopt SMS just for the sake of the tender requirements and to satisfy the clients during the bidding process. Hence the implementation of safety is still lacking (Fitts, 1996). In the context of Malaysia, according to Husin et al. (2008), current SMS practice does have sound features and characteristics, but lacks mission, vision, objectives and awareness due to the over-emphasis on productivity. SMS is under self-regulation, and it requires more constructive and practical ideas for implementation (Husin et al., 2008). Furthermore, occupational safety is still in the early development stage in Malaysia (Husin et al., 2008).

1.3 Research Aim And Objectives

The principal aim of this research is to inform an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS.

The research aim, therefore, is supported by the following objectives:

1.3.1 To review the literature concerning SMS;
1.3.2 To explore the existence and availability of safety practices based on SMS elements among Malaysian contractors working in processing plants;
1.3.3 To investigate issues related to SMS implementation, to determine the main obstruction that hinders effective SMS, and to represent this process through a suitable model according to contingency perspectives;

1.3.4 To suggest improvements that could be made for effective SMS implementation and ways in which contractors can improve SMS implementation.

1.4 Research Questions

To achieve the research aim and objectives, a broad research question is set as a guideline. The broad research question for this study is: “Are safety management systems effectively implemented by Malaysian contractors working in processing plants?” Eisenhardt (1989), as cited in Christenson (2007), suggests that “the investigators should formulate a research problem and possibly specify some potentially important variables, with reference to extant literature. However, they should avoid thinking about specific relationships between variables and theories as much as possible, especially at the outset of the process”. Therefore, this research has reviewed the existing literature and identified a possible construct; however, this remains uncertain, as it is based upon evidence and needs further investigation.

The broad research question is extended by the following general focus research questions (Saunders et al., 2003), which were derived from the literature review:

1.4.1 Do Malaysian contractors working in processing plants have appropriate SMS?

1.4.2 How effective is SMS among Malaysian contractors working in processing plants?

1.4.3 What are the issues that hinder SMS implementation from the viewpoint of Malaysian contractors working in processing plants?

1.4.4 How can SMS be managed and implemented effectively?
1.5 Research Scope And Limitation

The focus of this study is to understand SMS implementation by Malaysian contractors working in processing plants. Contractors, in this study context, are construction business entities involved in civil and maintenance construction activity in processing plants.

This research focuses on the exploration of the issues and problems related to SMS development and implementation faced by Malaysian contractors working in processing plants. The lack of sufficient theoretical understanding of SMS development and its implementation emphasises the requirement for a more grounded approach. This is achieved through the exploration of SMS from the perspective of those involved.

The research is intended to investigate the issues surrounding the successful and satisfactory delivery of SMS solely from Malaysian contractors’ perspective, and to develop a theory related to the reasons for those issues. It is intended that the results will assist various parties involved in construction projects in processing plants to understand what they need to do to address those issues.

1.6 Significance Of The Study

As a developing country, the Malaysian government is striving to bring SMS into the workplace to ensure that Malaysia becomes a developed country by the year 2020. In order to achieve a developed nation status by the year 2020, the Malaysian government, through the Ministry of Human Resources, aims to reduce the accident rate to three per 1000 workers per year (Abdul-Rahman, 2008; CIDB, 2008). Malaysia aims to match developed nations, such as the United Kingdom, the United States of America and Japan, which already maintain their accident rates to three per 1000 workers (Abdul-Rahman, 2008; CIDB, 2008). This target, however, is very hard to achieve without the full participation and commitment of the parties involved. There has been massive financial investment, plans and strategies, and several authorities have been created to ensure that all the programmes related to safety are working.

Currently, the level of industrial accidents in Malaysia is still upsetting (Abdul-Rahman, 2008; Utusan Malaysia Online, 2009). Therefore, this research is vital to understand the
scenario of safety practices based on SMS elements in Malaysia. The findings may inform policy makers in the construction industry generally and the processing plant industry specifically. The findings may also benefit Malaysian researchers, which will lead to the relevant authorities taking necessary steps to develop and improve the safety practices of local contractors.

1.7 The Organisation Of The Thesis

The thesis comprises eight chapters. The thesis layout is presented in Figure 1.3.

**Chapter One** introduces the research and sets the basis and overall purpose of the research. It defines the background of the research, the research settings, the research aim and objectives and its novelty. It also gives an overview of the structure and organisation of the thesis.

**Chapter Two** provides a synopsis of the literature about SMS. The background, elements and factors influencing SMS are explored. The major issues are the current approach to effective SMS and the problems of its implementation. These are the core issues of the research and also the secondary data. The findings of this literature search serve as the basis for the current research.

**Chapter Three** continues to present the literature about SMS in a Malaysian context. It seeks to address the issues of current safety practices in Malaysia. An overview of the background of processing plants in Malaysia is presented to highlight the importance of the industry to the Malaysian economy. The major issue of SMS and its implementation is highlighted.

**Chapter Four** is devoted to the description of the methodology used in this research. The development and the proposed methodology for the research are discussed, exploring its suitability to address and achieve the aims and objectives of the research. The basis of the selection of the most suitable methodological approach for the research is discussed, taking into consideration the significant and relevant factors that have an impact on the type of research method used.
**Chapter Five** presents the findings and analysis of the exploratory survey questionnaire, which is among the primary data for the research. Relevant and related research questions are posed in the questionnaire. The results are based on the analysis of feedback from respondents using the Statistical Package for the Social Sciences (SPSS) software.

**Chapter Six** presents the findings and analysis of the interview data from the view of contractors. This chapter describes the adapted grounded theory process undertaken to analyse the interview data. A summary of the key findings from the interviews is also presented, showing the categories developed that assisted the early part of the grounded theory coding process. Individual quotations are included to provide supporting verbal evidence of each finding.

**Chapter Seven** focuses on the discussion of the broader themes of the findings and presents it in a model. Details of the model include its aims, purpose and specifications, which will be deliberated upon further in this chapter.

**Chapter Eight** completes the thesis with a summary of the research, important conclusions and general recommendations. It defines the extent to which the research objectives have been achieved, the limitations of the present research, and gives recommendations for future research.
CHAPTER 1: INTRODUCTION
Introduction to the topic and general context of the research aim and objectives, problem statement, methodology outlines and overview of the thesis

CHAPTER 2: SAFETY MANAGEMENT SYSTEM
Literature review of the background of SMS, contractors' safety in processing plants and implementation issues

CHAPTER 3: MALAYSIAN SAFETY BACKGROUND
Literature review of Malaysian safety background and challenges facing Malaysian contractors working in processing plants

CHAPTER 4: METHODOLOGY
Methodological approach, data collection and analysis discussion

CHAPTER 5: EXPLORATORY SURVEY QUESTIONNAIRE

CHAPTER 6: SEMI-STRUCTURED INTERVIEW

CHAPTER 7: DISCUSSION OF FINDINGS

CHAPTER 8: CONCLUSION AND RECOMMENDATION
Thesis conclusion summarizing the findings and implications to practitioners, and knowledge and recommendations for future research

Figure 1.3: Thesis Layout
1.8 Conclusions

This chapter introduced the background to the study, including the challenges faced by Malaysian contractors working in processing plants and the motivation for researching this field. It is obvious that safety requirements are very high in processing plants; conversely, contractors’ safety is an issue. Accidents involving contractors still happen in processing plants, and lack of compliance with SMS is one of the main contributing factors (Fitts, 1996).

This research aims to improve the understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS. To achieve the aim it is important to unveil the conditions of safety implementation, with regard to SMS, among Malaysian contractors in processing plants. Firstly, the researcher investigated the status of SMS through an exploratory survey questionnaire. Secondly, the identification of critical factors affecting SMS implementation is made through an in-depth semi-structured interview and plotted into a model. Thirdly, recommendations are suggested to alleviate the prevailing problems associated with SMS implementation. The next chapter reviews the background literature of SMS.
CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter offers an overview of the literature pertinent to the study. The discussion has been divided into four broad sections: Safety Management Systems (SMS), contractors’ safety, the approach to effective SMS, and SMS implementation and the environment. In each section, a detailed explanation is provided to determine the current ‘state of the art’ on SMS. The first section comprises a discussion related to the background and elements of SMS. The second section comprises an exploration of contractors’ safety, centred upon identifying the relevant parties involved in construction safety. The third section deals with the current approach to effective SMS and its limitations. Section four explains the internal and external environment factors which can affect SMS implementation, focusing on the organisation as a whole, and discusses the development of a proposed conceptual model for the study.

This chapter is essential, as it defines the specific objectives of the research. This chapter aims to provide a basic framework to help the reader understand the context of the research. This chapter demonstrates the need for an approach to effective SMS implementation among contractors in processing plants, indicates where the contingency variables (the internal and external environment of organisation) would fit within the context of current practice, and briefly describes the framework of a proposed effective SMS implementation through the internal and external environment of an organisation.

2.1 Safety Management Systems (SMS)

2.1.1 The Background of Safety Management Systems (SMS)

Safety is more than just a condition where a human is protected against hurt, injury or loss. Maxwell (2004) defines safety as a state in which the risk of harm to persons or damage to property is under a predetermined condition with an acceptable minimum level. Grimaldi and Simmonds (1975), as cited in Kuusisto (2000), define safety as “reliable control of harm”.

One way to control harm in the industrial world is through a Safety Management System (SMS). SMS has emerged from the “industrial accident causation theories” introduced by H.W. Heinrich in 1931. Heinrich suggests that accidents are the result of a human act and the condition of the physical or social environment. Petersen (1988), as cited in Kuusisto (2000), extended that the management system is a causation theory from the individual acts and local conditions. He views the unsafe act, unsafe conditions and accident as a result of failure in the organisational management system. He further stresses the top management’s responsibility to develop a system that can effectively control the risks associated with the organisation’s operation. A comprehensive model of accident causation which relates to organisational error was introduced by Reason (1990). The term ‘safety culture’ is introduced in his model, which has been widely used since the Chernobyl accident (Cooper, 2000).

The definition of SMS varies depending on the context. Generally, according to the reference made by Fernandez-Muniz et al. (2007), SMS is “a set of policies, strategies, practices, procedures, roles, and functions allied to safety”. Burrage (1995) describes safety management as “the measures, procedures, and controls applied to working activities to minimise risks and maximise safety”. The Hong Kong Labour Department (1999) further describes SMS as “planning, developing, organising, and implementing of safety policy, which will involve measuring and auditing the performance of those functions”. Wilson and Koehn (2000) describe SMS in the context of the construction site as “a method of controlling the safety policies, procedures, and practicing”.

The definition of SMS has been expanded. Reason (1997) states that: “effective SMS means actively navigating the safety space in order to reach and then remain within the zone of maximum resistance”. The European Council Directive 96/82/EC, also known as SEVESO II, defines SMS as including the organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the major-accident prevention policy (Mitchison and Papadakis, 1999). Knegtering (2002), in defining process safety management (PSM), states that: “SMS could be considered as being the equivalent of a Quality System (QS)”.

Finally, Mitchison and Papadakis (1999) state that safety management is an aspect of the overall management function that determines and implements the organisation’s safety
policy. This involves a series of activities, initiatives and programmes which focus on technical, human and organisational aspects, and refers to all the individual activities within the organisation. Moreover, these activities are associated with the concept of continuous improvement through ‘control loops’, which involve planning, organising the work, implementing, evaluating, checking the outcome against the plan and adjusting/taking corrective action.

SMS is an essential fundamental for successful accident prevention (Grayham and Rosario, 1997) and has become a matter of concern in recent years (Hale et al., 1997). A series of catastrophic incidents occurred in the past (Hale et al., 1997; Mitchison and Papadakis, 1999; Kirchsteiger, 2002; Summers, 2007), which led to the development of safety regulations and emphasised the need for SMS (Gun, 1993; Osborne, 1993; Hale et al., 1997). These major incidents involved Flixborough (1974), Seveso (1976), Mexico City (1984), Bhopal (1984), Chernobyl (1987) and Piper Alpha (1988) (Hale et al., 1997; Summers, 2007; Santos-Reyes and Beard, 2008).

It is noticeable that the incidents prompted the adoption of safety regulations (Hale et al., 1997), especially in Europe (Kuusisto, 2000). Several safety management related standards, directives and regulations were published during the 1990s. The BS 8800 (1996) became the first widely used general safety management standard. Another good example is the regulatory requirement under ‘Seveso I Directive’ (82/501/EEC) and ‘Seveso II Directive’ (96/82/EC), which was adopted in Italy through a national act (Basso et al., 2004). The directive highlighted the need for SMS to prevent workplace accidents in the chemical and petrochemical industry (Mitchison and Papadakis, 1999; Kuusisto, 2000; Kirchsteiger, 2002; Basso et al., 2004). SMS is required under the directive due to the large proportion of accidents reported in the European Commission’s Major Accident Reporting System (MARS) since 1984 (Mitchison and Papadakis, 1999; Kirchsteiger, 2002). The Major Accident Reporting System (MARS) was established in 1982 to handle information about major accidents submitted by Member States of the European Union to the European Commission in accordance with the provisions of the 'Seveso Directive' (82/501/EEC) (Drogaris, 1993). Finally, the ‘framework’ Directive 89/391/EEC (1989), which presents the basic requirements for a company’s safety policy, can also be considered as a tool to be used in the development of a company’s SMS.
The regulatory requirement for SMS in the UK originated with the Cullen Report. The report was written in response to the Piper Alpha tragedy, which claimed the lives of 167 people in the North Sea in 1988 (Fitts, 1996). The safety regulations were revised regularly to cope with the rapid growth of the industry’s complexity and diversity, to meet the challenge of risks and hazards posed by new technological methods and to fit with current business practice (Eves, 1993; Raglan, 2003). The increasing pace of technological and social progress is becoming a major organisational problem in industrialised countries (Eisner, 1995), thus drawing up new regulations is essential.

In the UK, starting with the Robens Report in 1972, the previous regulation was replaced with a broad framework for safety through the Health and Safety at Work Act 1974 (HSWA). HSWA has remained the main primary legislation on safety in the UK to this day (James and Walter, 1999). However, the supporting regulation was revised and the ‘Six Pack’ has become one of the main sets of regulations to achieve a safe working environment. The ‘Six Pack’ came into force on 1 January 1993 to implement European Community directives designed to improve general levels of health and safety across the European Community (Eves, 1993). Under the ‘Six Pack’, the Management of Health and Safety at Work Regulations 1999 was developed. The Management Regulations focus on the key components of managing safety (Eves, 1993). The UK has a long and unique history in the development and administration of safety regulations, and many countries that have been colonies of the UK have been greatly influenced by UK safety regulations (Raglan, 2003).

The regulatory requirement of SMS is also important in other developed countries. For instance, the Occupational Safety and Health Act 1970 (OSHA) was created in the USA to help ensure safe and healthy working conditions (Walters, 2002). In Norway, under the Internal Control Regulation, the employer is responsible for the company’s safety activities. The Internal Control Regulation on safety management came into force in Norway in 1992 (Torp and Moen, 2006). Each company must adjust its SMS to its needs and special risk factors. The Regulation also emphasizes that both employers and workers should participate in constructing the safety routines and applying the safety activities (Torp and Moen, 2006).
According to Chew (1988), safety in developing countries remains distressingly poor (Chew, 1988). However, these days, safety management is considered to be a well-known approach to accident prevention. For example, Yu and Hunt (2004), reviewing the approach to SMS in Hong Kong, state that the Occupational Safety and Health Council (OSHC) of Hong Kong initiated an independent safety audit scheme in 1999, which has established a recipe of basic safety management issues to be audited in major enterprises. In November 1999, the Factories and Industrial Undertaking (Safety Management) Regulation was enacted in Hong Kong. The Regulation outlines the requirements for proprietors employing a workforce of over 100 people or undertaking a project worth over HK$100 million to develop and implement SMS in their organisations.

In Malaysia, SMS is quite a new approach, and came into being through the enactment of OSHA in 1994. Details of Malaysia’s safety background will be discussed in Chapter 3.

Regulatory requirements show that the government of every country takes safety seriously. A primary rationale for regulation is that government intervention is necessary to ensure that individual companies take into account the full social cost of their actions (Guasch and Hahn, 1999). Regulations aim to provide specific and constructive advice to employers. Detailed and elaborate clauses, setting minimal standards for safeguarding against particular hazards, are specified in the regulations. However, regulations alone do not and cannot ensure safety in the workplace (Walters, 2002).

Regulations as a means to control safety were proven to be effective in the mid 1980s (Raglan, 2003). As employers were concentrating on the development and management of their business, the safety agenda became less of a concern. Violation of safety rules is common, due to the relationship between internal and external rules and the role of human resources in socio-technical systems (Battmann and Klumb, 1993). As a result, safety relies very heavily on the enforcement actions of government agencies, and therefore the fear of prosecution has become an incentive to comply with safety regulations (Raglan, 2003).

Apart from violation, another important issue arose when the government introduced self-regulation of SMS. Dawson et al. (1983) define self-regulation as “the involvement of management and workers and their representatives in the conscious development of
strategies aimed at controlling the particular hazards which characterise any selected
work site”. Raglan (2003) defines self-regulation as “the active involvement of the
employers and employees, with minimum government intervention, to look after the
safety and health matters in their own workplaces by implementing a SMS in order to
identify hazards, to work out preventive measures and to implement controls”.

According to Dawson et al. (1983), the doctrine of self-regulation brought out by Robens
emphasises the importance of the involvement of both employers and employees in
solving safety problems. Gehrig and Jost (1995) further elaborate that the mechanism of
self-regulation consists of self-monitoring and self-enforcement. Under self-regulation, it
is up to the individual employers to decide how to meet the safety requirements (Dawson
et al., 1983).

An essential feature of self-regulation is that it will manifest differently in different
contexts. For instance, what is appropriate for a high-risk site employing large numbers of
people will be different from that for a smaller site with operations of intrinsically lower
risk. In other words, the implementation of SMS should interact with its surroundings.
Apart from that, SMS should be designed to fit the society, industry and culture (Raglan,
2003).

Dawson et al. (1988), state that: “self-regulation on safety has clear limits. Without it
being externally forced on them, people will often not take matters of safety seriously
until they come into direct contact with severe injury or death.” Furthermore, the
rigidity of the legal system can no longer catch up with the advancement of current
modern technology. Compliance with regulations is no longer enough to ensure the
safety of workers (Raglan, 2003). A new system of flexibility and feasibility, capable of
involving the active participation of duty holders, is therefore required.

2.1.2 Elements of SMS

SMS is a management system that is based on safety criteria standards and performance.
It aims to provide continual improvement in the prevention of workplace incidents via the
effective management of hazards associated with the business of an organisation. Burrage
(1995) describes SMS as “the measures, procedures, and controls applied to working
activities to minimise risks and maximise safety”. It is not static and must be capable of changing according to the business of the organisation and legislative requirements.

A variety of SMS standards, guidelines, models and frameworks have been developed and disseminated over the past 20 years. Several national and international initiatives over the past few years have aimed at developing guidelines for SMS in various domains, for example the British Standard Institute (BSI) (1999) and the International Labour Organisation (ILO) (2001). The following is an overview of selected standards, guidelines, models and frameworks of SMS.

![Figure 2.1: Successful Health and Safety Management (HSG65)](image)

Figure 2.1 is an SMS model known as ‘Successful Health and Safety Management (HSG65)’. It was first prepared by the UK Health and Safety Executive (HSE) - Accident Prevention Advisory Unit (APAU) in 1991 as a practical guide for directors, managers, health and safety professionals and employee representatives. Organisations need to manage health and safety with the same degree of expertise and to the same standards as their other core business activities. The aim of HSG65 is to provide a main framework
that best describes the process of health and safety management (HSE, 1997). According to the framework, a successful safety and health management system should include the following five key principles: (1) Policy; (2) Organising; (3) Planning and Implementing; (4) Measuring Performance; and (5) Auditing and Reviewing Performance.

Although the HSG65 is a useful guide to the suggested content of each element of a health and safety management system, due to the increased obligations imposed by the Management of Health and Safety at Work Regulation (MHSWR), many organisations wanted to follow a structured, auditable approach. As a result, the British Standard Institute (BSI) published the BS8800: 1996, ‘A Guide to Occupational Health and Safety Management Systems (OHSMS)’. The guide has recently been revised to produce the BS8800: 2004, which is a relatively short standard based mainly on the HSE’s model, providing guidance on how to develop a management system. The standard also shows how a health and safety management system can be integrated into an existing management system and contains information on how to evolve and maintain systems in response to internal and external influences. The main objective of BS8800 is to help organisations to develop a systematic SMS by applying the following five key essential management principles: (1) Policy; (2) Planning; (3) Implementing; (4) Measuring Performance; and (5) Management Review.

The following model (Figure 2.2) was introduced by the National Safety Council (NSC 1994) of the United States. This model, the Continuous Improvement Model on Safety Management Systems, consists of five phases: a) Management commitment and involvement; b) Establish a baseline; c) Set goals; d) Implement strategies; and e) Review and adjust.
A very basic model (Figure 2.3) was developed by the British Standard Institute (BSI) in 1999. The steps are: a) The occupational safety policy; b) Planning; c) Implementation and operation; d) Checking and corrective action; and e) Management review.

Another model (Figure 2.4) was developed by the International Labour Organisation (ILO) in 2001. It represents both the steps for creating an SMS and methods for organising and implementing the safety activities in practice. The main development
steps are: a) Preparation of safety policy; b) Organising, planning and implementing safety activities; c) Monitoring the performance; and d) Review and auditing.

Figure 2.4: Main Elements of the Safety Management Systems (ILO, 2001)

Figure 2.5: Occupational Safety and Health Management Systems (AS/NZS 4804, 2001)
The Australian/New Zealand Standard 4804 (AS/NZS 4804) of Occupational Safety and Health Management Systems (Figure 2.5) suggests another safety and health management system, which includes the following five key principles: (1) Commitment and Policy; (2) Planning; (3) Implementation; (4) Measurement and Evaluation; and (5) Review and Improvement.

Although the SMS models presented above seem to differ in certain aspects, such as the terms used, these different guidelines often have many similarities in substance (Mitchison and Papadakis, 1999). From the general point of view, all models have more or less the same following basic activities: policy; planning, organising and implementation; monitoring; and review and audit (Raglan, 2003).

A safety policy is the management’s expression of the decisions to be followed in the organisation (Kuusisto, 2000). Every employer should set out a safety policy in writing. The policy should be appropriate to the nature of the organisation. The policy should be concise, clearly written, dated and signed or endorsed by the employer, should include long-term and permanent objectives and indicate the key responsibilities and practical arrangements. An organisation’s safety policy sets the scene from the top regarding the board’s beliefs, intentions, priorities and requirements of managers and the workforce (Waring, 1996; ILO, 2001).

The policy should be communicated and readily accessible to employees. This can be done through planning, organising and implementation. Planning means the determination of the safety objectives and priorities and the preparation of the working programme to achieve the goals (Kuusisto, 2000). Organising means that clear tasks and responsibilities are determined at all hierarchical levels, from top management to every employee (Kuusisto, 2000). At this stage, coordination will be required from other people in the organisation. Implementation is about ensuring that risks are adequately controlled (Waring, 1996). According to the Health and Safety Executive (1998), managers need the commitment and participation of staff; staffs need to be competent; responsibilities must be clearly allocated; and staff should be consulted and involved in solving problems.

To be successful with implementation, appropriate and adequate monitoring of progress and outcomes is needed (Waring, 1996). Monitoring includes active monitoring (before
things go wrong), which establishes that procedures are in place and are working, and reactive monitoring (after things go wrong), which involves learning from mistakes (HSE, 1998).

The safety audit is the structured process of collecting independent information on the efficiency, effectiveness and reliability of SMS, and drawing up plans for corrective action (HSE, 1998). A safety audit and a periodic review are necessary for the final stage of SMS implementation. The safety review is a process concerned with making judgements about the efficiency of safety performance and decision making on the nature and timing of the actions necessary to treat insufficiency (Lindsay, 1992). This is to ensure that the SMS is designed and implemented so it can deliver safety to the required standard.

SMS is a management system based on safety criteria standards and performance. It aims to provide continual improvement in the prevention of workplace incidents via the effective management of hazards associated with the business of an organisation. It is not static and must be capable of changing according to the business of the organisation and as a result of legislative requirements. Fitts (1996) states that SMS has the “purpose to provide a description of the systems or methods by which an organisation will provide a safe and healthy working environment where the risk of harm to people, property, and the environment has been reduced to a level as low as reasonably practicable”. Fitts (1996) recommends that to implement SMS, the people that work within the system should set and maintain the safety standards of a company.

However, proper implementation of SMS is hard to achieve. The existence of SMS on paper is not necessarily how it exists in reality (Kennedy and Kirwan, 1998). Even though various models and elements have been developed, the underlying problem of SMS is the fallacy that it only describes the system and defines the standards without proper implementation (Fitts, 1996). According to ‘Successful Health and Safety Management’, produced by the Health and Safety Executive (1997), organisations fail for a number of reasons, either because of the policy, the organising, the planning and implementing of the policy, measuring its performance, auditing or reviewing its performance.
2.2 Contractors’ Safety

2.2.1 Contractors in Processing Plants

According to the European Construction Institute (1995), construction is the carrying out of any building, civil engineering or engineering construction works. A contractor is anyone that a client gets in to work for them who are not an employee. A contractor may be involved in any of the construction works – maintenance, repairs, installation, construction, demolition and many other jobs – which may be routine in any company (HSE, 1997). Contractors include subcontractors and may also be known as works, specialist, trade or nominated contractors (European Construction Institute, 1995). Contractors perform construction work in various workplaces, including processing plants. Contractors performing work in processing plants may also perform construction work outside processing plants (Robson, 1997).

Contractors perform regular maintenance procedures, repairs, construction and renovation in processing plants (Dole, 1990). The need to use the service of contractors is more crucial during shutdown (also known as ‘turnaround’) maintenance. In terms of shutdown maintenance, Lenahan (2006) describes contractors as “construction companies that specialise in performing some or all of the activities involved during shutdown maintenance”.

Shutdown maintenance is periodic and involves the shutdown of a plant to allow for inspections, repairs, replacements and overhauls that can be carried out only when the plant facilities are taken out of service (Duffuaa et al., 1999; Lenahan, 2006). The primary purpose of shutdown maintenance is to prevent the failure of plant function, which can threaten productivity and safety (Hale et al., 1998). Shutdown maintenance is needed to protect the reliability of the plant (Lenahan, 2006). Shutdown maintenance is normally associated with minor modifications to plants, but sometimes it involves major work. Some examples of types of work performed during shutdown maintenance are: work on equipment which cannot be done unless the whole plant is shut down; maintenance which can be done while equipment is in operation but requires a lengthy period of work and a large number of personnel; defects that are pointed out during operation but cannot be
repaired are maintained during the shutdown period (Hale et al., 1998; Dufuua et al., 1999; Dufuua and Daya, 2004; Lenahan, 2006).

A processing plant is a huge and complex workplace (Bahrin et al., 2004). Thus the use of contractors during shutdown maintenance in a processing plant is necessary to cope with engineering problems (Mueller et al., 1996). Contractors play a significant role during shutdown maintenance due to the amount of work to be accomplished in a short period of time (Duffuaa and Daya, 2004). Other reasons for using contractors include: experience and professionalism; some contractors are specialized in certain areas; and productivity, cost and efficiency (Duffuaa and Daya, 2004; Lenahan, 2006).

The growing complexity of the process industry has a great potential for serious accidents to happen in processing plants (Knegtering, 2002; Sanders, 2004; Bahrin et al., 2004). Many new technologies and the materials used in processing plants are potentially more dangerous than those of the past (APA U, 1983). For instance, many feedstock, intermediate products and finished products are flammable and involve large quantities. Some of the process operations involve high temperature and pressure; hence fires and explosions are always possible hazards. Other potential hazards associated with the industry arise from the handling and storage of toxic and corrosive chemicals (Huat, 1997). Research by Uth (1999) revealed that chemical reactions in processing plants occur mainly during shutdown maintenance, which is often carried out by contractors, who often lack experience and have insufficient knowledge of the specific conditions in the processing plant.

Accidents in processing plants are rare but serious events (Mitchison and Papadakis, 1999; Knegtering, 2002), because they involve fatalities and major injuries. However, minor accidents and near misses happen more frequently (Wilson and McCutcheon, 2003). Near-miss accidents occur from 10 to over 100 times more frequently than actual accidents. Near misses are warning signs of bigger trouble to come (Smith, 1994).

A significant number of serious accidents have happened during shutdown maintenance (Hale et al., 1998). Fatalities and injuries are commonplace among contractors due to the heavy physical activities of construction work during shutdown maintenance and the presence of a large number of contract workers (Hale et al., 1998; Ahmadun et al., 2003;
Duffuua and Daya, 2004). Accidents involving contractors are often more than five times higher than those involving the processing plants own personnel (as cited in Hale et al., 1998; Malmen et al., 2009).

Apparently, contractors working in processing plants are always being neglected by the industry. In certain situations, it has been shown that contractors are less important to the clients in term of safety. For instance, the fatalities among contractors are not included in the safety statistics of the industry, but counted elsewhere (Dole, 1990; Kochan, 1994; Baugher and Roberts, 1999; Wilson and McCutcheon, 2003). According to Wilson and McCutcheon (2003), investigations of incidents involving contract workers are often not carried out. They are regarded as being of lesser importance than the processing plants own personnel. The contractors are sometimes told by the client not to report small incidents for fear of investigation. This practice allows processing plants to keep accident rates down, as explained by Baugher and Roberts (1999).

In terms of academic research, much work has been done to investigate the causes of accidents in processing plants. However, little research has been conducted to investigate contractors’ safety problems in processing plants (Dole, 1990). The study by Drogarisis (1993), for instance, does not mention the underlying factors of the issues related to contractors. Drogarisi (1993), reviewing the MARS (Major Accident Reporting System established by the Commission of the European Communities within the framework of the Implementation of the Council Directive 82/501/EEC on the Major Accident Hazards of Certain Industrial Activities – known as SEVESO) accident report system, has elaborated on the causes of accidents in the most hazardous workplaces, including processing plants. He found that a significant proportion of accidents occur during shutdown maintenance due to high hazard potential and the use of contractors.

Khan and Abassi (1999) studied the underlying causes of various major accidents in high-hazard plants including processing plants, concentrating on technical errors. They concluded that most accidents are due to the malfunctioning of a component of equipment and the negligence of personnel during both normal and maintenance operations. They do not, however, mention in detail the contractors’ involvement in the accidents.
Uth (1999) found that the occurrence of human failure is greater compared to technical failure. The involvement of human failure is normal during maintenance operations, especially involving external companies. However, the study by Uth (1999) does not explain the factors underlying human failure.

In the context of Malaysia, there has been little or no empirical research into contractors working in processing plants. The studies by Ahmadun et al. (2003) and Shaluf et al. (2003), reviewing an explosion incident at a Malaysian petrochemical plant, do not reveal any fault on the part of the contractors. Their findings reveal the following factors that act as triggers to the accident: technical, operational and organisational errors; the management failed to recognise the warnings; the incident could have been avoided with management involvement and commitment toward safety; insufficient well-trained managers at all levels. This situation, therefore, emphasises the relevance of contractors working in processing plants, which is the context of this research.

### 2.2.2 Safety Responsibility of Contractors

In the context of the construction industry, the safety responsibility lies with various parties, especially the people who create the risks: employers, owners and occupiers of buildings, manufacturers, designers and employees (Hamilton, 1977; James and Walter, 1999). The Construction (Design and Management) Regulation (CDM), which was enacted in 1994 in the UK, is a good example of a regulation that states who the key parties are in construction projects, including the client, professional advisors, designers, the principal contractors and subcontractors or self-employed persons. Each of these parties has a defined set of statutory duties for ensuring that safety risks are managed during the life of the project. This section will discuss two parties: the client (also known as the employer, developer, promoter or owner) and the contractor (main contractors, subcontractors and general construction workers).

The client is the party who is accountable for the commencement of construction projects. They are responsible for financing the projects. Clients initiate and pay for construction work. They hire designers and sometimes construction managers, and they draw up construction contracts with contractors for their work. They hire designers to design the work and to see that it is performed according to the contract drawings and specifications.
Often an owner’s only significant responsibility, after they have provided access to the site and certain information to the contractor, is to pay the contractor on presentation of the designer’s certificates (Herns and Bryant, 1984).

The vast majority of construction is done under contractual arrangements between clients and contractors. A client may select a contractor based on past performance or through an agent such as an architect or engineer. In other cases, the client may decide to offer the project through advertising and tendering. The methods used and the client’s own attitude to safety can have a profound effect on the project’s safety performance (Herns and Bryant, 1984).

For example, if a client chooses to ‘pre-qualify’ contractors to ensure that they meet certain criteria, this process excludes inexperienced contractors, those who may not have had satisfactory performance and those without the qualified personnel required for the project. While safety performance has not previously been one of the common qualifications sought or considered by clients, it is gaining in usage, primarily with large industrial clients and with government agencies that purchase construction services.

Clients are liable to provide a safe construction environment free from hazard (Leopold and Leonard, 1987). Some clients promote safety much more than others. In some cases, this is due to the risk of damage to the existing facilities when contractors are brought in to perform maintenance or expansion work. Petrochemical companies in particular make it clear that contractors’ safety performance is a key condition of the contract (Erickson, 1997).

Clients, as the owners, have the legal responsibility of duty of care upon all parties involved in construction. This is what is required in many safety regulations, for instance in the UK, under the Health and Safety at Work Act 1974 (HSWA), the primary responsibility for ensuring safety in the workplace lies with those who create the risks (Eves, 1993).

Clients need to assess the risks associated with their work activity so that the necessary preventive and protective measures can be identified and put in place. They also need to make arrangements to cover safety, for example effective planning, organisation, control,
monitoring and review; provide safety surveillance where necessary; appoint competent people (from inside or outside the organisation) to help devise the measures that need to be taken; set up emergency procedures; and provide employees with safety information and training (Eves, 1993).

Contractors, on the other hand, bear the ultimate responsibility for their safety on site. Contractors have a three-part safety responsibility, which requires planning, estimating and administering adequate safe and economical methods of construction. Contractors should allocate a sum of money for accident prevention. The person in charge of safety then has the responsibility for providing an adequate safety programme within this budget. Part of the responsibility is assigned to each subcontractor. In each of these contracts there will usually appear a clause wherein the party doing the work has care, custody and control. Thus it is important for the person in charge of safety to establish who has control of the actual work being performed.

As employers, contractors have a responsibility to workers, which is required by the law. For instance, in the UK, the Management of Health and Safety at work Regulations 1992 (MHSWR) state that: “each employer has the duty to co-operate with other employers, so far as is necessary, to enable them to comply with the relevant statutory provisions” (Grayham and Rosario, 1997). Wilson and Koehn (2000) state that contractors may have the responsibility of safety to its own workers and also to subcontractors’ workers. However, contractors may not be competent enough to manage the safety of all subcontractors on the jobsite. Thus contractors often leave the safety responsibility to the individual subcontractor and may never take an active part in ensuring that the subcontractor is actually exercising all measures necessary to provide a safe working environment.

In the UK, under CDM Regulations, contractors are no longer left with sole responsibility for safety during construction work (Baxendale and Jones, 2000). Clients have a legal and moral responsibility for contractors’ safety (Smallwood, 1998). The client is responsible for the working environment within which the contractors work (Baxendale and Jones, 2000; Yule and Mearns, 2004). For example, under CDM Regulations, clients must appoint a safety coordinator to ensure coordination amongst employers (Grayham and Rosario, 1997; Shabha and Rudge, 1997; Baxendale and Jones, 2000). If a contractor and
the workers are at work in a client’s premises, both parties have safety obligations towards each other (Grayham and Rosario, 1997). Where two or more employers share a workplace, premises or site, even on a temporary basis, they have a duty to co-operate and share safety information (Grayham and Rosario, 1997). Grayham and Rosario (1997) use an example of painting and decorating contractors. They may use paints in places where fumes could cause headaches or sickness to the client’s employees; on the other hand, the client’s employees may use overhead machinery (such as for carrying objects) which pass through the area where the contractor’s worker may be working.

Conversely, Kochan et al. (1994) contend that there is an overriding issue for the contractor’s worker. Clients are advised by their legal counsel to refrain from supervising, training or determining the terms and conditions of employment of contractors’ workers. This can protect clients from liability for the workers’ compensation premiums and other fringe benefits of contract workers. This can also protect the client from third-party liability claims. However, this increases the risk of injuries to contractors’ workers.

It is indisputable that safety liability is the responsibility of the employer. However, in the case of contractors, safety becomes tougher to manage due to the complexity of the construction environment. According to Tyldesley (2008), there is a complication with the safety responsibility of contractors: either they are responsible under safety legislation or under civil law. Tyldesley (2008) affirms that the legal duties of contractors under safety legislation are unclear. He further states that following an incident, unclear responsibilities lead to arguments.

Tyldesley (2008) uses the example of two European directives, 99/92/EC and 94/9/EC, which aim to create a linked framework of law covering workplaces handling flammable gases, liquids and dusts and those who supply specialised equipment to such workplaces, but which have left those who design, assemble, install or modify processing plants for others to run unsure about what their responsibilities are.

Contractors will normally take the easiest way; that is to adopt and implement SMS only to fulfil the clients’ requirements or compliance with safety regulations (Yu and Hunt, 2002). Many researchers state that contractors are too dependent on the safety requirements of clients (Baxendale and Jones, 2000). This situation has created a lack of
safety responsibility by contractors, which has then led to problems with implementing SMS.

2.2.3 Factors Affecting Contractors’ Safety

In recent years, safety performance has become a more recognised issue in the construction industry for a variety of reasons. One of the reasons is the hazardous work environment, which may have a significant impact on the schedule and budget performance. Construction projects offer a flexible working environment. Construction involves the interaction of humans in complex activities, aligning individual objectives into one process, which is always difficult in practice, especially for large projects. Projects are complex in nature, as they involve technical, procedural, organisational and human elements in an integrated manner (Ruuska and Vartiainen, 2003). This complexity clearly demands SMS, as the efficiency and effectiveness of an accident prevention mechanism is vital.

Past studies have discovered that effective implementation of SMS on construction sites can help to prevent accidents (Baxendale and Jones, 2000; Wilson and Koehn, 2000; Tam et al., 2001; Hinze and Gambatese, 2003). Schaechtel (1997) suggests that the use of SMS can save a manager’s time, which can be used to deal with other job priorities such as customers, cost, productivity and schedules. Choi (2002), reviewing industrial safety in South Korea, states that the use of safety management to educate industries in South Korea caused the number of injuries to drop to 0.99 percent in 1995. However, due to the economic crisis, the government has cut expenditure on safety management, therefore the numbers of injuries rose to 2.3 percent in 1999. Smith (2004) suggests that companies could achieve “World Class Safety” through the proper use of SMS.

However, effective SMS implementation is hard to achieve in the construction industry (Kartam et al., 2000; Lee, 2001; Tam et al., 2004). The construction industry is one of the most dangerous industries worldwide (Tam, 2003; Hoonaker, 2005). The nature of the construction industry poses challenges to effective SMS. Safety statistics consistently reveal that accidents involving construction plant and equipment are responsible for a significant proportion of serious and fatal injuries on site (Edwards and Nicholas, 2002).
In processing plants, contractors’ safety is always a major issue worldwide due to poor SMS (Dole, 1990; Craft, 1991; Kong, 2001; Jannadi and Bu-Khamsin, 2002). The construction environment in processing plants is much tougher, where the possibility of fire, explosions and toxic emissions is frequent, potentially killing a large number of people, including clients’ employees, processing plant contractors and the population, as well as causing catastrophic damage to the environment (Huat, 1997; Fernandez-Muniz et al., 2007). Therefore, contractors working in processing plants encounter bigger challenges when compared to contractors working in other type of worksite. Contractors’ safety is much more challenging during shutdown maintenance, where time and work demands are intensified (Baugher and Roberts, 1999).

Many researchers have already attempted to find the underlying factors impeding safety development and the difficulties commonly encountered by contractors. It appears that contractors’ SMS is influenced by regulatory compliance (Fitts, 1996; Hale et al., 1997; Abudayyeh et al., 2006), the client’s requirements (Fitts, 1996; Smallwood, 1998; Abraham et al., 2004; Yu and Hunt, 2004; Teo and Ling, 2006; Abudayyeh, 2006) and industry pressure (Fitts, 1996).

Research by Gun (1993) revealed that regulatory compliance is significant in reducing injury. However, without the effort from employers, compliance with regulations cannot be achieved. On the other hand, Abudayyeh (2006) comments that safety should not only be viewed as compliance with regulations, but must also become a value and culture with clear commitment from all levels of management.

One critical factor that influences contractors’ safety is the client (Smallwood, 1998; Yule and Mearns, 2004; Abraham et al., 2004; Kashiwagi and Savicky, 2004). According to Abraham et al., (2004), there are three areas in which the client can influence contractors’ safety: the selection of safe contractors; a carefully drafted contract document; and active involvement in safety during construction. A study by Holt et al. (1994) revealed that safety emerged as the most importance organisational variable in the contractors’ selection process. These requirements should lead contractors to have better safety. However, other research (Fitts, 1996; Smallwood, 1998; Yule and Mearns, 2004; Abraham et al., 2004) states that contractors adopt SMS just for the sake of the tender
requirements and to satisfy the clients during the bidding process. Hence safety implementation is still lacking (Fitts, 1996).

Another factor that influences contractors’ SMS is industry pressure. Industry pressure normally occurs due to a highly competitive tendering system (Kartam et al., 2000; Lee 2001; Raglan, 2003). Raglan (2003) explains that one criterion during screening and selecting contractors is safety performance. Raglan (2003) further explains that the tender price usually includes the cost of material, labour and administration. Tender prices are kept confidential until the bidding process ends. In general, it is common that clients award the project to the lowest bidder, however negotiation with the second and third lowest bidder can be done if they agree to cut the tender price. This tendering process has the advantage to clients of keeping the cost to a minimum. Contractors are hardly likely to reduce their overheads to cut their operating cost; therefore, to win the tender, most contractors will neglect the safety budget. As competition is very intense and the budget is tight, it is not surprising that very little consideration is given to safety control measures.

There are several underlying causes which lead contractors to practise SMS just for the sake of regulatory compliance, the clients’ requirements and industry pressure. Construction firms are normally small (Raglan, 2003). It is usually in these small construction companies that accidents occur. According to Raglan (2003), the majority of small contractors do not know much about the existing legislation and are not enthusiastic about having access to safety advice. In addition, small contractors have a lack of resources to keep themselves abreast of the updated legislation and relevant technological developments. Raglan (2003) further states that small contractors remain in their own narrow world, where the flow of safety is rare. Because of this, safety performance is not as desirable as in other establishments. One common problem with small firms is the shortage of finance. Thus contractors are reluctant to put resources into safety (Tam et al., 2004), because safety programmes incur an expense (Wilson and Koehn, 2000).

Problems associated with temporary workers and a high turnover of workers is common in the construction industry (Kartam et al., 2000; Lee 2001; Abraham et al, 2004). Contractors working in processing plants during shutdown maintenance need to hire
contract workers because it is a short-term project, normally lasting between one and three weeks. The demand for workers during shutdown maintenance is high (Hale et al., 1998; Ahmadun et al., 2003; Duffuaa and Daya, 2004). During shutdown maintenance, contract workers account for 54% of the work hours in a typical plant (Kochan et al., 1992). In addition, contract workers offer flexibility. Since the project is not permanent, the contract workers will come and go on a short-term basis (Kochan et al., 1992).

Conversely, contract workers lead to alienation problems where they are unfamiliar with the working environment. This may increase the chance of worker injuries (Hinze and Raboud, 1988). According to Abraham et al. (2004), the characteristics of the work environment have proved to be the most frequent causes of accidents. A constantly changing and poor working environment has also contributed to workplace accidents (Lee, 2001). Contractors are also reluctant to send contract workers for safety training (Kochan, 1994; Tam et al., 2004). In addition, contract workers normally work long hours, normally up to 12 to 18 hours per day for three weeks or more. These turnaround times cause high levels of stress and therefore unsafe practices multiply. Kochan et al. (1994) confirm that accidents are due to work being contracted out to inexperienced, poorly trained and poorly paid workers, and to most of the risky work being done during shutdown maintenance. Kletz (1998) states that accidents are not usually caused by a single failure or mistake. He further lists some underlying causes of accidents during shutdown maintenance: a poor understanding of the hazards; a lack of understanding of the detail of the construction of mechanical equipment or the way it works; a lack of explanation during handing over the work permit from the processing plant employee to the contractors’ worker; and poor practice, e.g. rushing into action (Kletz, 1998).

Burrage (1995) examines the lessons to be learned from various disasters. The root causes of these disasters are: organisational failure; inadequacies in management; lack of maintenance; communication failures; shortfalls in design; and inadequacies in safety culture. In detail, the author discusses the following key areas which typically contribute to disaster: external influences; changes over time; organisational issues; and human response.

Another SMS difficulty is that contractors will normally prioritise performance over safety. As stated above, the duration of shutdown maintenance is normally between one
and three weeks. Thus contractors have a tight schedule, as the clients will expect the contractors to finish the work within a specified period. Hence contractors will give consideration to safety only after they meet the scheduled deadlines (Tam et al., 2001).

Multiple contracts are common in the construction industry. A majority of firms work with subcontractors, which apart from the supply of labour also includes the whole project (Raglan, 2003). Multiple contracts can easily lead to problems of safety responsibility (Raglan, 2003) when different main contractors and subcontractors are responsible for different sections of the plant (Tyldesley, 2008). Tyldesley (2008) further states that subcontracting brings different complications. Subcontractors are normally familiar with the construction industry, but processing plants have safety issues that need a sophisticated approach to resolve. In addition, the subcontractors’ problem with SMS implementation is satisfying the main contractors and the regulations (Wilson and Koehn, 2000).

One important criterion to ensure SMS effectiveness is organising. Organising is one of the issues that must be addressed by SMS (Basso et al., 2004). It should be the basic function of SMS. According to McDonald (2000), organising is “the management activity to ensure the provision of resources in the areas of methods/documentation, personnel, parts and facilities, in order to carry out the organisation's functions”. Organising involves establishing the structure and delineating roles, responsibilities, authority and accountability to accomplish the objectives (Santos-Reyes and Beard, 2002). This should lead organisations to establish, operate and maintain structures and systems which aim to ensure control, encourage co-operation of employees and safety representatives, ensure effective communication and encourage competence. This is helped by the creation of a safety culture that ensures the motivation, involvement and participation of people at all levels (Santos-Reyes and Beard, 2002).

Assigning responsibilities is a fundamental component of a SMS. If something must be done, someone must be assigned the responsibility to ensure that it gets done (Fitts, 1996). This is also an excellent way to involve more people in the safety programme.

Fitts (1996) comments that the purpose of SMS is to provide a description of the systems or methods by which an organisation will provide a safe working environment, where the
risk of harm to people, property and the environment has been reduced to a level as low as reasonably practicable. SMS defines the safety expectations of management and sets the minimum safety standards for the organisation. However, SMS only describes the system and defines the standards; it sets nothing because people that work within the system set and maintain the safety standard of a company.

Research by Attwood et al. (2006) confirms that the organisation has a significant influence over the accident frequency process, where safety culture is the most important organisational factor. Atwood et al. (2006) further state that organisations heavily influence accident frequency in the workplaces they govern. They would be well advised to concentrate their efforts in establishing a safety culture that encourages excellent safety-related behaviour.

Organisational factors can influence the status of an organisation’s internal safety status, and should be the focal area for further efforts to improve safety and to prevent accidents (Rundmo et al., 1998). These factors may also have a direct effect on risk behaviour and the probability of accidents (Rundmo et al., 1998).

The most important factor contributing to the organisation of process is management commitment. Many studies have shown that management commitment and involvement is the core element of any SMS. A study by Gun (1993) confirms that good management practices are likely to prevent injuries. Jannadi and Bu-Khamsin (2002) state that management involvement has an extremely important influence on safety performance. Hinze and Raboud (1988) state that it is important for safety to be addressed at a variety of managerial levels, and it should start from top management. Aksorn and Hadikusumo (2007) reveal that management support is the most influential factor for safety programme implementation in the Thai construction industry.

However, safety is not the only concern in an industrial environment. Customers, schedules, mechanical problems and other obstacles can get in the way of performing safety activities. As a result, safety is being ignored by management. This can increase the chances of an accident (Schaechtel, 1997).
2.3 Approaches to Effective SMS Implementation

Traditionally, approaches to SMS have emphasised the performance failures that immediately precede an accident (Hansen, 1993; Mansour, 1995). In a traditional approach, safety programmes are isolated from the mainstream of the organisation and are administered by staff managers who lack the authority and organisational positioning to effect a change (Hansen, 1993). Some critical elements of effective safety programmes have been identified as: a comprehensive safety policy; a supportive upper management attitude; informal and formal meetings with the field safety representatives, supervisors and workers; jobsite safety inspections; safety training; increased budget allocation to safety awards; safety committees; safety inductions; safety related promotions; and conducting after-the-fact accident investigation (Hansen, 1993; Rahimi, 1995).

There are a few records of the study and identification of the appropriate traditional approaches to SMS. It is evident from the literature that the traditional approach to SMS is still persistent (Veltri, 1991; Hansen, 1993). Many safety professionals adhere to the traditional approach (Rahimi, 1995; Herrero et al., 2002). Previous studies (Jaselski et al., 1996; Tam and Fung, 1998; Poon et al., 2000; Goldenhar et al., 2001; Hinze and Gambatese, 2003) confirm that the traditional approach is still significant to improve safety implementation.

In the construction industry, several attempts have been made to escalate continuous improvement of SMS. Hinze and Harrison (1981), as cited in Tam and Fung (1998), state that formal safety training and safety awards are the most effective tools in educating site workers and mitigating site accidents. Hinze and Raboud (1988) advocate top management involvement to reduce site accidents. Tam and Fung (1998) confirm the effectiveness of the traditional approach in Hong Kong construction industries. Wilson and Koehn (2000) introduced a weekly safety meeting and a weekly safety inspection by different parties during their real experience in a small to medium size construction project in the north-western United States of America. Tam et al. (2001) introduced a supervision plan which aimed to change the safety attitude and culture among construction practitioners in Hong Kong. Walker and Tait (2004) suggested the intervention of intermediaries to small enterprises to improve the traditional approach of SMS.
The traditional approach, however, does not always improve the results of safety, because they are centred exclusively on the technical requirements and on obtaining short-term results (Weinstein, 1996). Another shortcoming of the traditional approach is that the programme is isolated and often not integrated with the other functions of an organisation (Hansen, 1993).

It is undeniable that effective SMS involves paying attention to human factors (Yule and Mearns, 2004). One approach which is now commonplace is the behaviour-based approach (Cox and Cox, 1996; Marsh et al., 1998; Cooper, 2000). Behaviour-based safety is people oriented and is often based upon one-to-one or group observations of employees performing routine work tasks, feedback on safety related behaviour, coaching and mentoring. Behavioural approaches to safety management are designed to improve workplace safety by promoting those behaviours deemed critical to safety and risk control and characteristically focus on changing employee behaviour rather than attitude (Cox et al., 2004). However, the behaviour-based approach appears to suggest that the implementation and sustainability of behavioural safety intervention has been variable and has lost momentum (Cox et al., 2004).

Another approach is the employee-management consensus approach (Fuller, 1999). Fuller’s research discusses a case study regarding the UK distribution division of an international oil company and how the approach was applied to safety issues affecting the division's tanker drivers. This approach involved the employee as a decision maker to identify safety initiatives to improve SMS implementation. This is because the employees’ awareness and understanding of safety issues is often more focused as they deal with and suffer from the consequences of operational risks on a daily basis. Management’s attention is often distracted from safety by other issues competing for their time, for instance production, costs, efficiency, quality and the environment, and thus gaining safety initiatives from the employees is much more accurate.

Other approaches to SMS have been introduced by several researchers. Smallman (1994) suggests a holistic approach in the UK offshore operation due to the lack of safety case regulations. A safety case regulation is a regulation that governs offshore safety in the UK (Smallman, 1994). According to Smallman (1994), safety case regulations have certain problems of technological bias, poor communication on the safety culture concept,
complication of quantitative risk assessment, lack of guidance and acceptance by the Health and Safety Executive. Change is needed to improve SMS implementation, thus organisational learning is essential for a holistic approach to be a success (Smallman, 1994).

Currently, many organisations favour integrating safety with other organisational activities (Mitchison and Papadakis, 1999; Cheng et al., 2004). For instance, chemical and petrochemical companies have adopted integrated health, safety and environment (HSE) management systems (Cacciabue et al., 1994, as cited in Mitchison and Papadakis, 1999). Some integrate safety with quality management (Krause, 1993; Rahimi, 1995; Mitchison and Papadakis, 1999; Pheng and Shiua, 2000; Shen and Walker, 2001, Yu and Hunt, 2002; Koehn and Datta, 2003; Yu and Hunt, 2004; Yu et al., 2004) and safety with project management (Cheng et al., 2004). An integration management approach has also been developed in the area of quality management and assurance (Amendola, 2001). This approach was initially adopted for projects which had large investment costs and very high reliability and safety targets. The integration approach reduces accident rates (Petersen, 1994) and improves the firm's productivity and economic and financial performance (Health and Safety Executive, 1997; Smallman and John, 2001; Rechenthin, 2004).

Although the approach to effective SMS is now a well-established discipline and an emerging trend in industry, its application is rather confined to large organisations and the construction industry in general. The integration approach is commonplace in large companies such as processing plant clients (e.g. BP, Texaco, Shell and Exxon Mobil). Hence the applicability of the integration approach to contractors can be questioned, as most construction companies consist of small and medium sized organisations. Furthermore, the integration approach, such as SMS-TQM, has been stretched in too many directions, thus it has failed to cure the problems of poor management or business strategy (Smallman, 1994). Managing safety using quality methods requires a new level of thinking in which employees are viewed as safety problem solvers (Smith, 1996).

Waring (1996) lists some reasons that the integration of safety can be difficult to achieve. One reason is that there can be confusion about the scope and practical requirements of these two systems. Secondly, safety is covered by a great deal of detailed legislation
requiring specific management and technical systems, and many of these management systems are mandatory. Contrary to this, some management systems, such as quality systems, are voluntary and not inspected by the authorities. Finally, there can be conflicting professional ambitions between the people managing these activities, causing control of integration to become a power struggle, which detracts from the actual aim.

Santos-Reyes and Beard (2008), on the other hand, contend that current approaches may not be sufficient to achieve effective SMS. They argue that SMS needs to be more systemic, which means that SMS should try to consider the organisation in its entirety (from top to bottom, the channels of communication, the people), including the environment. Santos-Reyes and Beard (2008) address the environmental factors in their study of an oil and gas organisation. With support from Santos-Reyes and Beard (2008), it is of interest to this study to examine the environmental factors of contractors working in processing plants that can affect their SMS implementation.

2.4 SMS Implementation and the Environment

Davies (2008) defines effective implementation as “something that is in operation or in use”. Davies (2008) defines the words ‘effective’ and ‘implementation’ according to dictionary definitions; ‘effective’ “as successful or achieving the results that we want” and ‘implementation’ as “to put a strategy or system into operation”.

Effective implementation is vital for any organisation. Implementation is about allocating resources and changing organisational structure. However, transforming strategies into action is a far more complex and difficult task. It is claimed that more than half of the strategies devised by organisations are never implemented (Mintzberg, 1994). Implementation often gets neglected for various reasons. Some important reasons are a lack of commitment from stakeholders, ignorance from top management, unclear tasks, ineffective communication, failure to understand progress, impatience and lack of reward (Freedman, 2003; Atkinson, 2006).

Smith and Mourier (2007) state that implementation will fail easily due to delegation without a detailed plan, without clearly defined accountabilities and with little or no follow-up. Aaltonen and Ikavaloko (2002) state that organisations seem to have difficulties
in strategy implementation due to weak management roles, lack of communication, lack of commitment to the strategy, unawareness or misunderstanding of the strategy, unaligned organisational systems and resources, poor coordination and sharing of responsibilities, inadequate capabilities, competing activities and uncontrollable environmental factors.

Freedman (2003) suggests that to achieve successful implementation, strategy needs to be well planned and communicated. Previous research (Atkinson, 2006; Freedman, 2003; Aaltonen and Ikavalko, 2002) confirms that the focal problem of strategy implementation is communication. Aaltonen and Ikavalko (2002) state that the components of successful implementation are communication, interpretation, adoption and action.

Another factor important for effective implementation is the behaviour of management and employees (Saad and Siha, 2000). Vrakking (1995) argues that the chances of successful implementation increase if employee participation is applied correctly and in a controlled manner. In addition, successful implementation involves various organisational tasks such as aligning the organisation, reducing complexity and installing an issue resolution system.

The implementation task has become tougher due to a period of accelerating diversity and change, for instance improvements in communication techniques, transportation, energy generation and consumption, economic growth and knowledge accumulation abound (Dessler, 1976). There are more complex organisational structures, which have increased the number of variables that need to be taken into account in organisational processes. The growing environmental turbulence creates many problems for organisations (Kast, 1970).

Working under schedule pressure and in a stressful environment has become a routine phenomenon at many construction sites, including working in processing plants. Construction, as a high-risk industry (Rechenthin, 2004), is becoming increasingly complex (Kast, 1970) and dynamic in its nature, and is shrouded in uncertainty and vagueness (Tah and Carr, 2000).
Uncertainty may be defined as a lack of information about future events, where alternatives and outcomes are unpredictable (Hickson et al., 1971). Uncertainty is a fundamental problem for complex organisations, and coping with it is one of the major responsibilities of its members (Buckley, 1967). The level of environmental uncertainty has become a major variable in contingency theories of organisational structure.

In the construction industry, the implementation task has become vulnerable due to the nature of the construction firm, which is an organic type of organisation. There are two types of organisation: mechanistic and organic (Stinchcombe, 1959; Burns and Stalker, 1961; Lawrence and Lorsch, 1967; Child, 1977). The mechanistic type of organisation suits relatively stable environments, and the organic type of organisation is best suited to unstable environments. According to Wilson (1989), the organic type of organisation creates difficulties for SMS. If the mechanistic type of organisation requires close supervision, rules and procedures, permanence of employment, exclusive decision-making roles and the use of discretion by employees, an organic type of organisation, on the other hand, requires the opposite organisational capabilities. The organic type of organisation must cope with less reliance on rules and procedures, depend on temporary employment, greater decision-making roles and the use of discretion at workforce and lower management levels, few training facilities and so on. Wilson (1989) argues that current accident prevention is most suited to the mechanistic type of organisation and is difficult and sometimes impossible to operate in the organic type of organisation.

Due to Wilson’s (1989) argument, this study intends to explore SMS implementation according to the contingency theory. Contingency theory is a class of behaviour theory that claims that there is no best way to organise a corporation, to lead a company or to make decisions. An organisational style that is effective in some situations may be not successful in other situations. In other words, the optimal organisation style depends upon various internal and external constraints (factors). Some examples of such constraints include: the size of the organisation; how the firms adapts itself to its environment; differences among resources and operations activities; assumptions of managers about employees; strategies; and the technologies being used (Waterhouse and Tiessen, 1978; Rayburn and Rayburn, 1991).
Rayburn and Rayburn (1991) further explain that contingency theory first became prominent as a means of explaining organisational structure. It suggests that organisational design is contingent on the degree of task uncertainty. Contingency theory identifies optimal forms of control under different operating conditions and attempts to explain how organisational control procedures operate.

One of the central issues in this process is coping with uncertainty. The uncertainty occurs due to the internal and external environment of the organisation (Burns and Stalker, 1961; Lawrence and Lorsch, 1967; Duncan, 1972).

The external environment consists of those relevant physical and social factors outside the boundaries of the organisation or specific decision unit that are taken directly into consideration (Duncan, 1972). Table 2.1 lists the examples of external environment factors according to Duncan (1972).

Table 2.1: Organisational external environment

<table>
<thead>
<tr>
<th>Component</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Client</td>
<td>• Distributors of product or service&lt;br&gt;• Actual users of product or service</td>
</tr>
<tr>
<td>b) Suppliers</td>
<td>• New materials suppliers&lt;br&gt;• Equipment suppliers&lt;br&gt;• Product part suppliers&lt;br&gt;• Labour supply</td>
</tr>
<tr>
<td>c) Competitors</td>
<td>• Competitors for suppliers&lt;br&gt;• Competitors for clients</td>
</tr>
<tr>
<td>d) Socio-political</td>
<td>• Government regulatory control over the industry&lt;br&gt;• National and local culture</td>
</tr>
<tr>
<td>e) Technological</td>
<td>• Meeting new technological requirements of own industry and related industries in production of product or service&lt;br&gt;• New technological advances in the industry</td>
</tr>
<tr>
<td>f) Physical</td>
<td>• Working location&lt;br&gt;• Weather/climate</td>
</tr>
</tbody>
</table>

Lawrence and Lorsch (1967) view organisations as open systems constantly interacting with their external environment. An organisation’s external environment consists of a body of knowledge and information, which the organisation members must absorb and act upon if the organisation is to achieve its goals.
The internal environment consists of those relevant physical and social factors within the boundaries of the organisation or specific decision unit that are taken directly into consideration in the decision-making behaviour of individuals in that system (Duncan, 1972). Table 2.2 lists the examples of internal environment according to Duncan (1972).

Table 2.2: Organisational internal environment

<table>
<thead>
<tr>
<th>a) Organisational personnel component</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Educational and technological background and skills</td>
</tr>
<tr>
<td>• Previous technological and managerial skills</td>
</tr>
<tr>
<td>• Individual member’s involvement and commitment to attaining system’s goals</td>
</tr>
<tr>
<td>• Interpersonal behaviour styles</td>
</tr>
<tr>
<td>• Availability of manpower for utilization within the system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b) Organisational structural component</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Characteristics of subunits</td>
</tr>
<tr>
<td>• Interdependence of subunits in carrying out their objectives</td>
</tr>
<tr>
<td>• Intra-unit conflict among organisational functional and staff units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c) Organisational characteristics component</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Organisational objectives and goals</td>
</tr>
<tr>
<td>• Integrative process integrating individuals and groups into contributing maximally to attaining organisational goals</td>
</tr>
<tr>
<td>• Nature of the organisation’s product service</td>
</tr>
</tbody>
</table>

The basic theme of contingency theory is that organisations have to deal with different situations in different ways. There is no single best way of management applicable to all situations. To be effective, the internal functioning of an organisation should co-relate to the demands of external environment. The managers must regulate the organisational functioning in harmony with the needs of the people, for instance members from within and customers and others externally. It advocates the comparative analysis of organisations to bring about matching or fit between the organisation structure and situational variables.

SMS is a type of organisational control mechanism where the nature of the organisational control is dependent on the type of organisational structure, which in turn is contingent on several organisational variables (Waterhouse and Tiessen, 1978). Contingencies are fundamental problems for complex organisations and coping with them is one of the major responsibilities of its members (Buckley, 1967). Given the complexity and organic nature of construction companies, the construction process is perceived as an open system which is continuously subject to different environmental forces, both externally and internally. SMS, being a sub-system of the entire construction management discipline, is also subject to the same environment and has to adjust itself to fulfil the goals of regulatory compliance, the clients’ requirements and industry pressure. In
addition, contingency theory has been seen as an appropriate approach to cope with the SMS implementation of contractors due to the different characteristics of construction companies, described by Wilson (1989). Moreover, current industry practice needs a systemic implementation strategy, as suggested by Santos-Reyes and Beard (2002, 2008). This is the underlying reason for bringing contingency theory into this research, so that the impact of the internal and external environment of the organisation can be easily determined.

Figure 2.6: A contingency approach to effective SMS (adapted from Okumus, 2003)

For the purpose of this research, a framework from Okumus (2003), shown in Figure 2.6, was adapted as a guideline. Okumus (2003) introduced a framework for strategy implementation, where there should be continuous interactions among the variables which make implementation possible. Ten important key variables chosen by Okumus (2001) are strategy formulation, environmental uncertainty, organisational structure, culture, operational planning, communication, resource allocation, people, control and outcome. To achieve organisational effectiveness, the organisation’s structure and management system has to be appropriate for or ‘fit’ its environment and task (Okumus, 2001).

Contractors’ safety in processing plants involves unique challenges. Characteristics such as fragmentation of the design and construction phases, instability of the workforce and the transient nature of construction projects contribute to disproportionate injury and
illness rates. The construction environment is unique, transient and dynamic in nature, is constantly changing, is exposed to stochastic elements and differs significantly from previous projects. This shows that the working environment of construction is unstable and full of uncertainty. Additionally, work tasks are often unpredictable, workers are constantly changing and the work conditions distract workers from safely completing tasks. As the working environment of construction is constantly changing, it is essential to take into account these changes, which influence the success or failure of SMS implementation according to contingency perspectives.

2.5 Conclusions

This chapter has reviewed the existing literature that has studied SMS in general and the important function it plays as an industrial accident prevention mechanism in the industry. Many major incidents in the industry prompted the adoption of safety regulations, and SMS has been widely used since then. Many regulatory requirements stress the importance of SMS, however simply complying with the legislation is insufficient to ensure the safety of workers. In addition, under self-regulation, the adoption and implementation of SMS is limited to certain organisations. It is noticeable that under self-regulation, many organisations enjoy a greater flexibility to adopt and implement SMS. A new system of flexibility and feasibility, capable of involving the active participation of stakeholders, is therefore required.

Many guidelines for SMS have been introduced. However, proper implementation is always an issue, as the existence of SMS on paper is not necessarily reflected in reality. The complexity of an organisation is one of the main reasons for improper SMS implementation. For instance, in the construction industry, the responsibility of safety is always unclear, as too many parties are involved during the construction processes. As a consequence, the adoption and implementation of SMS is totally for the sake of regulatory compliance, the clients’ requirements and industry pressure.

The review has indicated that there have been many attempts in previous research to investigate the underlying factors and to recommend an approach for effective SMS. Traditionally, previous research has tended to address SMS by focusing on technical aspects and looking for the immediate causes of incidents or accidents after they have
taken place. More recently, organisations have focused on the consequences of the incidents or accidents and integrated safety with other organisational activities. However, most of the research is confined to large organisations or a high-risk group of the workforce, such as offshore workers (Mearns and Flin, 1995; Flin et al., 1996; Rundmo et al., 1998; Mearns et al., 2003), and much work has focused on construction work in general (Kartam and Bouz, 1998; Kartam et al., 2000; Tam et al., 2001; Tam et al., 2004; Zeng et al., 2008). Little attention has been given to contractors working in processing plants. Therefore, this research will attempt to close this gap.

Previous studies failed to notice the influence of the internal and external environment of organizations on the strategic implementation of SMS. However, the literature also reveals that the strategic implementation of a system must take these factors into account. The review indicates that safety still tends to be addressed in isolation. There is a need for a systemic approach to understand the systemic nature of SMS. For this purpose, the review further explores SMS implementation and the environment, and brings in contingency theory to cope with the implementation issue. The review has also revealed that current accident prevention is most suited to the mechanistic type of organisation (Wilson, 1989). Given the uncertain nature of construction companies, which are of the organic type of organisation, this research attempts to close the gap by allocating internal and external environmental factors according to the contingency theory of organisation during the SMS implementation process. At present, it is doubtful whether the current approach is appropriate in tackling safety issues in an organic type of organisation such as construction.

The literature review reveals a significant amount of research in various safety areas, but studies related to developing countries are very few (Jaselskis and Suazo, 1994; Cheng et al., 2004). Furthermore, many previous studies concentrate on Western countries (Fitts, 1996; Hale et al., 1997; Smallwood, 1998; Yu and Hunt, 2004; Abraham et al., 2004; Kashiwagi and Savicky, 2004; Yule and Mearns, 2004; Teo and Ling, 2006; Abudayyeh, 2006). In the case of Malaysia, little is known regarding the implementation of and approach to SMS. Published studies of SMS implementation in Malaysia are lacking, but studies of SMS in other countries can help provide a perspective for this research. As Malaysia is striving to bring SMS into the workplace to ensure that Malaysia becomes a developed country by the year 2020, and aiming to reduce the accident rate (Section 1.6,
p.9), this research is vital to understand the scenario of safety practices based on SMS elements in Malaysia. The level of industrial accidents in Malaysia is still upsetting (Abdul-Rahman, 2008; Utusan Malaysia Online, 2009). It is then worth questioning how Malaysian contractors cope with the high safety requirements of clients in processing plants. There is thus a need to be aware of the approach to SMS taken by Malaysian contractors in processing plants. It is thus appropriate to ask whether SMSs are effectively implemented by Malaysian contractors working in processing plants. Before this question can be answered, a further insight into safety in the Malaysian context is required. Therefore, a further literature review of SMS in the Malaysian context is given in the next chapter.
CHAPTER 3
MALAYSIAN SAFETY BACKGROUND

3.0 Introduction

This chapter presents the background to Malaysian safety practices. The explanation helps in the understanding of the past and present scenario, and also the future expectations of safety, especially concerning the achievement of Vision 2020, a long-term goal which outlines the policy of transforming the country into an industrialised nation.

3.1 Malaysian Safety Law and Regulations

Occupational safety and health (OSH) was first implemented in Malaysia some 120 years ago, towards the end of the 19th century. In the early stage of the country’s development, economic structure depended heavily on the agricultural, rubber and tin mining sectors. The growth of these sectors created various hazards for workers.

The development of OSH can be divided into five eras: the Steam Boiler Safety Era – before 1914; the Machinery Safety Era – 1914 to 1952; the Industrial Safety Era – 1953 to 1967; the Industrial Safety and Hygiene Era – 1970 to 1994; and the Occupational Safety and Health Era – after 1994 (Ahmad, 2008). The Perak Boiler Enactment 1890 was the first legislation in the country to address industrial safety issues (MTUC, 2000). The legislation mandated the compulsory inspections of boilers by the Mines Department inspectors before operation. Boilers were mainly used to generate power for tin mining activities, especially to operate the gravel pumps, the key machinery used in the process of mining tin ores. The legislation was enacted in recognition of the boiler’s potential risk to workers and the industry.

These industries introduced additional hazards to the workplace, which led to the enactment of other legislation. On 1 January 1914, the steam boiler enactments of the Federated Malay States were void and replaced by the Machinery Enactment of 1913, and this enactment was subsequently replaced by the Machinery Enactment of 1932 (DOSH, 2008).
In 1953, another law was enacted known as the Machinery Ordinance 1953, which superseded all previous legislation related to industrial safety and was enforced in all the other states of Malaya (as Malaysia was then known) under the jurisdiction of the Machinery Department, Ministry of Labour (MTUC, 2000). Four regulations were enacted under this Ordinance to reinforce its implementation. They were the Electric Passenger and Goods Lift 1953, Safety and Health Welfare 1953, Engine Drivers and Engineers 1957 and Transmission Machinery 1959. The Ordinance superseded all the Boiler Enactments enforced earlier. It contained provisions to ensure the safety of machinery including boilers and combustion engines to prevent the occurrence of industrial accidents.

The attainment of independence in 1957 marked the beginning of the economic development of the country. The economy grew steadily and as it expanded, its composition changed as well. In the 1960s, the government implemented a policy to move towards industrialisation. More and more factories were set up as a consequence of economic development. This resulted in an increasing number of workers in the manufacturing sector.

To manage safety and health problems associated with the manufacturing sector, the Factory and Machinery Act (FMA) was then enacted in 1967 to supersede the Machinery Ordinance 1953. It was enforced by the Factories and Machinery Department, which was previously known as the Machinery Department (Malaysian Trade Union Congress, 2000). The FMA aimed to protect people who worked at places where no machinery was involved (Soehod and Laxman, 2007).

A number of regulations were also introduced in 1970 to further strengthen the FMA 1967. These included the Fencing of Machinery and Safety Regulations, the Notification, Certificate of Fitness and Inspection Regulations, the Steam Boiler and Unfired Pressure Vessel Regulations and the Persons-In-Charge Regulations. All of these regulations were primarily targeted at addressing safety problems. Provision of first aid and welfare facilities such as drinking water, toilets and washing facilities were included in the Safety, Health and Welfare Regulation 1970. From 1984 to 1989, four other regulations addressing specific health hazards in the workplace such as lead, asbestos, noise and mineral dust were added to the list. In total there were seventeen regulations enacted
under the FMA (Soehod and Laxman, 2007). For the next three decades after its commencement, this FMA and its Regulations became the cornerstone for occupational safety and health improvement in Malaysia (Bahari, 2002 as cited in Soehod and Laxman, 2007).

Although the FMA was an improvement over earlier pieces of legislation, it had some important limitations. Among them was the fact that it did not cover the majority of the national workforce, such as those in agriculture, forestry, fishing, construction, finance and public services (Soehod and Laxman, 2007).

Realising that it was not possible to continue with the existing structure, as Malaysia is moving rapidly towards becoming an industrialised state by the year 2020, the Occupational Safety and Health Act (OSHA 1994) was enacted in 1994 (Soehod and Laxman, 2007). Malaysia was the first Asian country to have enacted a Safety and Health Act covering all occupations in 1994. OSHA 1994 was introduced to respond to the need to cover a wider employee base and newer hazards in the workplace. A number of incidents that occurred locally (for example the Bright Sparklers’ factory explosion in Sungai Buloh on 7 May 1991, which killed 22 workers) and abroad (the Union Carbide workers in Bhopal, India in 1984, the Chernobyl nuclear power disaster in Russia in 1986 and the explosion of the LPG factory in Mexico City in 1994, which sacrificed the lives of 2000 people) also prompted the Ministry of Human Resources to undertake serious initiatives that would promote safety and health in the workplace in Malaysia (Soehod and Laxman, 2007).

OSHA 1994 also provides, where appropriate, approved codes of practice, which have a special legal status. OSHA 1994 contains provision for formulating regulations and Codes of Practice (COPs), which indicate ‘what should be done’ and thus assist the employer to conform to the Act. Industry codes of practice may be in the form of gazettes providing guidance in compliance with the Act. Although codes of practice are not statutory requirements, they may be used in criminal proceedings as evidence that the statutory requirements have been contravened. Promulgation of industry codes of practice can be initiated by the industry, the government or other interested parties (Fernandez, 2002).
In the last 40 years, the occupational safety and health legislation has undergone massive transformation. With the Occupational Safety and Health Act 1994 (OSHA 1994), the philosophy of ensuring safety and health in the workplace changed from one that was very prescriptive and contained detailed technical provisions under the Factory and Machinery Act (FMA) 1967 to one that is more flexible and encourages self-regulation. OSHA 1994 was promulgated based on the philosophy that the responsibility to ensure safety and health lies with those who create the risk and those who work with the risk. OSHA 1994 has led to the introduction of SMS at enterprise level (Che Man and Musri, 2005).

Malaysia is now moving away from the traditional approach whereby it is believed that all occupational hazards can be controlled through detailed regulations (Abdul Hamid et al., 2003). However, regulations alone do not and cannot ensure safety in the workplace (Walters, 2002). Although OSHA 1994 was an improvement over earlier pieces of legislation and quite comprehensive, the level of awareness and practicability are generally lower than what was supposed to come into force, especially within the society of the construction industry (Abdul Hamid et al., 2003; Rampal and Nizam, 2006). A study by the Malaysian Trade Union Congress (MTUC) (2001) affirmed that the implementation of safety in Malaysia is poor in the workplace.

It appears that the number of Malaysian companies subscribing to SMS is still small compared to the total number of industries in the country (Thye, 2001). Only 20 percent of the companies that deal with processing plants comply with safety regulations (The Star, 2003). SMS in Malaysia is still under the encouragement of voluntary adaptation without nationally applied models (Kogi, 2002). Husin et al. (2008) state that SMS in Malaysia is suffering due to a lack of mission, vision and objectives. In addition, there is a lack of awareness of SMS due to an overemphasis on productivity. The authors further assert that SMS in Malaysia needs to be more constructive and practically led towards implementation. More needs to be done to enhance SMS in Malaysia, particularly to develop a better system of SMS implementation and participation from the industry and other stakeholders.
3.2 The Government and Private Agencies’ Roles in Promoting Safety

The Ministry of Human Resources, particularly the Department of Occupational Safety and Health (DOSH), is essentially responsible for ensuring that safety matters throughout the country. However, recognising the critical safety conditions that need improvement, four other agencies have been formed to safeguard the construction industry’s interests. They are the National Council for Occupational Safety and Health (NCOSH), the Construction Industry Development Board (CIDB), the Social Security Organisation (SOCSO) and the National Institute of Occupational Safety and Health (NIOSH). Figure 3.1 illustrates the administrative system under the Ministry of Human Resources.

<table>
<thead>
<tr>
<th>Department</th>
<th>Ministry of Human Resources</th>
<th>Company</th>
<th>Advisory Council</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Manpower Department</td>
<td>• Social Security Organisation (SOCSO)</td>
<td>• National Institute of Occupational Safety and Health</td>
<td>• National Labour Advisory Council</td>
</tr>
<tr>
<td>• Labour Department (P. Malaysia)</td>
<td>• Human Resources Development Council</td>
<td></td>
<td>• National Council for Occupational Safety and Health</td>
</tr>
<tr>
<td>• Labour Department (Sabah)</td>
<td></td>
<td></td>
<td>• National Vocational Training Council</td>
</tr>
<tr>
<td>• Labour Department (Sarawak)</td>
<td></td>
<td></td>
<td>• Wages Council</td>
</tr>
<tr>
<td>• Industrial Court</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Industrial Relations Department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Trade Union Affairs Department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Occupational Safety and Health Department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• National Vocational Training Council</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.1: Ministry of Human Resources’ administrative system in Malaysia
(Source: Abdullah et al., 2007)

The Department of Occupational Safety and Health (DOSH), which was known originally as the Factories and Machinery Department, was established under OSHA 1994. The goal of DOSH is to ensure a safe and healthy work culture among all employers and employees. It protects the safety, health and welfare of workers and others exposed to hazards associated with working activities (DOSH, 2008).

The main activity of DOSH is to draft and study policies, legislation, practices and guidelines associated with occupational safety, health and welfare. DOSH is responsible for conducting activities to encourage a safe and healthy work culture among employers, the self-employed, designers, suppliers, importers and workers. Some examples of such programmes are seminars and advisory services.
DOSH also provides assistance and support in the form of expert services for training, information dissemination and research conducted by government agencies, private agencies, institutions of higher learning as well as employers’ associations, workers associations and professional associations, in line with its efforts to improve occupational safety, health and welfare standards. DOSH identifies and checks safety reports, provides preventive measures for health hazards and emergency action plans, and also conducts inspections and audits of large hazardous installations. DOSH also performs technical analysis and determines the steps required to control safety and health hazards in the workplace. In addition, the Department also provides competency accreditation examination syllabi and evaluation for individuals and organisations, as well as conducting the examinations. Officers in each state, through periodic inspections as well as security, carry out enforcement and health audits on factories, machinery and other relevant workplaces.

Officers from DOSH will conduct checks to ascertain whether recommended machinery designs are acceptable. The machinery comprises steam boilers, unfired pressure vessels, machines for lifting goods and electrical lifts. Machinery associated with the use of petroleum substances, industrial hygiene equipment and protective gear for workers, as well as restoration and transmission systems, are also included.

DOSH officers are trained to investigate occupational accidents, illnesses and poisoning. Complaints of hazardous occurrences and accidents in the workplace will lead to prosecution. At the same time, a few officers will be assigned to the secretariat, which provides input on occupational safety and health to the National Council.

Under OSHA 1994, the National Council for Occupational Safety and Health (NCOSH) was established. NCOSH is a body established within the scope of the Ministry of Human Resources that discusses, studies and investigates through a tripartite process and makes recommendations to the Minister on matters that are consistent with the objectives of the Occupational Safety and Health Act 1994 (DOSH, 2008). NCOSH consists of 15 council members with tripartite representation from government, employers, employees and OHS professionals, with at least one female member. The Objective of NCOSH is to be the prime mover in shaping a safe and healthy work culture and thereby improving the quality of life of Malaysians.
NCOSH performs its functions by means of discussions, studies and investigations on matters related to Act 514 for the purpose of raising the level of OSH in all sectors of the industry whilst not restricting the breadth of scope contained in the provisions of Act 514 in matters relating thereto:

- Amendments that are deemed appropriate for legislation on occupational safety and health;
- Advancement of the administration and enforcement of legislations on OSH;
- Promotion of consultative co-operation between management and labour on the safety, health and welfare of other people within the community;
- Establishment of sufficient control procedure for the chemical industry;
- Statistical analysis of occupational deaths and injuries;
- Provision of healthcare facilities at the workplace;
- Support of legal measures for the development and acceptance of industry codes of practice on occupational safety, health and welfare;
- Development of plans and recuperating facilities for injured persons at the workplace.

Another important body that caters for safety, which is involved directly in the construction industry, is the Construction Industry Development Board (CIDB). CIDB started its operation on 1 December 1994, with the main objectives of developing, promoting, improving and streamlining the growth and expansion of the construction industry. This board was set up as the governing body to look specifically into the interests of the construction industry. CIDB, under Act 520, has the responsibility of providing effective leadership and co-ordination among construction industry players. Act 520 empowers the CIDB’s role particularly to provide leadership to the stakeholders and to stimulate the sustainable growth and improvement of the construction industry (http://www.cidb.gov.my).

CIDB upholds the vision of “to nurture and mould the Malaysian Construction Industry to become a respected leader in the global construction market by the Year 2010”. In fulfilling this vision, three key areas have been identified:

- Setting the stage for industry players to embrace new technology;
• Undertaking development and accreditation programmes designed to improve construction quality delivery as well as a competitive edge;
• Functioning as a gateway for the construction industry players to get involved in the international construction marketplace and enable them to earn leadership positions in overseas ventures and maintain an open exchange of information with construction leaders worldwide.

Therefore, to co-ordinate the construction activities in the country, it is mandatory for every contractor to register with CIDB. There are three registration categories: Civil Engineering Construction; Building Construction; and Mechanical and Electrical. These categories are further classified into various specialisation groups. The contractors are also categorised into grades based upon their tendering capacity, as shown in Table 3.1.

Table 3.1: Grade categories (http://www.cidb.gov.my)

<table>
<thead>
<tr>
<th>GRADE</th>
<th>TENDERING CAPACITY (RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Not exceeding 100,000</td>
</tr>
<tr>
<td>G2</td>
<td>Not exceeding 500,000</td>
</tr>
<tr>
<td>G3</td>
<td>Not exceeding 1 million</td>
</tr>
<tr>
<td>G4</td>
<td>Not exceeding 3 million</td>
</tr>
<tr>
<td>G5</td>
<td>Not exceeding 5 million</td>
</tr>
<tr>
<td>G6</td>
<td>Not exceeding 10 million</td>
</tr>
<tr>
<td>G7</td>
<td>No limit</td>
</tr>
</tbody>
</table>

All contractors are responsible for notifying CIDB about every contract secured by them, regardless of whether it is awarded by developers, project owners or main contractors. CIDB also introduced the Green Card Programme for all construction personnel. The main objective of this programme is to enhance the level of safety at construction sites, which in turn will enable everyone to work in a healthier and safer environment. It is a requirement for all construction personnel who enter a site to attend the ‘One-Day Safety and Health Course for Construction Workers’. The Malaysian Department of Occupational Safety and Health (DOSH) define workers as all
construction personnel from management to general workers. Therefore, construction personnel have to be registered with CIDB and issued with a Green Card.

In an effort to facilitate the continuous development and enhancement of the construction industry, CIDB, in collaboration with various Government Agencies and construction industry players, has embarked on a series of reviews and revisions of the rules and policies. It also offers numerous programmes that focus on key issues related to productivity, quality, health and safety and globalisation. CIDB serves as a platform to disseminate pertinent information and for communication for the industry. Information such as data pertaining to construction capacity, construction support services and the emerging trends in the industry provide an opportunity for stakeholders to keep abreast of the latest developments in CIDB and both the domestic and international construction marketplace. As such, several publications, for example the Malaysian Construction Standard, Construction Industry Reviews and the Modular Design Guide, provide fruitful information to contractors and the public at large.

For the past ten years, CIDB has shown remarkable progress towards promoting the construction industry. Today, it has an influential role in turning the industry into a more resilient income-generating contributor to the country’s economy. Efforts to improve the efficacy of the construction industry are not merely restricted to the local markets, but also include global customers. With these responsibilities, CIDB has introduced initiatives to develop improvements in many aspects, such as quality, cost, technology, creativity, innovation and other crucial elements. These are intended to help Malaysians to upgrade their skills and expertise according to the current industry demand and, importantly, to be able to face the unavoidable challenges.

Apart from CIDB, another important establishment that acts as a compensation body for employees’ safety is SOCSO (the Social Security Organisation). SOCSO was established in 1971 under the Ministry of Human Resources to implement and administer the social security schemes under the Employee’s Social Security Act 1969 (Act 4), for instance the Employment Injury Insurance Scheme and the Invalidity Pension Scheme. Under this scheme, workers are protected against industrial accidents including commuting accidents, occupational diseases, invalidity and death.
SOCSO’s main aim is to provide benefits to employees in the case of invalidity and employment injury, and includes occupational diseases. It also acts as a compensatory organisation, whereby in the event of mishap, SOCSO provides monetary security for beneficiaries and employees. SOCSO function includes the registration of employers and employees, collecting contributions, processing benefit claims and making payments to the injured workers and their dependents. SOCSO also provides vocational and physical rehabilitation benefits and enhances the occupational safety and health awareness of workers.

However, under the Social Security Act of 1969, SOCSO covers only certain employers and employees. Only industries employing five or more employees make mandatory contributions to SOCSO. SOCSO is available only to employees with the earning capacity of RM2000 and below (Mansor and Awang, 2002). SOCSO is the only scheme that follows the internationally accepted social security norms. SOCSO is based on social insurance principles and the pooling of risks.

To mark the new era in the promotion of OSH in Malaysia, a private agency, NIOSH, was established on 1 December 1992. NIOSH was established as a Company Limited by Guarantee under the Malaysian Companies Act 1965. As a company, NIOSH is expected to operate efficiently and with minimal administrative bureaucracy. NIOSH was launched to improve the safety and health of workers at the workplace, and with the vision of being the leading centre of excellence in OSH. NIOSH serves as a backbone to create self-regulation on safety.

The NIOSH Board of Directors comprises 15 board members, ten of which are appointed by the government while the remaining are elected by NIOSH members during the annual general meeting (AGM). This makes NIOSH different from similar institutions in other countries. NIOSH was established with an endowment fund from SOCSO and from the government. This fund was invested to become part of NIOSH’s source of income. NIOSH was set up with a RM1 million Launching Grant from the government, a RM50 million Endowment Fund (RM40 million from SOCSO) and a further RM10 million from the Malaysian government, which will be invested and the return on the investment will be used to partly finance the operation of NIOSH.
NIOSH’s role is to ensure that organisations in Malaysia operate in a safe working environment (Abdullah et al., 2007). To upgrade the level of OSH in Malaysia, NIOSH has developed curricula and training programmes for employers, employees and others in compliance with the Occupational Safety and Health Act (OSHA) 1994 and its regulations. Employees, by themselves, cannot do much to improve safety and health. It is the managers and supervisors who hold the key. Managers must show their commitment to OSH, while supervisors should implement and monitor the management of OSH in line with the Occupational Safety and Health Act 1994. Employees will play their role by complying and showing their co-operation towards these efforts. For this reason, most of NIOSH’s training courses are designed for management and supervisory personnel, especially those directly involved in OSH such as Safety and Health Officers and Safety and Health Committee members.

NIOSH also handles research activities. In general, NIOSH research activities can be divided into three categories: (1) research projects using external sources/research grants from government and the private sector; (2) supervising research projects for students in higher learning institutions; and (3) writing articles for journal publication. The research activities focus on OSH aspects at the workplace. The relevant issues include stress at the workplace, exposure to chemical substances, physical working capacity, workplace physical assessment and OSH in the logging industry. Information gained from these studies and research findings benefit NIOSH in its efforts to increase the quality of its information service, especially to industry and the public as a whole.

Consultation services and information dissemination activities are NIOSH’s core activities in the effort to elevate Occupational Safety and Health (OSH) in the workplace. NIOSH continually emphasises the quality of the consultation services provided to meet the client’s request. Information dissemination activities play a vital role in enhancing OSH awareness among industries, students and the public as a whole. The activities conducted are seminars, road shows and external and in-house exhibitions. NIOSH has actively conducted these activities to fulfil the industries’ growing needs for greater OSH awareness promotion. NIOSH also provides library services, an OSH shop and OSH talks and distributes and publishes OSH publications to cater to the needs of industry.
Under the Ministry of Human Resources, various safety activities have been developed according to each agency. Figure 3.2 presents OSH activities in Malaysia by each agency.

It can be concluded that Malaysia has very good safety law, policies and agencies to promote safety. However, several issues have re-arisen. Abdul-Aziz (2003), reviewing construction entrepreneurship in Terengganu, Malaysia, reveals that contractors are made to pay levies of 0.25 percent of the contract value for jobs above RM500,000. Compulsory registration with CIDB only imposes additional paperwork and fees. Furthermore, CIDB offers short courses, which duplicate what the clients have been doing already. Another safety issue in Malaysia is the lack of enforcement by the authorities (Araya, 2006, as cited in Heng, 2006).

### 3.3 The Development of Processing Plants

Processing plants, which perform important downstream activities in the oil and gas industry, were first constructed in Malaysia in the early 1970s. This was in parallel to the commercial development of the oil and gas industry in Malaysia, which began in the 1970s, with the first oil production off the coast of Terengganu in 1978. The government plays a pivotal role in the exploitation of these resources through the national oil company...
Petronas, which was formed in 1974. Petronas then established its own exploration and production subsidiary company, Petronas Carigali Sdn Bhd. In less than four years, Petronas Carigali Sdn Bhd made its first discovery of oil in the Dulang field offshore of Terengganu. As exploration activities increased, the downstream facilities and projects took off.

By March 1983, Petronas had constructed its first refinery at Kerteh and petroleum products were exported to the international market. The Terengganu Crude Oil Terminal (TCOT) followed in November 1983, and had an initial storage capacity of two million barrels of oil. TCOT was the first and biggest of four crude oil terminals to be constructed in Malaysia. This marked the beginning of the oil and gas era in Malaysia, paving the way for the development of the oil, gas and petrochemical industries in the country.

The processing plants received a major boost in 1992 with the completion of the first two phases of the Peninsular Gas Utilization (PGU) project. Construction of three gas-processing plants in Kertih has spurred development by providing the feedstock for petrochemical manufacturing (Anonymous, 2000).

One out of three major energy developments in Malaysia include natural gas downstream development (Ibrahim, 2004). The development and utilisation of natural gas continues to be the main thrust of Petronas’s activities to exploit the economy’s substantial gas reserves through value-adding projects. The completion of Gas Processing Plant (GPP) 6 in Kertih, Trengganu, in the east coast of Peninsular Malaysia, has increased the capacity of the Peninsular Gas Utilisation (PGU) system by one third to 2,000 million standard cubic feet per day. Currently, Malaysia is the world’s third largest exporter of LNG, after Algeria and Indonesia, with gas reserves estimated to be 89 trillion cubic feet (Tcf), which could last up to 43 years. These exports go primarily to Japan, with smaller volumes to Taiwan and South Korea. Three liquefaction terminals have been developed at the Bintulu LNG complex in Sarawak, Malaysia Satu, Dua, and Malaysia Tiga, the first train of which went on-stream in mid-2003. A second train will come online in November 2003, raising the total capacity of the Bintulu complex to an annual 1.1 Tcf (22.7 million tons) (Energy Information Administration, 2007).
The oil and gas sector is set to emerge as the new key driver of the Malaysian economy this decade. The sector is the largest taxpayer and the biggest hard-currency earner. By 2007, contributions were expected to reach 21.7 percent of federal revenue. Malaysia’s gross domestic product (GDP) grew at an estimated rate of 5.9 percent in 2006, with average growth at 5.4 percent since the 1997/1998 Asian Financial Crisis. Sustained economic growth has helped make the country a growing energy consumer in its own right. Malaysia held proven oil reserves of 3.0 billion barrels as of January 2007, down from a peak of 4.6 billion barrels in 1996. Several new oil production projects have been started during the last few years, although Malaysia’s oil output declined somewhat in 2006. Investment in infrastructure has been extensive throughout the region, including liquid natural gas (LNG) plants and trains, pipelines, refineries and shipyards (Berthamet, 2004).

The success of the nation’s oil and gas industry has continued to contribute significantly to the country’s socio-economic development. This contribution has enabled the government to build infrastructure and provide better education and health facilities.

3.4 Contractors’ Involvement in Processing Plants

The growth of petrochemical processing plants has benefited the construction industry. Many construction activities are carried out to meet the high demands of development in processing plants. One important role of contractors in processing plants is to provide civil and mechanical maintenance tasks. Details of the involvement of contractors in processing plants are discussed in Chapter 2.

In Malaysia, the role of contractors in processing plants is essential, especially since the government introduced the production-sharing contract (PSC). Through the Petroleum Development Act of 1974, any company wishing to exploit Malaysia’s resources must do so in partnership with Petronas, normally through a PSC (Abd. Razak, 2005). The Petroleum Development Act is undoubtedly the single most important factor in the transformation of Malaysia's oil and gas industry. Before the introduction of the Act, Malaysia’s oil and gas sector was dominated by foreign companies. Every activity in the oil and gas chain, from upstream right down to petroleum retailing, was dominated by these foreign entities. To support their operations they bought everything and anything
through their associate companies in the US and Europe. Equipment, materials and services were brought in through Singapore, with millions of dollars of purchases made outside Malaysia.

This practice came to a stop when the government, through Petronas, assumed control of the nation's petroleum resources. The PSC was and continues to be a mechanism in developing Malaysian companies in the support services sector. Through the PSC, oil companies are required to source locally certain amounts of materials and services for their operations. Malaysian companies that were previously denied the chance to engage in this business were given the opportunity to participate. However, they need to provide the technical and commercial requirements (Abd-Razak, 2005).

While many of these companies started as small service providers, a good number have grown successfully and have benefited their business, with some expanding into heavy engineering and fabrication. Clearly, the stringent policies in localising the oil and gas sector have had positive results. The direct involvement of Malaysian contractors in the supporting industries has resulted in the significant transfer of new technology and the acquisition of management skills (Abd-Razak, 2005).

Apart from PSC, the government, under Petronas, introduced a Vendor Development Programme (VDP) (Abdul-Aziz, 2003). Through VDP, local operators, such as subcontractors, have been able to build strong domestic positions. Petronas has endeavoured to get as many local companies as possible to assist in the development of the country’s oil and gas resources. Today, Malaysian-based service operators range from engineering firms to fully integrated service companies. The year 2003 was marked by significant merger and acquisition activity among key players, mainly because Petronas’ VDP helped small and medium-sized enterprises (SMEs), consequently fragmenting the market.

The VDP is an initiative that ensures that local services or locally manufactured goods are used in preference to international services or goods. Only leading technology equipment not available locally is exempt from the VDP. The majority of VDP vendors supply low technology goods and services, cover only a very small scope of work and make up only a very small percentage of the total number of companies (local and foreign) supplying the Malaysian oil and gas industry (Abd-Razak, 2005).
3.5 The Construction Environment and Safety Challenges

Despite its important contribution to the development of processing plants, the Malaysian construction industry is still saddled with serious safety problems. Relatively speaking, construction projects are more challenging than other industrial projects because of their fragmented complexity and their characteristic of having separate functions of design and construction.

The characteristics of Malaysian contractors are influenced by various factors. There are two major registration centres for contractors, CIDB and Pusat Khidmat Kontraktor (PKK). The categories of CIDB registration are explained in Section 3.2 (p.58). Contractors who wish to tender for public sector projects are required by the Ministry of Finance and Public Works Department (PWD) to register with PKK, which is under the Ministry of Entrepreneur and Cooperative Development.

Table 3.2: Number of Contractors by Grade, 2001 – June 2007 (Source:CIDB, 2008)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>21,104</td>
<td>27,085</td>
<td>35,230</td>
<td>39,847</td>
<td>41,340</td>
<td>38,141</td>
<td>35,709</td>
</tr>
<tr>
<td>G2</td>
<td>5,841</td>
<td>6,535</td>
<td>7,887</td>
<td>8,916</td>
<td>8,022</td>
<td>6,937</td>
<td>7,119</td>
</tr>
<tr>
<td>G3</td>
<td>7,394</td>
<td>8,673</td>
<td>9,784</td>
<td>10,434</td>
<td>10,930</td>
<td>10,043</td>
<td>10,294</td>
</tr>
<tr>
<td>G4</td>
<td>1,619</td>
<td>1,806</td>
<td>1,931</td>
<td>2,105</td>
<td>2,197</td>
<td>2,140</td>
<td>2,215</td>
</tr>
<tr>
<td>G5</td>
<td>2,115</td>
<td>2,485</td>
<td>2,802</td>
<td>3,039</td>
<td>3,116</td>
<td>2,818</td>
<td>2,887</td>
</tr>
<tr>
<td>G6</td>
<td>850</td>
<td>957</td>
<td>1,024</td>
<td>1,132</td>
<td>1,156</td>
<td>1,003</td>
<td>1,043</td>
</tr>
<tr>
<td>G7</td>
<td>3,242</td>
<td>3,536</td>
<td>3,486</td>
<td>3,713</td>
<td>3,730</td>
<td>3,736</td>
<td>3,937</td>
</tr>
<tr>
<td>Foreign</td>
<td>99</td>
<td>130</td>
<td>135</td>
<td>149</td>
<td>159</td>
<td>48</td>
<td>N/A</td>
</tr>
<tr>
<td>Total</td>
<td>42,264</td>
<td>51,209</td>
<td>62,079</td>
<td>68,335</td>
<td>70,650</td>
<td>62,864</td>
<td>63,204</td>
</tr>
</tbody>
</table>

Table 3.2 presents the number of contractors by grade registered to CIDB. Generally, the lower ranking contractors, mostly G1, are very much driven by cost and reluctant to invest to build up their specialisation in niche areas. Most of them work as subcontractors to larger contractors. This condition is the main reason that local projects are insufficient to sustain them. Thus, many of the lower-ranking contractors have left
the industry.

Contractors are appointed through a competitive tender. The selection of contractors has been primarily based on the lowest tender price. This practice has extended throughout the supply chain, with the main contractor competitively outsourcing elements of the job to subcontractors and material suppliers. As a result, some firms have priced work unrealistically low and then sought to recoup their profit margins through contract cost variations arising from, for example, design change, and other claims leading to disputes and litigation.

According to the Construction Industry Master Plan (CIMP) 2005-2015 (CIDB, 2008), the construction industry often lacks a supervisory and monitoring mechanism to ensure that projects are progressing smoothly. This is mainly due to a manpower shortage in the enforcement unit. In addition, feedback is not provided to contractors on their performance when bidding for projects. Currently, the bidding practice does not include reasons for non-selection, ranking of contractors, owners’ estimation and other relevant information that can help contractors to improve their bidding exercise in future projects.

One of the key challenges expressed by the construction players is securing timely and adequate financing. This situation is especially prevalent amongst the small to medium-sized players. Financial institutions, on the other hand, have restrained lending to certain players because of poor credit rating, incomplete loan application information, etc. Furthermore, they are more conservative when assessing borrowing for foreign projects.

The transient, unique and complex nature of construction projects makes safety management exceptionally difficult, which leads to accidents. In the case of Malaysia, there have been 700 negligence cases in the construction industry since 2002, which included high-profile incidents (Basri and Kumar, 2006; The Star, 2006). However, the number of accidents is expected to be more than this. According to Abdul-Aziz (2001), official statistics do not reveal the true situation, as on-site observations reveal the under-reporting of accidents to be frequent. The construction industry continues to contribute to the high fatal accident rate in Malaysia (Kong, 2001; Berita Harian, 2007; MOHR, 2008).
Abdul-Aziz (2001) states that even though there are various safety laws which contractors are supposed to implement, safety performance in the industry leaves much to be desired. Contractors are slow to upgrade their safety standards, even though stricter enforcement and publicity campaigns have inculcated greater safety awareness in the construction industry. In addition, safety is still a low priority due to clients pressing for their projects to be completed. Furthermore, from on-site observations by Abdul-Aziz (2001), it appears that the unsatisfactory construction safety record should be blamed upon both employers and workers.

Husin et al. (2008) state that the safety culture and safety responsibility is unsatisfactory in the real construction field in Malaysia. There is inadequate imagination and ideas about propagating safety at work. Lack of management control leads to a lowering of performance standards, such as in safety training, communication and programmes.

In general, contractors’ workers have a low level of awareness of the use of personal protective equipment (Abdul-Aziz, 2001; Abdul-Hamid et al., 2003). For instance, the wearing of helmets and boots is not the preference among workers (Abdul-Aziz, 2001). Even for the employer, the supply of protective equipment is seen to be quite inadequate (Abdul-Hamid et al., 2003). This situation still requires enormous improvement to catch up with an acceptable level of safety practice on site.

Ghani et al. (2009) state that the majority of the contractors in Malaysia fail to instil a safety culture among their staff and workers. Problems occur when the safety personnel, for example the safety officer, who is employed directly by the contractor, does not have autonomy to strictly enforce the regulations.

Realising the importance of safety awareness in the construction industry, the Construction Industry Development Board (CIDB), as the regulating body for the construction industry in Malaysia, has teamed up with the National Institute of Occupational Safety and Health (NIOSH) to conduct the Safety and Health Induction for Construction Workers (SICW), better known as the Green Card Program. It is an integrated safety-training programme for all construction workers and personnel, and
involves the registration and accreditation of construction personnel to enhance safety levels at construction sites.

This programme was originally started in 1997 as a construction workers’ registration programme to comply with Section 33 of Act 520 (1994). It was then upgraded to a safety and health programme when CIDB adopted the SICW module of training from NIOSH, better known as the CIDB Green Card Program. In this programme, participants have to register and attend a one-day safety and health induction given by a qualified trainer. The green card is issued only when the participants successfully attend the induction.

The objectives of this programme are: (1) to ensure that the construction worker is aware of the importance of a safe and healthy working place; (2) to provide basic knowledge on safety and health at the construction work site; and (3) to inform construction workers of the legal requirements in relation to safety and health. According to CIDB Green Card Program Circular No 1/2000, it is the responsibility of the main contractor to implement the Green Card Program on their construction site.

The Green Card Program, however, costs a lot of money. Employers are reluctant to spend money on the Green Card due to the short-term nature of workers in the construction industry (Hasnan, 2006). Therefore, it is hard for these workers to comprehend safety instructions, signs and manuals, and this renders them vulnerable to accidents. Hence it is not surprising that the industry has a considerable frequency of injuries and fatalities.

As of today, the Malaysian government is working towards a strategy called the National Vision Policy, or Vision 2020. This strategy aims to strengthen the country’s competitiveness and resilience, build a stable society and continue to attract FDI in certain strategic areas. To become more attractive to foreign investors, the Malaysian Industrial Development Authority (MIDA) was established, aiming to improve the foreign investment climate in the country. The Malaysian government has also initiated a unit called the Multimedia Super Corridor (MSC), which aims to help global information and communication technology (ICT) companies to become established in Malaysia, which is in line with Vision 2020.
Corresponding with Vision 2020, Malaysia aims to be the number one liquid natural gas (LNG) producer. Hence, to cope with the trends of the global market (Kim et al., 2003), contractors need to compete for this challenge, for instance bear the impact of the Production Sharing Contract (PSC).

Transforming Malaysia into a developed country by the year 2020 has its own costs, which have to be borne by the workforce. Rapid industrialisation has led to numerous new hazards in the work environment. Workplaces in the country are subjected to the phenomenon of globalisation, with the introduction of new technology, work organisation and work processes and substances. The development and expansion of processing plants (Oey, 1997; Anonymous, 2000), for instance, provide a lot of opportunity to contractors to be involved directly or indirectly. However, numerous emerging safety issues need to be attended to and managed in an appropriate manner, for instance the lack of trained personnel, deficiency in enforcement and small and medium-sized firms not having the proper infrastructure in place. All these challenges need to be dealt with for good occupational safety delivery (Abdullah et al., 2007).

3.6 Construction Safety Policy

The rapid development of Malaysia in various industrial sectors, together with the introduction of new technologies, poses challenges to DOSH to ensure that safety and health in the workplace is in control. DOSH, therefore, has to be proactive and farsighted to ensure that safety and health in the workplace is in line with the development of the country. Under DOSH, a safety policy was set up with the following objectives:

- to prepare and maintain a workplace with a safe and healthy working system;
- to ensure that all staff are provided with the relevant information, instruction, training and supervision regarding methods to carry out their duties in a safe manner and without causing any risk to health;
- to investigate all accidents, diseases, poisonous and/or dangerous occurrences, and to take action to ensure that the occurrences will not be repeated;
• to comply with all requirements of legislation related to safety and health, as stated in the Occupational Safety and Health Act 1994, as well as regulations and approved codes of practice;
• to provide basic welfare facilities to all workers; and
• to revise and improve on this policy whenever necessary.

To ensure that the objectives of this policy are fully met, a safety and health officer is appointed in every DOSH office for the purpose of coordinating safety and health. DOSH has also introduced a five-year strategic and systematic plan called the Strategic Plan (SP) 2005-2010. The objectives of SP are as follows:

• to reduce the rate of accidents (fatal, permanent loss of ability, non-permanent loss of ability) by 20 percent;
• to increase enforcement activities by 100 percent;
• to increase the number of workplaces employing a safety and health officer by 20 percent.

Three strategies have been identified by DOSH to tackle the challenges of SP. Strategy one is to formulate policies, legislation, industrial codes of practice and guidelines, which take into consideration the current situation and future needs. Strategy two is strategic and effective enforcement of the legislation. Strategy three is to increase the level of OSH awareness.

In the case of the construction industry, the government has launched the Construction Industry Master Plan 2006–2015 (CIMP), which was initiated by the Construction Industry Development Board (CIDB) Malaysia. The CIMP is a comprehensive plan charting the strategic position and future direction of the Malaysian construction industry over the next 10 years. The purpose of CIMP is to gear up the Malaysian construction industry towards globalisation and competitiveness. It is intended to provide industry stakeholders with a clear direction of the Malaysian construction industry through its clearly defined vision, mission, critical success factors, strategic thrusts, recommendations and action plans. The CIMP is also intended to ensure that the construction industry is well positioned to support the nation’s overall economic growth.
and in meeting various challenges, such as the need to enhance productivity and quality along the entire construction industry value chain.

CIMP constitutes seven strategic thrusts which encompass the construction value chain. The strategy emphasises striving for the highest standard of quality, occupational safety and health and environmental practices. To keep abreast with development, particularly in relation to the issue of occupational safety and health, construction players should take their roles in consolidating the industry to reach greater heights. Safety in construction must be a priority among the construction fraternity during pre-construction, construction and post construction. A holistic approach of safety must be introduced to the construction industry as a strategic way for construction stakeholders to move to greater safety in future.

The objective of the CIMP is to reduce injury rates, work-related ill health and consequent days lost from work in the industry. It is hoped that the fatality rate of 26 per 100,000 workers in 2003 can be further reduced by 30 percent by the year 2010. The current fatality rate in developed countries like Japan, France and the USA is below 20 per 100,000 workers, and Malaysia, which is striving to achieve developed nation status by 2020, should also strive to achieve a target of this level (CIDB, 2008).

According to the CIMP report (CIDB, 2008), well-designed occupational safety should have the following functions: surveillance of the work environment; initiatives on the control of hazards at work; surveillance of the safety and health of employees; adaptation of work and the work environment for the worker; organisation of first aid and emergency response; health promotion; and provision of curative services for occupational diseases. In the private sector, the responsibility for the provision of occupational safety lies with the employer. The employer has to make the necessary arrangements within its organisation to ensure sufficient resource allocation (financial and manpower). Proper arrangements should also be made in the government sector. This is no different to the private sector, and requires the expertise of safety practitioners to help identify the hazards, evaluate their risks, implement control measures, conduct medical surveillance and re-evaluate the effectiveness of the control measures. Collaboration and co-ordination by all the occupational safety providers, both government and private agencies, is essential to ensure efficient occupational safety delivery. In conclusion,
comprehensive, well-designed and accessible occupational health services are important to ensure the health and safety of the workforce. Table 3.3 illustrates the detailed action to enhance OSH under the CIMP.

Table 3.3: Enhancement of OSH under CIMP (Source: CIDB, 2008)

<table>
<thead>
<tr>
<th>No.</th>
<th>Action Plan</th>
<th>Responsible Body</th>
</tr>
</thead>
</table>
| 1.  | Create awareness through OSH promotions  
• Promote through various media  
• Promote DO-It-Yourself concept  
• Form MCSHA to pool the industry stakeholders’ resources under “one umbrella” body  
• Introduce recognition award | CIDB, DOSH                |
| 2.  | Enhance OSH education and training  
• Increase and improve education and training programmes on OSH  
• Extend training to all levels of workers  
• Develop clear guidelines to accredit training providers/individual trainers  
• Incorporate Osh content into the course curriculum  
• Train enforcement officers (inspectors) in matters relating to enforcing safety and health, and welfare-related legislations | CIDB, DOSH, Academic institution |
| 3.  | Tighten OSH enforcement and legislation  
• Strengthen enforcement agencies  
• Review existing regulations that govern OSH in the construction industry | CIDB, DOSH                |
| 4.  | Consider financial incentives for undertaking certain activities to improve OSH  
• Encourage corporate sponsorship of training programmes by CIDB, SOCSO, insurance companies  
• Evaluate tax exemption on personal protective equipment used for the purpose of securing OSH of construction workers  
• Reduce fee for OSHMS certification | CIDB, DOSH                |
| 5.  | Develop OSH standards, guidelines and codes of practices for the construction industry  
• Develop comprehensive set of standards to guide industry players  
• Accredit relevant agencies, e.g. CIDB, to carry out certification exercise on Construction OSHMS | CIDB, Regulatory bodies (including DOSH, NIOSH), Industry players |

3.7 Are Malaysian Safety Management Systems Any Better?

Having described the safety background in Malaysia, it is now appropriate to discuss the general scenario of the current safety need in Malaysia and how the study of the issues and problems of SMS implementation factors can assist the country to solve its construction safety problems, particularly in processing plants.
Malaysia has appropriate safety legislation and various government and private bodies to cater for safety issue in the industry. For instance, under DOSH, government inspectors were sent to inspect industrial undertakings including factories and construction sites to give advice and guidance as well as, of course, to stipulate the safety requirements. Prosecutions became an incentive for compliance with safety legislation. Companies would be willing to follow the instructions given by the inspectors to fulfil legal obligations and to avoid prosecution. However, the practice that relies heavily on enforcement actions is not effective at present (Section 2.1.1, p. 14).

There has been a great change in industry; the rapid evolution of technologies, new processes and new agents have been evolving and creating new hazards and risks to workers. The approach of legislation and enforcement is no longer comprehensive enough to cope with the changes. Complying with the legislation is insufficient to ensure safety in the workplace. The Malaysian government can no longer solely rely on the regulator to carry out enforcement actions to maintain the safety standards at workplaces. Furthermore, there has always been a lack of enforcement by the authorities due to a lack of staff. A new system of flexible and feasible enforcement, capable of involving the active participation of stakeholders, is therefore required.

Malaysian safety legislation has undergone a massive transformation from being too prescriptive and containing detailed technical provisions to being more flexible and encouraging self-regulation supported by codes of practice and guidelines, especially under the Occupational Safety and Health Act 1994 (OSHA 1994). These changes have been necessary and consistent with the trend of legislation development in industrialised countries to face the challenges of the new millennium.

However, under self-regulation, companies are still able to enjoy great flexibility in the setting up of SMS. In addition, SMS is still under the encouragement of voluntary adaptation without nationally applied models (Kogi, 2002). As a consequence, there are still only a small number of companies, including contractors in processing plants, which subscribe to SMS (The Star, 2003). At present, it is still doubtful whether the approach of self-regulation is appropriate in tackling construction safety issues in Malaysia.
The government has introduced CIMP to tackle the issues and problems in the construction industry, mainly on the safety and health issue. According to the CIMP report (CIDB, 2008), the success of CIMP implementation depends very much on the stakeholders’ incorporation of its guidelines and objectives into their business operations and also its use as part of the forward planning document within their organisations. Under this approach, the leadership role of stakeholders (e.g. contractors, owner organisations and workers’ organisations) is crucial in order to define standards, provide advice and guidance, monitor progress and remind and urge the members to implement the CIMP.

Stakeholders are the driving force for the improvement of occupational safety and health performance in the construction industry. The Occupational Safety & Health Act 1994 states that ‘the management of safety and health at the work place is the responsibility of those who create the risks and those who work with the risks’. Thus, the participation of all stakeholders is a prerequisite for any safety and health programme to succeed. It is essential that stakeholders coordinate the implementation of the guidelines and objectives set out in the CIMP and avoid any duplication of effort. However, the involvement of the stakeholders within the construction industry is complicated, as safety becomes tougher to manage due to the complexity of the construction environment (Section 2.2.2, p.29).

As discussed in Sections 2.3 and 2.4 in Chapter 2, current approaches in accident prevention are more suited to mechanistic organisations than to organic types, of which the construction industry is one. Mechanistic organisations are designed to suit relatively stable environments, whilst organic types are best suited to unstable ones. As an organic type of organisation, the construction industry needs a great deal of integrating and coordinative effort to function properly due to rapid changes in its environment.

Construction is continuously subject to both external and internal environmental forces. Examples of the external and internal forces are technological advancement, clients’ requirements, financial constraints and organisational culture. As a management system, SMS implementation is also subject to the same environment and has to adjust itself to fulfil the clients’ requirements. However, little attempt has been made to
develop an effective SMS implementation approach that addresses the overall issues related to the internal and external environment of an organisation. To effectively impact SMS at construction worksites, it becomes necessary to look at the systemic issues and problems of contractors during the development and implementation of SMS. This research addresses SMS implementation issues in terms of contingency factors that can affect its outcomes. A prerequisite for successful implementation of SMS based on self-regulation is the willingness of contractors to cope with the internal and external environment within the organisation.

In the context of processing plants, contractors are always being neglected by the industry. Clients regard contractors as less important. In term of academic research, little has been conducted to investigate contractors’ safety. Many improvement approaches are applied mostly at the level of multinational or large processing plant companies. Apart from that, most of the existing approach presents lists of characteristics. They are deficient in identifying a causal relationship between their components, with little or no emphasis on the logical links between them.

Given the high rate of accidents among Malaysian contractors in general, the question of how contractors ensure safety in processing plants should be asked frequently, as safety is a crucial requirement during the bidding process. Having realised the crucial role of safety during the contractors’ selection process, and with the poor safety conditions of contractors, it is doubtful how contractors cope with the clients’ safety requirements.

3.8 Conclusions

The objective of the literature reviews in Chapter 2 and Chapter 3 has been to bring to the fore the state of the SMS of contractors in processing plants and the environmental effect of implementation strategies. Some of the principles involved and the concepts generally referred to in the SMS implementation process have been explained. There is much idea generation in the area of SMS implementation, however this indicates the lack of research into contractors’ SMS implementation in processing plants. The requirement for further study is evident in a number of particular areas.
Malaysia is a society with a unique culture, a traditional social background and an ever-changing economic environment. It can tolerate and adapt easily to variety and transience. Nevertheless, the implementation of SMS in the construction industry is still premature, although Malaysia has the potential for development and improvement in SMS implementation.

The literature revealed that the improvement of SMS implementation in Malaysia cannot depend on monitoring and enforcement by the authorities. Occasional prosecutions would not have any impact on initiating a behavioural change among contractors. The enforcement approach of regulating safety can hardly build a safety culture among contractors nor bring long-term improvements to the safety environment in workplaces. Hence, a new approach to regulating and implementing safety has been adopted. Self-regulation of SMS has been introduced, which means that companies enjoy the flexibility to develop SMS within their organisations. Although Malaysia is adopting the self-regulation approach, it is being attempted through the legislative medium, which has been questioned as being incompatible with the organic nature of the construction industry. As a consequence, many companies tend to ignore SMS. The number of companies subscribing to SMS is still small in Malaysia. This practice is obvious among contractors, where safety is considered just for the sake of fulfilling the clients’ requirements. On the other hand, the requirement for safety in processing plants is critical. Therefore, given the strict safety regulations set by the clients in processing plants, and the safety implementation problems of contractors in general, it is then questionable whether Malaysian contractors have an appropriate SMS and how effectively it is implemented.

Malaysia is still in an early stage of SMS history, and given the ignorant attitude of contractors and the organic nature of construction companies, it is therefore worthwhile to question what the issues are that hinder SMS implementation. It is important to review SMS implementation in terms of its elements while analysing the possible problems and obstacles likely to be encountered, so that a system more suited to the Malaysian construction society could be designed. By determining the common obstacles encountered by contractors during SMS implementation, the root of these obstacles can be investigated. Knowledge of the problems is indeed the key to its solution and improvement. This study is crucial to investigate the way in which SMS has been
adopted in Malaysia and whether or not it reflects the realities of the dynamics of contractors in processing plants. A change of attitude as well as organisation structure is needed for the improvement of SMS implementation.

The exploration on how contractors experience SMS in the context of Malaysian processing plants is essential. As statistics does not reveal the real situation (Abdul-Aziz, 2001), it is crucial to explore the existence and availability of SMS among Malaysian contractors working in process plants, in order to determine whether the area of research is worth studying. Hence exploratory research is needed to reveal the availability of SMS and its implementation among Malaysian contractors working in processing plants. Through exploratory research, the researcher will define the issues and problems of SMS approach and implementation, and hence suggest the appropriate means to improve the implementation of SMS among Malaysian contractors working in processing plants. Details of the steps taken for this study are explained in the following chapter.
CHAPTER 4
METHODOLOGY

4.0 Introduction

This chapter discusses how the work was carried out to meet the study’s aims and objectives and discusses the choices of methodology. It encompasses the overall review of the research design, the preliminary study, which includes a literature review and the exploratory survey questionnaire, the in-depth, semi-structured interview, data preparation, data analysis, reliability and validity of the data and, finally, the ethical procedures undertaken in the research. The discussion of these aspects provides a better understanding of the appropriateness of the research approach employed and its ability to provide adequate answers to the research questions. Specifically, it is intended to explicitly demonstrate the means of the research process.

4.1 Research Design

The research design is the backbone of any research work. It describes each of the research components and how they are incorporated and linked together in the process. There are many arguments about the correct research design approach, but the quality of research design relates to the overall logic of the research and the coherency of its components. This is where the influential factors in the research design are important and critical, which will be explained later in this chapter. The research design is important to “ensure that the evidence obtained enables the researcher to answer the initial question as unambiguously as possible” (Aaker et al., 2007).

Saunders et al. (2003) and Robson (2002), for instance, explain the importance of the research approach and strategy according to the nature of the research topic and the purpose of the research enquiry. There are two types of research approach: deductive and inductive (Saunders et. al., 2003). The deductive approach is one where the researcher develops a theory and hypothesis (or hypotheses) and designs a research strategy to test the hypothesis. The inductive approach, on the other hand, is one where the researcher collects data and develops a theory as a result of the data analysis.
Robson (2002) identifies three potential purposes of enquiry, which are linked to the status of the existing research in the area. For instance, there is little need to carry out exploratory research if the area under investigation has already received broad attention from a wide variety of perspectives. Similarly, explanatory research is based on hypotheses generated from preceding work and is often looking to test already established knowledge, perhaps in a different context or in a different population. The following are research strategies according to their purpose, which are described by Robson (2002) and Saunders et al. (2003):

Exploratory: To find out ‘what is happening; to seek new insights; to ask questions and to assess phenomena in a new light’
Descriptive: ‘To portray an accurate profile of persons, events or situations’
Explanatory: ‘Emphasis on studying a situation or problem, in order to explain the relationships between variables’

The aim of this research reflects the desire to explore and increase the understanding of the nature of SMS implementation among Malaysian contractors working in processing plants. It is based on the premise that research to date has failed in its quest to establish an overarching theory of SMS implementation in the Malaysian context, and how Malaysian contractors experience it.

Several objectives were set to achieve the research aim. Objective 1 focuses on the literature concerning SMS, developing an understanding of the basis of SMS in general and in the Malaysian context. Objective 2 focuses on the existence and availability of safety practices through the exploratory investigation of Malaysian contractors. Objective 3 is to investigating the experience of SMS implementation from the perspective of those involved rather than testing existing theory. Objective 4 is to suggest improvements to effective SMS, based on the findings from the players in the industry. Based on the work of Saunders et al. (2003), a general focus research question was set after the literature survey, and detailed research questions (Section 5.4.4, Figure 5.9, p. 125) was set after objective 2 was achieved.

In order to achieve the research aim and objectives, several data collection methods were considered, as illustrated in Table 4.1 (Yin, 2003). The data collection methods
must be consistent and credible, therefore each of the data collection methods was reviewed against the research aim.

Table 4.1: Six sources of evidence: strengths and weaknesses (source: Yin, 2003)

<table>
<thead>
<tr>
<th>Source of Evidence</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation</td>
<td>• stable - can be reviewed repeatedly</td>
<td>• retrievability - can be low</td>
</tr>
<tr>
<td></td>
<td>• unobtrusive - not created as a result of the case study</td>
<td>• biased selectivity if collection is incomplete</td>
</tr>
<tr>
<td></td>
<td>• exact - contains exact names, references, and details of an event</td>
<td>• reporting bias – reflects (unknown) bias of author</td>
</tr>
<tr>
<td></td>
<td>• broad coverage - long span of time, many events and many settings</td>
<td>• access – may be deliberately blocked</td>
</tr>
<tr>
<td>Archival Records</td>
<td>• (same as above for documentation)</td>
<td>• (same as above for documentation)</td>
</tr>
<tr>
<td></td>
<td>• precise and quantitative</td>
<td>• accessibility due to privacy reasons</td>
</tr>
<tr>
<td>Interviews</td>
<td>• targeted – focus directly on case study topic</td>
<td>• bias to poorly constructed questions</td>
</tr>
<tr>
<td></td>
<td>• insightful – provide perceived causal inferences</td>
<td>• response bias</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• inaccuracies due to poor recall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• reflexivity – interviewee says what interviewer wants to hear</td>
</tr>
<tr>
<td>Direct Observations</td>
<td>• reality – covers events in real time</td>
<td>• time-consuming</td>
</tr>
<tr>
<td></td>
<td>• contextual – covers context of event</td>
<td>• selectivity – unless broad coverage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• reflexivity – event may proceed differently because it is being observed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• cost – hours needed by human observers</td>
</tr>
<tr>
<td>Participant Observation</td>
<td>• (same as above for direct observations)</td>
<td>• (same as above for direct observations)</td>
</tr>
<tr>
<td></td>
<td>• Insightful into interpersonal behaviour and motives</td>
<td>• bias due to investigator’s manipulation of events</td>
</tr>
<tr>
<td>Physical Artefacts</td>
<td>• insightful into cultural features</td>
<td>• selectivity</td>
</tr>
<tr>
<td></td>
<td>• insightful into technical operations</td>
<td>• availability</td>
</tr>
</tbody>
</table>

The research sought to develop a theory not only about what the issues are, but also how those issues appear in and may affect the life cycle of SMS implementation. The theory is then plotted into a model, which describes what influences and affects contractors’ perception of SMS implementation. The novelty of this research lies in its desire to create a model that is relevant and applicable to the industry and those involved, and is not
based on an assumption of existing knowledge. This model will, however, be context specific; it will reflect the particular attitudes and beliefs of the subjects and cannot claim to be reliable and valid in all circumstances. The hope is that the model will be developed and tested in further research. The research is therefore exploratory and not descriptive or explanatory in nature.

The research design chosen in this study was contingent upon the general objective of the research project, discussed above. The research design adapted in this study is illustrated in Figure 4.1.
The inductive approach is used for the main study in this research. This is because it can give a deep insight into management system practices in organisations and provides rich data (Leonard and McAdam, 2001). The aim of the inductive approach in this study is to develop a theory as a means of forming an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS. To achieve this target, the research has been divided into the following process:
4.1.1 A preliminary study based on the primary and secondary data, comprising informal conversation, a literature review and an exploratory survey questionnaire.

4.1.2 The main study, involving in-depth, semi-structured interviews with questions based on the issues that emerged from the preliminary study. The data was grounded to develop the theory.

The preliminary study is the initial exploration of the issues under investigation to refine the general research ideas (Saunders et al., 2003). Saunders et al. (2003) further state that many approaches can be chosen where the underlying purpose is to gain a deeper understanding so that the research questions can be refined. From the literature review, it was revealed that in the Malaysian context, existing research on the approach to effective SMS is still lacking. The literature review did reveal a significant amount of research into various safety areas, but studies related to developing countries are very few (Jaselskis and Suazo, 1994; Cheng et al., 2004). Furthermore, many previous studies have concentrated on Western nations (Fitts, 1996; Hale et al., 1997; Smallwood, 1998; Yu and Hunt, 2004; Abraham et al., 2004; Kashiwagi and Savicky, 2004; Yule and Mearns, 2004; Teo and Ling, 2006; Abudayyeh et al., 2006). Therefore, an exploratory survey questionnaire was deployed, because the literature review failed to locate the current safety status of contractors working in processing plants. The exploratory survey questionnaire was important as one of the preliminary study steps, because the current status of SMS among Malaysian contractors working in processing plants was not clear enough to start with and required further investigation.

Once the current status had been sought, the work on the main study could begin. The aim of the main study is to discover a theory that aids understanding and action in the area under investigation. The main study includes descriptive research, the results of which have been analysed and interpreted, and their value will be discussed in Chapter 6.

4.2 Target Respondents and Sampling

The target respondents for the interviews were Malaysian contractors working in processing plants. The sample was selected from Malaysian contractors in all categories (large, medium and small) of the Malaysian Contractor Industry Development Board
(CIDB) registration and which specialise in civil and mechanical engineering for both maintenance services and project shutdown in processing plants. All local contractors are required to register with the CIDB in one of seven grades (G1 to G7). The categories reflect the size of the firms, with G7 being the largest and G1 the smallest (for details of grading, see Chapter 3, Section 3.3). The categories are based on the tendering capacity or the project cost at which they are qualified to participate, the minimum capital available, the organisation of resources and the level of experience.

A list of Malaysian contractors has been sought from Trade Partners UK (www.tradepartners.gov.uk) and CIDB Malaysia. Trade Partners UK is the UK Government’s lead organisation for developing trade overseas. For the purpose of this study, purposive sampling was used to select the respondents because due to resource constraints, this was more practical.

Purposive sampling (also known as judgmental sampling) enables the researcher to use her judgment to select cases that will best answer the research question (Saunders et al., 2003). Purposive sampling targets a particular group of people. When the desired population for the study is small or very difficult to locate and recruit for a study, purposive sampling may be the only option (Saunders et al., 2003; Aaker et al., 2007). Purposive sampling involves targeting a particular group because it is that group the researcher is interested in.

One of the commonest uses of purposive sampling is in selecting a group of geographical areas to represent a larger area. The choice of group provides control over the two scales of generality: first, the conceptual level and second, the population scope. It provides simultaneous maximisation or minimisation of both the differences and the similarities of the data that have a bearing on the categories being studied (Glaser and Strauss, 1967). The researcher can select groups regardless of where they are found. In this research, the researcher is able to compare the contractors involved in all kinds of construction work in processing plants (Glaser and Strauss, 1967).

Respondents are chosen because they have particular features or characteristics which will enable detailed exploration of the research objectives. It is important to note that it is not possible to draw statistical inferences from this kind of sampling method, since with a
purposive non-random sample, the number of people interviewed is less important than the criteria used to select them.

4.3 Preliminary Studies

The research commenced by having an informal conversation with safety experts in Malaysia and reviewing the relevant literature on SMS, particularly regarding implementation. In addition, other studies pertaining to workplace accidents and the safety of Malaysian contractors working in processing plants were analysed to gain preliminary ideas before embarking upon the fieldwork. The review is discussed in Chapters 2 and 3.

A literature review is defined as the selection of available documents (both published and unpublished) on the topic which contain information, ideas and evidence written from a particular standpoint to fulfil certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed (Hart, 1998). A review of the literature is important to acquire an understanding of the research topic, of what has already been discovered about it, how it has been researched and what the key issues are (Hart, 1998).

This literature review presents a detailed and comprehensive study of all the sources of information related to the research objectives available. The review was undertaken using the following types of references: books, PhD theses, Malaysian newspapers and journal articles from all over the world, conference papers, online databases such as Scopus and Emerald, and some other sources. The literature review covered a wide range of topics.

The literature review is an important stage of the research, as it provides an invaluable source of knowledge for the researcher. It provides ideas on the direction of the project. The objective of this stage is to explain and give detailed information about the work done by other researchers in each particular research area. Studying the literature gives a general picture of each area, with different authors providing information on similarities and inconsistencies in the work of previous researchers, criticism and analysis, the strengths and weaknesses of particular theories and areas for further research.
The main focus of the literature review in this study is on the following main areas: safety management systems (SMS), contractors’ safety, the approach to effective SMS and SMS implementation and the environment. The literature review serves as a preliminary data collection source for exploring the general interpretation of the subjective meaning of safety management systems and other underlying phenomena of SMS implementation among contractors working in processing plants. The findings from the literature review also contributed to an understanding of Malaysian safety practices. A research gap was identified at the end of the literature review process, which allowed the researcher to focus and narrow down the area under investigation.

The literature review process is never-ending, and was conducted throughout the whole course of this research. This was done to attain an up-to-date insight into ongoing developments and progress in the fields of interest, both theoretical and practical.

A general focus research question (Saunders et al., 2003) was set up after the literature review, which then led to the decision to adopt an exploratory method. This was chosen because the researcher found little information about the current status of SMS among Malaysian contractors working in processing plants. It was essential to know the current status of SMS before proceeding to the main study, because the researcher needed to confirm the existence of SMS development among Malaysian contractors working in processing plants. An exploratory study is advisable when the researcher has little knowledge of the situation or has no information on how similar problems or research issues have been solved in the past (Sekaran, 2003). This was deemed to be important for the development of a research instrument comprising an appropriate and meaningful set of questions to be asked at the next stage of data collection. Furthermore, it helped to ensure that the information sought would be relevant to current practice as well as suitable for the respondents to provide.

In addition, Powell (1996) stresses that one of the objectives of an exploratory study is to increase the researcher’s familiarity with the phenomena in question or to describe the characteristics of the population being studied. Robson (2002) states that an exploratory study is a valuable means of finding out “what is happening; to seek new insights; to ask questions and to assess phenomena in a new light”.

87
The instrument used in this study was a structured questionnaire. A questionnaire has been used widely as a method of data collection for exploratory study in various areas (Lee and Leung, 1999; Ahlstrom and Westbrook, 1999; Oyelere and Turner, 2000; Themistocleous et al., 2001; Cheng, 2004; Abd. Manaf, 2007). The questionnaire was intentionally designed to obtain very basic company information about SMS. The aim was to investigate the status of SMS and to explore whether it is difficult for construction firms to implement SMS in Malaysia, as revealed in the literature survey.

A questionnaire should not be long and complicated (Greenfield, 1996), thus the researcher developed very straightforward questions with a choices of answers. The survey questionnaire was developed based on Health and Safety Executive (HSE) guidelines (HSE, 1998) and previous publications (Mbakaya et al., 1999; Varonen and Matila, 2000; Champoux and Brun, 2003; Mearns, 2003; Griffith, 2004).

The contents of the questionnaire were:

- The background of respondents;
- Exploration of the availability of SMS;
- Exploration of safety awareness;
- Barriers to SMS.

The questionnaire was tested for its validity and reliability. Powell (1996) stresses that research is considered to be valid when the conclusions are true and reliable and when the findings are repeatable. Bernard (2000) refers to validity as the accuracy and trustworthiness of instruments, data and the findings in research, and he states that in research, nothing is more important than validity. In this study, the review of existing literature during the development of the questionnaire helped to ensure adequate content validity.

The questionnaire was sent to four selected experts in the area of safety to evaluate the appropriateness of the issues raised. They were chosen based on their sound knowledge and expertise in this field, as they have the insight to judge the relevance of this study. Input and suggestions from the panel experts were highly encouraged and played an important role in contributing to the success of the design of the questionnaire.
The sample for the study consisted of 250 firms, which were randomly selected from a list of contractors prepared by Trade Partners UK, the UK government’s lead organisation for developing trade overseas, and the Construction Industry Development Board (CIDB) Malaysia. A questionnaire was mailed to the top management of each firm. A reply-paid envelope was included. In total, 63 completed questionnaires were returned, of which 62 were usable, yielding an overall response rate of 24.8 percent. The response rate is considered reasonably adequate, given the low rate of responses associated with mail surveys (Rahman, 2001) experienced in previous studies in the Malaysian context (Abdul-Rahman and Alidrisyi, 1994; Sohail and Hoong, 2003). Furthermore, for a purposeful statistical analysis, the rule of thumb indicates that a minimum of 30 responses is normally adequate (Roscoe, 1975). The response rate is therefore sufficient for analysis in this research.

The data obtained from the questionnaire was analysed using the Statistical Package for the Social Sciences 12.0 (SPSS) software. Data from the questionnaire survey were coded before being entered in the SPSS software. Since all the questions are straightforward, there was no need to pre-code. However, the data was scrutinised while entering it to avoid any misleading results. In most instances, the responses to the survey questions are presented as frequencies expressed as percentages. This method has been used by several previous researchers (Mayhew et al., 1997; Mbakaya et al., 1999; Lee and Leung, 1999; Harms-Ringdahl et al. 2000). Chapter 5 presents details of the exploratory survey questionnaire results.

Having analysed the data obtained from the exploratory survey questionnaire, the results were then evaluated against the literature review. Several issues and problems were discovered at this stage, and further exploration was needed. The detailed research questions (Saunders et al., 2003) were developed at the end of this stage. This has helped the researcher to focus on the issues to be investigated further in the next stage.

4.4 Main Study

The research questions of this study call for a qualitative approach. As implementation is such an abstract and complex construct concerned with values, attitudes and behaviours, a
qualitative approach (i.e. a research interview) was adopted to elicit the meanings and to facilitate exploration of the key issues related to the research. Clearly, there is a need to explore the underlying causes of barriers to SMS implementation from the perspective of Malaysian contractors working in processing plants to find solutions that will influence their actions and enhance the desired implementation behaviour.

A series of in-depth, semi-structured interviews were set up with Malaysian contractors working in processing plants. They were designed to identify the issues faced by the contractors during the implementation of SMS. Interviews are an appropriate means of conducting discussions to not only reveal and understand the ‘what’ and the ‘how’ but also to place more emphasis on exploring the ‘why’ (Saunders et al., 2003). The in-depth, semi-structured interviews may be used to explore and explain the themes that have emerged from the use of questionnaires (Wass and Wells, 1994). The main objective of the in-depth, semi-structured interview in this research is to explore further issues that were raised from the exploratory survey questionnaire and to develop a theory which will inform an understanding of why SMS implementation is ineffective among Malaysian contractors working in processing plants.

During the distribution of the questionnaire, a letter of invitation for the second phase was attached. Respondents who were interested in participating in the second phase were advised to attach their contact details upon returning the questionnaire. From 62 respondents, only nine were interested in participating in the second phase. The researcher contacted the respondents via e-mail and telephone to set up the interview, however only four were available. The researcher then approached another 15 contractors via e-mail, but only three gave their feedback. Thus the total number of respondents for the in-depth, semi-structured interview was seven.

Even though a small number of respondents participated in this study, it is considered sufficient (Mintzberg, 1979; Abdul-Rahman and Alidrisyi, 1994; Mullen, 2004). There is no rule of thumb on what the appropriate number of respondents should be for this sort of interview (Strauss and Corbin, 1998). Mintzberg (1979, pp.585) notes: “No matter how small our sample or what our interest, we have always tried to go into organisations with a well-defined focus – to collect specific kinds of data systematically.” Furthermore, there
are several researchers who have interviewed fewer than ten respondents (Lihong and Goffin, 1999; Mullen, 2004; Georgieva and Allan, 2008). In addition, previous studies of Malaysian construction have recognised the difficulty involved in gaining access to the companies (Abdul-Aziz, 2003; Hasnan, 2006).

Prior to conducting the interviews, the respondents were contacted via phone or e-mail to ask their consent and give them the opportunity to arrange a convenient date and place. The participants selected were the project or safety managers and safety officers or foremen from the contractors involved in maintenance and civil work in processing plants. These were the people who were involved directly in managing safety in the companies. The target respondents for the interviews were those who had adequate knowledge and experience of SMS and were involved in the safety process.

The interviews were conducted in the respondents’ offices or project sites, whichever was appropriate for the respondents. Interviewees were encouraged to talk openly by the assurance of anonymity. The interviews typically lasted between 30 minutes and three hours. During each interview, the conversation was tape-recorded and a written note was made of the respondents’ answers. The tape recording allowed all answers to be accurately gathered for the purpose of transcription.

The researcher developed the themes and questions to be covered. To prevent the interviewees and the researcher going off the point into irrelevant conversation, a detailed description of the interview questions was used as a reference. The detailed description is shown in Appendix C. However, the actual interview process was managed as an open-ended interview to reveal unintended latent constructs. The order of the questions varied depending on the flow of the conversation. The following areas of concern were used to help keep the interviews in focus without biasing the responses from interviewees:
Introduction

Section 1 – Warm up question (personal and company background).
Section 2 – What are the current safety practices?
Section 3 – What encourages contractors to develop SMS?
Section 4 – What are the problems and factors influencing the implementation of SMS?
Thank you

Before any questions were asked, the researcher introduced herself and explained the purpose of the research. Confidentiality issues were explained and the structure and flexibility of the interview were described. The agreement for the interview to be taped was also gained from each respondent at this stage.

Section 1 was designed to help the respondents feel more comfortable and relaxed with the conversation by engaging them in a discussion about their background and their current position within the organisation. In Section 2, information about the safety practices in their company was gained. Section 3 investigated whether Malaysian contractors develop SMS and how they implement the system. Section 4 dealt with the issues raised during SMS implementation, specifically with regards to problems and barriers and the factors that contribute to successful SMS. Finally, the session ended with an expression of thanks and the offer of further discussion if the respondent so desired.

In general, the interview is believed to be a suitable way to support the research objective for two main reasons. Firstly, the study concerns people’s attitude to SMS and its implementation. An interview provides the opportunity to probe answers to better understand the attitudes to and the interpretation of SMS and the implementation concepts. Secondly, an interview allows the researcher to explore the research questions through interaction with the interviewees. Face-to-face communication can develop trust and gives more freedom for the respondents to express their views, especially when dealing with sensitive issues. Saunders et al. (2003) reveal that managers are more likely
to agree to be interviewed rather than complete questionnaires. In addition, an interview session gives the researcher the opportunity to receive feedback and give personal assurance about the way in which the information will be used (Saunders et al., 2003).

Nevertheless, an interview has several limitations. An interview takes the researcher longer than entering data from questionnaires. Several interviews were interrupted by urgent phone calls and the arrival of important guests. Bearing in mind that construction personnel have a less structured routine in their working life and the interview needs to be carried out at the respondents’ convenience, follow-up interviews were arranged, which indirectly affected the initial time planning. Due to time, location and financial constraints, it was impossible to cover as big a sample as the survey coverage. Interviews are often intensive and time-consuming, and run the risk of covering only a small and possibly unrepresentative sample of respondents (Saunders et al., 2003). However, this problem was minimised by utilising the in-depth, semi-structured interview. Therefore, there was a critical need for the researcher to spend a considerable amount of time in the research setting. There is also the possibility that the data may be highly influenced by the researcher’s interpretation, which could lead to bias. This disadvantage can be minimised by maintaining a close association with both the participants and the research setting. The researcher is then able to prevent any misconceptions and gain an insider's view of the real situation.

The interview process was affected by a number of additional factors, including: the nature of the research problem; the location of the interview; the position of the respondent in the organisational hierarchy; the respondent’s perception of the interviewer’s relative status and experience; the organisation’s general attitude to ‘outsiders’; the respondent’s current relationship with their employer; and organisational politics.

Before the researcher proceeded with the analysis, each interview was translated and transcribed into a word-processing document. The interviews were held in the Malaysian language, thus translation into English was needed. After completion of the transcription, the researcher read the transcript and made some revisions based on the notes taken during the interview.
The interview transcripts were analysed according to the grounded theory approach, following recommendations in the grounded theory analysis literature (Strauss and Corbin, 1998; Goulding, 2002; Heath and Cowley, 2004). Grounded theory has a well-defined process of data analysis for qualitative research (Walker and Myrick, 2006). The full transcriptions were analysed line by line (Strauss and Corbin, 1998; Goulding, 2002; Charmaz, 2006) to identify the full range of possible codes. The codes represent the interviewee and the number of the statement. To ensure the robustness of the analysis, data reduction was performed by the researcher independently inspecting the interview notes and transcripts. Details of the grounded theory for data analysis process are explained in the following section.

4.5 Grounded Theory for Analysing the Data

4.5.1 Introduction

There are several approaches that could be used to support the process of theory building, but the favoured one is that of grounded theory, as initially developed by Glaser and Strauss (1967). Once the in-depth, semi-structured interviews were transcribed, a grounded theory approach was applied for the analysis. Data analysis according to grounded theory has a number of significant advantages, as elucidated by Reid (2006) and Georgieva and Allan (2008). The data was analysed manually due to theoretical sensitivity, and although some qualitative researchers have encouraged the use of qualitative data analysis software tools, there are still some others (Allan, 2003; Douglas, 2004; Reid, 2006; Georgieva and Allan, 2008) who prefer to handle the data manually. Theoretical sensitivity refers to the background knowledge, experience, literature and intuition that a researcher uses to generate and compare categories while coding (Glaser, 1992; Douglas, 2004). Strauss and Corbin (1990) see theoretical sensitivity as “the ability to recognise what is important in data and to give it meaning” by drawing on the literature and personal experience and by interacting with the data. Researchers need to think theoretically and conceptually, looking for relationships between concepts in the data without forcing theory (McCluskey, 2003).
The rest of this section explains the process of data analysis according to the grounded theory approach. Details of the results of the data analysis of the in-depth, semi-structured interviews are given in Chapter 6.

4.5.2 Grounded Theory: Background and the Debate

The grounded theory method was developed by two American scholars, Barney G. Glaser and Anselm L. Strauss, during their sociological field investigation of the awareness of dying as a social problem (Glaser and Stauss, 1967). As they constructed their study of dying, they developed more defined and systematic methodological strategies for collecting and analysing qualitative data which researchers in various disciplines could adopt. Grounded theory was intended as a methodology for developing theory. It is grounded in data that are systematically gathered and analysed. Glaser and Strauss’s book *The Discovery of Grounded Theory*, which was published in 1967, first articulated these strategies and advocated developing theories which are eventually grounded in the behaviour, words and actions of those under study (Goulding, 2002). With grounded theory, the researcher must work in the real environments in which the actions take place to analytically relate informants’ perspectives to the environments through which they emerge (Goulding, 2002; Douglas, 2004). Hence the emerging theory from grounded theory analysis is valid and reliable and does not require further proving or testing in the real environment because it comes directly from the real environment’s data itself (Georgieva and Allan, 2008).

Although Glaser and Strauss thought they were using the same method in grounded theory, an ideological split, which culminated in two different approaches to grounded theory data analysis, occurred. It happened in 1990 when Strauss co-authored a textbook on grounded theory with Juliet Corbin (Strauss and Corbin, 1990). The textbook, entitled *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, was intended to assist the grounded theory beginner by outlining a detailed step-by-step guide on how to use the grounded theory method. However, this publication and further revelations were considered by Glaser to be violating the belief of grounded theory (Glaser, 1992). His opposition was based on the argument that the proposed guide was too prescriptive and imposed a framework on the data analysis that forced rather than facilitated the emergence of the theory (Glaser, 1992).
According to Heath and Cowley (2004), Glaser had extended grounded theory beyond the original text to explain in more detail concepts such as theoretical sampling, theoretical coding and the use of theoretical memos, but it was Strauss and Corbin who focused on developing the analytic techniques and providing guidance to novice researchers.

Strauss and Corbin (1990) claim that grounded theory can be used to better understand any chosen phenomenon about which little is yet known. Whilst Glaser (1992) remains an adherent to the principles of the seminal grounded theory (Glaser and Strauss, 1967), his traditionalism, irrespective of a disdain for the later revisionist approach (Strauss and Corbin, 1990; 1998), assures the qualitative researcher of the values of grounded theory in developing answers to socially purposeful questions of what is happening and why.

Glaser and Strauss (1967) originally described two levels of coding, first into as many categories as possible and then the integration of the categories. Strauss and Corbin (1990), on the other hand, describe three levels of coding. Strauss and Corbin (1990) describe the first level procedures as open coding, whilst Glaser (1978) refers to substantive coding. Strauss and Corbin (1990) introduced the second level of coding, called axial coding. Strauss and Corbin’s (1990) final coding procedure is called selective coding, which is similar to the theoretical coding of Glaser (1978).

Strauss and Corbin (1990) are significantly more prescriptive in specifying the steps to be taken by a researcher in open, axial and selective coding and to follow their process model (identifying codes as causal conditions, phenomenon, context, intervening conditions, action/inaction strategies, consequences) in developing a theoretical framework. The Glaser adherent allows for the central concept to emerge inferentially from the coding process – reflecting key issues or problems as perceived by the actors being studied. Thus, following the Strauss and Corbin approach, the researcher could elect in advance to focus the observations, interviews and other data gathering on a particular issue, such as management-employee communication. Coding is then oriented around this topic, and a central concept is then sought to represent the interplay of the subjects’ and researcher’s perceptions of the nature and dimensions of the elected phenomenon. As a critique of Strauss and Corbin’s (1990, 1998) revisionist methods, the emergence of conceptual themes may not legitimately freely surface, in which case, arguably, a true ontology would not materialise (Glaser, 1992).
As the researcher is left with a basic choice between the ‘Glaserian’ and ‘Straussian’ approach, it is essential to acknowledge the dissimilarity between the two founders of the grounded theory method. It is important to recognise the overlapping use of terms in both the ‘Glaserian’ and ‘Straussian’ approaches, such as the terms axial and theoretical coding. Glaser’s advocacy is a less specific analytical approach, and Strauss and Corbin’s provision has more detailed operational guidelines. The latter offers greater potential assistance to the field researcher, who must nevertheless take particular care to avoid imposing concepts that reflect his own epistemological predilections, rather than those emerging from interaction with the study site, its participants and subsequent data.

As mentioned earlier, at the heart of grounded theory methodology are three coding procedures, which Strauss and Corbin (1990) refer to as open coding, axial coding and selective coding. The detailed coding procedure is explained in the following sections.

4.5.3 Open Coding

Open coding is the initial stage of the whole theoretical and comparative analysis process and is designed to generate theory within a grounded theory framework (Reid, 2006). Open coding occurs at the early stage of the analysis, and the primary goals are to conceptualise and categorise the data. These goals are achieved through two basic analytic procedures: making comparisons and asking questions of the data.

Open coding is the process of breaking down the data into distinct units of meaning (Goulding, 2002). Text in a full transcription of an interview is analysed line by line in an attempt to identify key words or phrases which connect the informant’s account to the experience under investigation.

Using the open coding technique, data is initially reviewed line by line (Strauss and Corbin, 1998) to enable close examination, interpretation and categorisation of information (Glaser, 1978).

Pandit (1996) elaborates that open coding refers to that part of analysis that deals with the labelling and categorising of phenomena indicated by the data. Open coding requires the application of what is referred to as the ‘comparative method’, that is the asking of
questions and the making of comparisons. Data is initially broken down by asking simple questions such as what, where, how, when and how much.

### 4.5.4 Axial Coding

According to Goulding (2002), axial coding involves a higher level of abstraction and is achieved by specifying relationships and delineating a core category or construct around which the other concepts revolve. Through axial coding, the researcher develops a category by specifying the conditions that gave rise to it, the context in which it is embedded and the action/interactional strategies by which it is handled, managed and carried out.

Strauss and Corbin (1998) defines axial coding as: “the process of relating categories to their subcategories, termed ‘axial’ because coding occurs around the axis of a category, linking categories at the level of properties and dimensions”. The purpose of axial coding is to begin the process of reassembling data that was fractured during open coding. Categories are related to their subcategories to form more precise and complete explanations about phenomena. Several basic tasks include the following:

- Laying out the properties of a category and their dimensions, a task that begins during open coding.
- Identifying the variety of conditions, actions/interactions and consequences associated with a phenomenon.
- Relating a category to its subcategories through statements denoting how they are related to each other.
- Looking for clues in the data that denote how major categories might relate to each other.

In conclusion, axial coding puts the data back together in new ways by making connections between a category and its subcategories. Thus axial coding refers to the process of developing main categories and their subcategories (Pandit, 1996).
4.5.5 Selective Coding

Selective coding is the final stage of coding in grounded theory data analysis. It builds upon the foundation of open and axial coding exercises. Strauss and Corbin (1990, p.116) define selective coding as: “the process of selecting the central core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development”. Selective coding involves the identification of the ‘core category’ (the central phenomenon that needs to be theorised about) and linking the different categories to the core category using the paradigm model (consisting of conditions, context, strategies and consequences). Often, this integration takes the shape of a process model with the linking of action/interactional sequences. Selective coding involves the integration of the categories that have been developed to form the initial theoretical framework (Pandit, 1996).

Selective coding requires the selection of the focal core, i.e. the central phenomenon that has emerged from the axial coding processes. All other core codes derived from that axial coding process must be related in some way to this focal core code, either directly or indirectly.

4.5.6 The Coding Process

The approach in this study was influenced by recent publications on grounded theory analysis, but it follows as closely as possible the combined descriptions of the methods of both Glaser and Strauss (1967) and Strauss and Corbin (1990).

Grounded theory data analysis involves searching out the concepts behind the actualities by looking for codes, then concepts and finally categories (Allan, 2003). The researcher first translated and transcribed the interview data using the computer software Express Scribe version 3.0, then copied it into a word-processing document (Appendix D). The next step was coding, which involved analysis and sorting of data and is the first step in theory development (Charmaz, 2006). The goal of coding is to fracture the data to aid in the development of theoretical concepts and rearrange it into categories that facilitate the comparison of data within and between these categories (Maxwell, 1996). The researcher
looked for recurring patterns of the passages in the document, which applied to the coding scheme, known in the system as connecting them to a ‘node’ (Appendix E). This coding is regarded as the key process because it represents the first step in the conceptualisation of the data.

The codes are then analysed and those that relate to a common theme are grouped together. This higher order commonality is called a concept (Allan, 2003). Concepts are then grouped and regrouped to find yet higher order commonalities called categories. Categories are the outcome of the whole process (Maxwell, 1996). The comparison provided an avenue to explain the phenomena that exist within the field of research interest. The researcher then embarked upon the process of cutting and pasting each coded statement into a new word-processing document (Appendix F). Each coded statement was placed within a box and grouped according to category. This process is important for revealing the common themes. Connections between the significant themes were investigated in the data. A number of the themes were dropped at earlier stages of data collection when subsequent interviews revealed them to be less theoretically important or part of another theoretical theme. The sifting process continued in tandem with data collection. If theoretical parallels could not be found, the themes were abstracted into generic descriptive labels.

4.6 Reliability, Validity and Ethical Procedures

The qualitative approach is often criticised for lack of academic rigour. This is because of the qualitative nature of the data, which are based on the perceptions and subjective interpretations of the researcher. The researcher recognised this fact and designed the research to meet the aspects of quality in terms of validity and reliability, as advocated by Bryman (1989), and Yin (1989).

The researcher needs to justify every movement, demonstrating how the overall strategy is appropriate to the social setting and the researcher-subject relationships within it. Therefore, this study has disclosed the steps involved in the research strategy in an operational way as much as possible. This can be one way of approaching the validity and reliability problem. Before embarking on the fieldwork, the researcher pre-tested the questions with practitioners and academicians who are involved in safety tasks. This
helped to improve validity and reliability, so that the written questions or questions that were to be asked orally would be consistently understood by every respondent. In interviews, the researcher had to probe respondents if they seemed to provide vague or complex answers. Multiple sources of evidence were used for evaluation of the findings and interpretations to assure construct validity. The validity of the main study is ensured by a multiple case study approach and the comparison of findings from multiple case studies.

Basically, the ethical procedures undertaken in this study comply with these requirements:

- Participation was voluntary.
- The anticipated research benefits were explained to the participants to alleviate any concerns they had about the use of the information they provided.
- The participants have the right to know the researcher’s identity, the research nature, the research objectives and the duration of the study.
- The information obtained is confidential and to be treated solely for academic purposes.

In addition, the industry is given the opportunity to validate the framework developed from the emerging themes. This industrial validation is essential to ensure that the framework is relevant to current SMS practices. Industry validation occurred through the distribution of a validation sheet to three respondents. They were asked to rate the result and comment on the suitability of the framework according to their company’s situation.

### 4.7 Conclusions

This chapter has illustrated the detailed methodology involved in the research process. The research design was chosen based on the aim and objectives. The aim is to inform an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS. Since the study focuses on Malaysian contractors working in processing plants, it is important to explore the Malaysian condition of subjects such as the development of SMS, the current issues and problems of implementation and preventive action taken to improve the situation. This helped the researcher to understand
the current SMS practices and trends, and provided comparison with the theoretical concepts. It is apparent that both the preliminary and the main study are needed to fulfil the study objectives.

In general, the research design encompassed two steps. Firstly, the preliminary study consisted of a literature review and an exploratory survey questionnaire, which were undertaken to explore and generate views concerning the current practices. In this stage, the researcher was able to identify any new themes that emerged, particularly on the implementation perspectives. Secondly, an in-depth, semi-structured interview was conducted to expand the information gained from the exploratory survey questionnaire and to refine the development of theory.

This chapter has also explained the methodology of the in-depth, semi-structured interview conducted in this study and the way data were analysed. A brief description of grounded theory was presented, as well as the three different coding techniques applied in the analysis of the in-depth, semi-structured interview data.

The following chapters present the results from the exploratory survey questionnaire and the interview data analysis.
CHAPTER 5
EXPLORATORY SURVEY QUESTIONNAIRE

5.0 Introduction

A survey was conducted in 250 construction firms listed by Trade Partners UK and CIDB. The purpose of the survey was to obtain a general knowledge and understanding of the status of SMS and safety in general among Malaysian contractors working in processing plants. Questions were posed about the elements of SMS (policy, organising, planning and monitoring, and auditing), awareness of safety and barriers to SMS implementation.

This chapter presents the exploratory analysis of the responses obtained from the survey questionnaire. The exploratory survey questionnaire was undertaken after the review of the pertinent literature.

5.1 Objective

The issue of the availability of SMS among contractors working in processing plants was determined in Chapters 2 and 3. It is clear that the adaption of SMS is dependent on the initiatives of the company. However, the majority of contractors develop SMS to fulfil their clients’ requirements, especially in processing plants, where safety is an important factor to secure a contract. This practice has, therefore, led to a lack of SMS implementation.

Given the gaps discussed in Chapters 2 and 3, the aim of this research is to explore why SMS implementation is still lacking among contractors working in processing plants, even though the safety requirements in processing plants are very high. To understand the reason behind this, one must fully understand the current safety management practices that dominate the industry. There is no clear understanding of the status of contractors’ SMS, as there has been little or no attention given to contractors working in processing plants in previous research. A survey questionnaire was distributed with the objective of determining the availability of SMS among Malaysian contractors working in processing plants, and to compile a list of the barriers to SMS implementation.
Another objective of this survey was to produce an empirical analysis of safety practices in Malaysia. Empirical research on SMS in Malaysia has received little or no attention, especially involving contractors working in processing plants. The literature review revealed a significant amount of research in various safety areas, but studies related to developing countries are very few (Jaselskis and Suazo, 1994; Cheng at el., 2004). Furthermore, as elaborated in Chapter 2, many previous studies concentrate on Western countries (Fitts, 1996; Hale et al., 1997; Smallwood, 1998; Yu and Hunt, 2004; Abraham et al., 2004; Kashiwagi and Savicky, 2004; Yule and Mearns, 2004; Teo and Ling, 2006; Abudayyeh et al., 2006).

It is essential to explore the availability of appropriate SMS and to make sure that Malaysian contractors are really familiar with safety before embarking upon the main study. Once the data was analysed, a number of key issues emerged, and these issues were later explored in greater detail during the main study.

The instrument used in this study is a questionnaire, which is useful for gathering descriptive data. Questionnaires have been used as a method of data collection for exploratory surveys in various areas (Abdul-Rahman and Alidrisyi, 1994; Ahlstrom and Westbrook, 1999; Oyelere and Turner, 2000; Themistocleous et al., 2001; Cheng et al., 2004; Abd Manaf, 2007).

5.2 Questionnaire Design

5.2.1 Content of Individual Questions

Determining the content of individual questions is very important to ensure good responses. Churchill and Iacobucci (2004) state that the content of individual questions is highly important and point out that it is largely controlled by the “researcher’s previous decisions regarding information needed, the structure and disguise to be imposed on its collection, and the method for administering the questionnaire” (Churchill and Iacobucci, 2004: pp. 239-240). To ensure thoroughness, Churchill and Iacobucci (2004) further suggest that the researcher needs to ask a few additional questions, such as: is the question necessary; are several questions needed instead of one; do respondents have the necessary information; will respondents give the information?
For this study, the questionnaire was based upon the literature review and incorporated all the variables of SMS elements, as discussed in Chapter 2 (Section 2.1.3). Specifically, the questionnaire was developed based on Health and Safety Executive (HSE) guidelines (HSE, 1998) and previous publications (Mbakaya, 1999; Veronen, 2000; Champoux and Brun, 2003; Mearns et al., 2003; Griffith, 2004) about the elements of SMS.

The questionnaire is divided into three sections. Section A contains questions related to the background of the respondents. The aim of Section A was to build a profile of the respondents’ personal and company background. Section B consists of 18 questions related to the availability of SMS. It is divided into the four stages of SMS: developing safety policy, organisation, planning and monitoring, and auditing. Section C deals with safety awareness in general. A further question regarding obstacles to SMS implementation is asked at the end of the questionnaire.

The full questionnaire is shown in Appendix B, and the information required and an explanation of the content of each question is explained in Table 5.1.

Table 5.1: Explanation of question content

<table>
<thead>
<tr>
<th>Information Required</th>
<th>Explanation of Question Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section A: About Organisation (Questions 1 to 6)</strong></td>
<td>Questions in this section are needed to gain an overview of the background of the respondents.</td>
</tr>
<tr>
<td><strong>Position of respondent:</strong> The position of respondents is sought.</td>
<td>There were various sizes of contractor (large, medium and small, based on CIDB grades 1 to 7), with different types of project and scope of work, and different levels of contractors (main contractors, subcontractors). In addition, every contractor has a different number of employees, either permanent or temporary (also known as contract workers). It is essential to know the characteristics of each respondent, as only suitable respondents, that is contractors who deal with projects in processing plants, would be asked for information.</td>
</tr>
<tr>
<td><strong>Workplace of respondent:</strong> The respondents are required to indicate the place of work, either head office or project site.</td>
<td></td>
</tr>
<tr>
<td><strong>Company’s grade:</strong> The respondents are required to indicate the grade of the company they work for. The grade of the company is based on the Malaysian Construction Industry Development Board (CIDB). The grades are from G1 to G7. Details of the grade have been stated in the questionnaire.</td>
<td></td>
</tr>
<tr>
<td><strong>Type of contractor:</strong> The respondents have to indicate whether the company is a main contractor or subcontractor.</td>
<td></td>
</tr>
<tr>
<td><strong>Project involved:</strong> Four types of project have been</td>
<td></td>
</tr>
</tbody>
</table>
stated in the questionnaire. The respondents have to indicate the type of project involved in by their company.

**Number of employees**: The respondents have to indicate the number of employees within their company. Four options have been given.

<table>
<thead>
<tr>
<th>Section B: Safety Management System (Questions 7 to 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section B is divided into the four elements of SMS, as follows:</td>
</tr>
<tr>
<td><strong>Policy</strong>: The respondents are asked if their company had a safety policy. Furthermore, the respondents are asked to indicate the availability of the policy to all staff, their understanding of the policy and the affect of the policy on the way they work.</td>
</tr>
<tr>
<td><strong>Organisation</strong>: The respondents are asked to indicate whether their company has a department responsible of safety. Furthermore, information regarding the person in charge of safety was sought.</td>
</tr>
<tr>
<td><strong>Planning and Monitoring</strong>: The respondents are asked eight questions regarding planning and monitoring. They are asked to indicate the availability of safety planning, accident rates, safety record, risk assessment within their company and the involvement of directors in monitoring safety.</td>
</tr>
<tr>
<td><strong>Auditing</strong>: The respondents are asked if auditing of safety is practised within the company.</td>
</tr>
</tbody>
</table>

This section gains an overview of the four elements of SMS (based on Chapter 2 Section 2.1.3). Questions in this section ask about the respondents’ basic understanding of SMS. Such data provides clear evidence of how available SMS is among the contractors.

<table>
<thead>
<tr>
<th>Section C: Safety Awareness (Questions 25 to 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this section, questions related to safety awareness are asked. The respondents are asked to indicate their knowledge related to safety regulations, the situation within their company and safety training.</td>
</tr>
<tr>
<td><strong>Obstacles</strong>: Question 36 is about obstacles to SMS implementation. A list of possible obstacles is given in the questionnaire.</td>
</tr>
</tbody>
</table>

It is important to know the level of safety awareness of each respondent, as this may influence their responses to other questions. Apart from safety awareness, information regarding obstacles to SMS implementation was sought. This information is important, as it relates to the effectiveness of SMS implementation.
5.2.2 Form of Response to Each Question

The next step in designing a questionnaire is to decide what form of response to each question might fit the needs of the survey. The form of response to questions can be classified as either closed-ended (also known as multichotomous) or open-ended (Churchill and Iacobucci, 2004: p. 242; Pallant, 2006: p. 7). Open-ended questions allow the interviewee to respond in the way they feel is most appropriate. Closed-ended questions can take the form of multiple choices, two choices, or represent a scale (Churchill and Iacobucci, 2004). For this study, only two questions were open-ended and the rest were closed-ended. Closed-ended responses are generally easier to ask, easier to answer, reduce interviewer bias, have less potential for errors being recorded, make data analysis much easier and provide better comparability between respondents (Tull and Hawkins, 1993; Aaker et al., 2007).

The first section of the questionnaire in this study offered multiple answers to the respondents. In Sections B and C, respondents were given three choices of answer to the question; yes, no and don’t know.

5.2.3 Question Wording and Sequence

The choice of words and phrases employed in a questionnaire is extremely crucial in mail surveys. The wording of the questions is in fact the most difficult part in questionnaire design, but it is certainly one of the most critical to get right. Churchill and Iacobucci (2004) argue that choosing the right phrase in every question is vital, as poor question phrasing can cause respondents to refuse to answer it, even though they agreed to cooperate in the study.

There are some guidelines to follow to ensure the coherence and appropriateness of the questions. Some of the guidelines and principles are: use complete sentences and questions; use simple words; avoid ambiguous words and questions; avoid leading questions; avoid alternatives; avoid assumptions; avoid double-barrelled or double-negative questions; be careful of jargon and technical expressions; use a loaded question, if necessary, but be cautious; have the questions reviewed by experts and potential
respondents; and adopt or adapt questions that have been used successfully in other surveys (Fink, 1997; Churchill and Iacobucci, 2004).

Apart from the above guidelines on wording, the determination of the question sequence is also a highly important factor to take into account during the development of the questionnaire. Churchill and Iacobucci (2004) highlight five points in organising the questions: use simple and interesting open questions; use a funnel approach – start with broad questions and progressively narrow down the scope; design branching questions with care; ask for classification information last; and place difficult or sensitive questions later in the questionnaire.

The researcher tried to follow the above guidelines as closely as possible. For instance, instead of the word ‘safety’, the term ‘health and safety’ was used in the questionnaire, because this term is commonly used in Malaysia. The funnel approach was adopted. The easiest question was used as an introduction, followed by more specific questions.

5.2.4 Questionnaire Layout

The physical appearance or layout of a questionnaire must not be overlooked when seeking a clear response. The researcher must design a questionnaire that “looks professional and relatively easy to answer”. Slack and unattractive questionnaires will produce a poor response, as respondents may feel that “the study is unimportant, and hence refuse to co-operate, despite the researchers’ assurance that it is important” (Churchill and Iacobucci, 2004: p. 252). On the other hand, “well-formatted questions assist response rate and accuracy of answers” (Balnaves and Caputi, 2001: p. 84). To ensure a sound response, Sproull (1988) states that the questionnaire should be “professionally typed and printed so that its appearance gives the impression of credibility and professionalism”.

A clear introduction and ending to the questionnaire is an important aspect in its design to determine its direction and the estimated time it will take to complete (Sproull, 1988). A covering letter is crucial to introduce the study to potential respondents (Czaja and Blair, 1995) and to persuade the respondents to reply (Sproull, 1988). The covering letter should answer the following questions, which might come from the respondents: what is the
Choosing response formats must also be looked at when designing questionnaires. Balnaves and Caputi (2001) suggest that the response format must be “consistent in the use of the format, and consistent in the type of response required for that format”. Moreover, response format should also be well structured to facilitate quick and easy responses (Sproull, 1988).

For this study, the researcher provided a clear introduction and directive that the respondents should follow when completing the questionnaire. Specific objectives and purpose were explicit from the start. This was to ensure focus and to assist the respondent to answer the questionnaire accurately. The format of the questions was clear and consistent and instructions were given throughout. For example, respondents were specifically instructed to tick only one answer if the question required only one answer. For multiple-response questions, respondents were instructed to tick every applicable answer.

With regard to the layout, the researcher made a conscious effort to make sure that the appearance of the questionnaire was proficient. Every question was numbered and given a sub-topic to guide each respondent. Font size and type and the size of the answer boxes were standardised to make the questionnaire look attractive and user friendly. A covering letter was attached to each questionnaire which explained the aim of the research, introduced the researcher, stressed the confidentiality of the response and asked the respondent to help by returning the questionnaire at the appointed time.

A questionnaire should not be long and complicated (Greenfield, 1996). Thus this questionnaire was short and straightforward, as the aim was to gain an insight into the current status of SMS among Malaysian contractors working in processing plants. Greer et al. (2000) cite that most researchers agree that a questionnaire should be kept short to get good responses. Previous researchers have confirmed that respondents are more willing to complete a short questionnaire than a long one. Shorter questionnaires are likely to produce better response rates than longer ones. Since this study involved the industrial population (refer to Section 5.3.1), the questionnaires were likely to be

study about; who is conducting it; and why is the study important? (Czaja and Blair, 1995)
completed during company time. The industrial population may be more willing to complete a short questionnaire than a long one because less time, energy and effort are likely to be consumed (Greer et al., 2000).

5.2.5 Questionnaire Revision and Pre-Test

Questionnaire revision and pre-testing is the key to good design and administration. It helped the researcher to ensure clarity and precision in the design and execution of the research questionnaire. In this study, the questionnaire required four revisions before it was distributed. The questionnaire was sent to four selected experts in the area to verify its validity. The revisions were done to simplify complicated terms by replacing them with straightforward and appropriate words, to clarify unclear questions, to include an open-ended section to elicit respondent views and to reformat questionnaire design for ease of answer selection.

5.3 Data Gathering

5.3.1 Population and Sample

The population was sampled, as it was not possible to collect data from all Malaysian contractors working in processing plants owing to the limitations of time, money and access. A definition of the population has been elaborated upon by Tull and Hawkins (1993: p. 537) in terms of elements, sampling units, extent and time. This research focuses upon companies involved in any mechanical or civil construction project in Malaysian processing plants. The population, therefore, includes all Malaysian contractors who are directly involved with projects in processing plants.

The population of this study is categorised as an industrial population. According to Greer et al. (2000), an industrial population refers to those respondents who receive questionnaires at their place of employment. One disadvantage of industrial populations is that they are less likely to respond to survey questionnaires (Greer et al., 2000).

This study adapted probability sampling to distribute the questionnaire, where a suitable sampling frame was identified. The sampling frame is the listing of the elements from
which the actual sample will be drawn (Churchill and Iacobucci, 2004). This differs from the whole population, as it is only one means by which the population may be represented. The sampling frame for this study was the list of hundreds of contractors that are already in the Trade Partners UK and CIDB lists (details of Trade Partners UK and CIDB are explained in Chapter 4 Section 4.4).

A low response rate can be a problem since it may result in non-response bias, where those who do not return the questionnaire may have a different viewpoint to those who do. The safe way to deal with non-response is to reduce it to a sufficiently low level. This can be accomplished by taking several measures to ensure a reasonable rate of response.

In this research, the researcher attached a simple covering letter to each questionnaire. The covering letter was written on an official letterhead and was no more than one page in length. An explanation of the research purpose and usefulness along with an assurance of confidentiality was given. In addition, a stamped and self-addressed envelope was provided for the respondents. Follow-up telephone calls were also made after a predetermined period.

5.3.2 Questionnaire Distribution

The final questionnaire was sent to every respondent together with a personalised official covering letter (Appendix A). A total of 250 questionnaires were sent to construction companies in Malaysia. Respondents were contractors performing work in processing plants.

The questionnaire was distributed in two phases. In the first phase, the questionnaire was distributed directly by hand to 17 respondents. A mailed self-administered completion was adapted in the second phase. A mail survey is a popular research method used by various researchers and academicians (Greer et al., 2000). A survey instrument, consisting of a covering letter, questionnaire and freepost envelope, was administered to another 233 respondents. A month and a half after the questionnaires were distributed, the researcher contacted the respondents by telephone and e-mail, as such a follow-up can enhance the response rate (Kelley, 1999: p. 87). However, not all telephone calls and e-mails were answered.
A total of 12 questionnaires were returned undelivered. In total, 63 completed questionnaires were returned. Sixty-two questionnaires were usable, yielding an overall response rate of 24.8 percent, as shown in Table 5.2.

### Table 5.2: Number of questionnaires distributed and returned

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of Questionnaires</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of questionnaires distributed</td>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>Questionnaires distributed by hand</td>
<td>17</td>
<td>6.8</td>
</tr>
<tr>
<td>Total number of completed questionnaire received by hand</td>
<td>17</td>
<td>6.8</td>
</tr>
<tr>
<td>Questionnaires distributed by mail</td>
<td>233</td>
<td>93.2</td>
</tr>
<tr>
<td>Total number of completed questionnaire received by mail</td>
<td>46</td>
<td>18.4</td>
</tr>
<tr>
<td>Total questionnaires returned undelivered</td>
<td>12</td>
<td>4.8</td>
</tr>
<tr>
<td>Total number of completed questionnaires</td>
<td>63</td>
<td>25.2</td>
</tr>
<tr>
<td>Usable</td>
<td>62</td>
<td>24.8</td>
</tr>
<tr>
<td>Not Usable</td>
<td>1</td>
<td>0.4</td>
</tr>
</tbody>
</table>

The response rate is considered reasonably adequate given the low rate of response associated with mail surveys experienced in previous studies in Malaysia (Abdul-Rahman and Alidrisyi, 1994; Rahman, 2001; Sohail and Hoong, 2003; Ahmad Anuar, 2005; Hasnan, 2006). Another reason for the low response rate could be the sensitive nature of the subject matter (Kheni, 2008), where people are reluctant to co-operate. Furthermore, for the purpose of statistical analysis, the rule of thumb for survey return indicates that a minimum of 30 responses is normally adequate (Roscoe, 1975; The Economist, 2001: p. 121; The Economist, 1997, as cited in Saunders et al., 2003). In this research, the response rate is therefore sufficient for analysis.

### 5.4 Findings and Discussion

The data obtained from the questionnaire was analysed using the Statistical Package for the Social Sciences 12.0 (SPSS) software. Responses to the survey questions are presented as frequencies expressed as percentages. This method has been used by several researchers in various fields (Mayhew et al., 1997; Mbakaya et al., 1999; Lee and Leung,
5.4.1 Profile of Respondents

Table 5.3 to Table 5.8 present the characteristics of the respondents. Table 5.3 shows the respondents’ position in the company. For the purpose of analysis, the position was designated as one of three management hierarchical levels (O'Dea and Flin, 2003): corporate (or senior level) management; middle (or site level) management and supervisors (also known as first-line managers or team leaders); and one hierarchical level of workers.

In the vast majority of companies, it was top management personnel (corporate management and middle management) who responded to the questionnaire. Seventeen respondents (27.4%) were corporate managers and 34 (54.8%) were middle managers. Only seven respondents (11.3%) were supervisors and four (6.5%) were workers. This is due to the distribution method: the questionnaires were sent to the top management. This has definitely affected some of the responses, as most of them tend to be ideal in their answers, unconsciously expressing desirable conduct rather than actual behaviour or situations (Samman, 2000). Even though an unequal number of each position responded, this is still valid, as it is consistent with previous research (Cox et al., 1998).

Table 5.3: Position within the company

<table>
<thead>
<tr>
<th>Position</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate manager</td>
<td>17</td>
<td>27.4</td>
</tr>
<tr>
<td>Middle manager</td>
<td>34</td>
<td>54.8</td>
</tr>
<tr>
<td>Supervisor</td>
<td>7</td>
<td>11.3</td>
</tr>
<tr>
<td>Worker</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>Total number of respondents</td>
<td>62</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 5.4 presents the respondents’ place of work. There are 34 respondents (54.8%) who perform their job within the head office only. Twenty respondents (32.3%) perform their job within the project site only, while only eight (12.9%) perform their job both in the head office and project site.

**Table 5.4: Place of work**

<table>
<thead>
<tr>
<th>Place of Work</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head office</td>
<td>34</td>
<td>54.8</td>
</tr>
<tr>
<td>Site-project site</td>
<td>8</td>
<td>12.9</td>
</tr>
<tr>
<td>Head office and project site</td>
<td>20</td>
<td>32.3</td>
</tr>
</tbody>
</table>

The study covered all sizes of company, large, medium and small, which fall into seven grades of contractors according to the Malaysian Contractors Industry Development Board (CIDB). The grading is explained in Chapter 4 (Section 4.3). Table 5.5 presents the respondents’ company grade. There are six respondents (9.7%) representing G1 companies, four (6.5%) representing G2 companies, five (8.1%) representing G3 companies, four (6.5%) representing G4 companies, seven (11.3%) representing G5 companies, five (8.1%) representing G6 companies and 31 (50%) representing G7 companies.

**Table 5.5: Grade of company**

<table>
<thead>
<tr>
<th>Grade of Company</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>6</td>
<td>9.7</td>
</tr>
<tr>
<td>Grade 2</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>Grade 3</td>
<td>5</td>
<td>8.1</td>
</tr>
<tr>
<td>Grade 4</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>Grade 5</td>
<td>7</td>
<td>11.3</td>
</tr>
<tr>
<td>Grade 6</td>
<td>5</td>
<td>8.1</td>
</tr>
<tr>
<td>Grade 7</td>
<td>31</td>
<td>50</td>
</tr>
</tbody>
</table>

There are 45 respondents (72.6%) involved as main contractors only. Eight respondents (12.9%) are involved as subcontractors only, while nine (14.5%) are involved as both...
main and subcontractors. The breakdown of the respondents’ type of contractor is shown in Table 5.6.

Table 5.6: Type of contractor

<table>
<thead>
<tr>
<th>Type of Contractor</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main contractor</td>
<td>45</td>
<td>72.6</td>
</tr>
<tr>
<td>Subcontractor</td>
<td>8</td>
<td>12.9</td>
</tr>
<tr>
<td>Main and subcontractor</td>
<td>9</td>
<td>14.5</td>
</tr>
<tr>
<td>Total number of respondents</td>
<td>62</td>
<td>100</td>
</tr>
</tbody>
</table>

It is the nature of contractors to be involved in various types of project. Details of the type of projects in processing plants are explained in Chapter 2 (Section 2.2.1). Out of 62 respondents, 12 (19.4%) represent companies which are involved in maintenance projects only, one (1.6%) represents a company which is involved in shutdown projects only, nine (14.5%) represent companies which are involved in new projects only and four (6.5%) represent companies which are involved in other projects only.

It is common for the contractors to work on several different types of project at the same time. There are nine respondents (14.5%) representing companies involved in maintenance and shutdown projects, 13 (21%) representing companies involved in maintenance, shutdown and new projects, ten (16.1%) representing companies involved in maintenance and new projects and three (4.8%) representing companies involved in new projects and other projects. One respondent (1.6%) did not answer this question. The breakdown is illustrated in Table 5.7.

Table 5.7: Type of project

<table>
<thead>
<tr>
<th>Type of Project</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>12</td>
<td>19.4</td>
</tr>
<tr>
<td>Maintenance, shutdown</td>
<td>9</td>
<td>14.5</td>
</tr>
<tr>
<td>Maintenance, shutdown, new project</td>
<td>13</td>
<td>21.0</td>
</tr>
<tr>
<td>Maintenance, new project</td>
<td>10</td>
<td>16.1</td>
</tr>
<tr>
<td>Shutdown</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Shutdown, new project</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>New project</td>
<td>9</td>
<td>14.5</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>No answer</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Total number of respondents</td>
<td>62</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 5.8 illustrates the breakdown of the number of employees. Out of 62 respondents, 40 (64.5%) represent companies with fewer than 100 employees, 12 (19.4%) represent companies employing between 101 and 250 people, seven (11.3%) represent companies employing between 251 and 500 people and three (4.8%) represent companies with more than 500 employees. This finding reveals that most contractors do not have large numbers of employees. As the nature of construction work demands a large number of workers to execute the project, there is a possibility that most contractors use contract workers (also known as part-time or temporary workers).

Table 5.8: Number of employees

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100</td>
<td>40</td>
<td>64.5</td>
</tr>
<tr>
<td>Between 101 and 250</td>
<td>12</td>
<td>19.4</td>
</tr>
<tr>
<td>Between 251 and 500</td>
<td>7</td>
<td>11.3</td>
</tr>
<tr>
<td>More than 500</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>Total number of respondents</td>
<td>62</td>
<td>100</td>
</tr>
</tbody>
</table>

The aim of the questions in this section was to seek the background of the respondents. It is essential to know the characteristics of each respondent, as only suitable respondents would be asked for information. This study did not intend to gain responses from only one type of respondent. Thus the questionnaire was distributed to all levels of employee and all level of company (large, medium and small). This is because safety requirements from clients are applicable to all types of contractors.

5.4.2 Overview of Safety Management Systems

This part of the questionnaire aimed to determine whether the contractors have developed comprehensive long-term and permanent objectives through a safety policy. The purpose of the safety policy is to demonstrate management commitment and responsibility towards safety matters. As shown in Figure 5.1, 95.2% of the respondents claim that their companies have a safety policy. Of all respondents whose companies has an available safety policy, only one (1.69%) states that the policy is not available to all staff, while two (3.38%) do not know whether the policy is available to all staff or not. Of the respondents, 96.6% understand the safety policy of the company. Even if such a policy exists, only 84.7% of the respondents state that the policy really affected the way they
work. The positive result in this section may be due to the fact that safety requirements in processing plants are very strict and an important criterion during the bidding process. Contractors, therefore, need to show the clients that a safety system is available in their company.

Figure 5.1: Safety policy

Figure 5.2 presents the findings on organising safety. Only 66.1% of the respondents state that their company has a department responsible for safety. That means that most of the respondents have a safety policy, but not a well-structured organisation to implement the system. In addition, only 79% of the respondents claim that their company allocates responsibilities for safety to specific people, and 65.3% of the respondents state that these people are dedicated to safety tasks alone. It is obvious that safety is being handled only by the responsible safety personnel, such as the safety officer, and is not taken as the overall responsibility of all employees in the organisation. The respondents were asked whether specific safety training has been provided to the person responsible for safety; 93.8% of respondents state that the person responsible for safety has had specific training and has qualifications in safety.
Figure 5.2: Organising

From Figure 5.3, it appears that the planning and monitoring of SMS among respondents is good. The high positive response was expected because one safety requirement in processing plants is to provide a safety plan when submitting tender documentation to clients. A safety plan is important, as it serves as the foundation for an effective safety programme. A written safety plan involves the documentation of project-specific safety objectives, goals and methods for achieving success. This element should be specific to the project. Additionally, the company should have a written safety plan that defines the safety objectives, goals and direction of the company as a whole. In the case of contractors, the safety plan is an important selection criterion during the bidding process.

Of the respondents, 80.6% state that goals for accident rates are set and monitored and 80.6% claim that their company has accurate records of injuries, ill health and accidental loss and that follow-up reports are required for the accident report. And 83.9% of the respondents state that employees are informed of accident rates and progress. For the implementation of the risk assessment procedure, 75.8% of the respondents gave a positive answer.

Of the respondents, 85.5% agree that their company informs workers of the risks present and the necessary control measures to take. Top management involvement is a key element in SMS implementation, and 91.9% of the respondents claim that their
directors/managers do monitor safety issues within the company. This encouraging and positive result indicates that top management has a serious involvement in safety matters.

<table>
<thead>
<tr>
<th>Safety plan/ procedure</th>
<th>Goals on accident rate</th>
<th>Accident records</th>
<th>Accident follow-up</th>
<th>Accident information to staff</th>
<th>Available risk assessment</th>
<th>Information on risk</th>
<th>Directors'/managers' involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>90.3</td>
<td>80.6</td>
<td>80.6</td>
<td>80.6</td>
<td>83.9</td>
<td>75.8</td>
<td>85.5</td>
<td>91.9</td>
</tr>
</tbody>
</table>

**Figure 5.3: Planning and monitoring**

 Whereas a safety audit is a prerequisite for safe working conditions, only 77.4% of the respondents claim that their company carries out safety audits, and 77% state that the audits involve staff at all levels. This result is presented in Figure 5.4.

**Figure 5.4: Safety audit**
5.4.3 Safety Awareness

In this section, safety awareness information was sought. The purpose of this section is to seek contractors’ knowledge, concern and understanding of general safety issues. Surprisingly, as illustrated in Figure 5.5, only 74.2% of the respondents are aware of OSHA 1994. The lower response rate may be due to the ignorance of contractors of their duty and roles according to OSHA 1994. Of the respondents, 61.3% state that the legislation regarding safety is difficult to interpret.

![Figure 5.5: Safety legislation](image)

The data further reveals that 91.9% of respondents are well informed about safety issues within the company. Of the respondents, 72.6% are satisfied with the safety situation within their company. Interestingly, however, only 58.1% state that a themed campaign has ever been held in their company. It could therefore be said that management pays less attention to providing safety awareness to their workers. This finding further reveals that only 38.7% of the respondents claim that an external safety consultant is brought in to advise on safety matters. Only 82.3% of respondents know who is responsible for safety in their organisation. The breakdown of these results is shown in Figure 5.6.
The data shows that 95.2% of the respondents claim that their employer ensures that safe working practices are followed, but only 79% of the respondents mention that they receive safety training within the company. The data further reveals that only 62.9% of the respondents receive formal safety training (a certified course). This indicates that Malaysian contractors working in processing plants have a low interest in safety training. Meanwhile, 98.4% of the respondents claim that they learn about safety at work (see Figure 5.7).

Questions regarding obstacles to SMS implementation were asked. This type of question was posed to determine factors that hinder the effectiveness of SMS implementation.
More than half of the respondents agree that cost (62.9%) is the main obstacle to the implementation of SMS, while employees’ attitude (46.8%) is also an important problem to cope with. Respondents also claim that there is lack of training (38.7%) within the company, and lack of time spent on safety (35.5%). Safety is not a priority, as compared to production (32.3%), and paperwork and documentation (30.6%) are lacking. The rest of the obstacles include top management/manager attitudes (24.2%), lack of staff (22.6%), employee demands (22.6%), not profitable (22.6%), planning difficulties (21%) and others (9.7%). The breakdown of the obstacles is presented in Figure 5.8.

The finding is important and shows that even though contractors admit that they have a safety policy and plan, implementation problems still exist. It is obvious that having a good safety plan and policy does not mean that contractors will have a positive attitude towards effective SMS implementation. It could therefore be said that having a complete and thorough safety policy and plan does not mean that effective implementation of SMS can be achieved.

**Figure 5.8: Obstacles to SMS implementation (percentage)**
5.4.4 Summary of Findings and Discussion

The aim of the survey was to explore the availability of SMS and to identify obstacles to and issues of SMS implementation among Malaysian contractors working in processing plants. The questionnaire was designed by incorporating the elements of SMS and further sought information regarding safety awareness and obstacles to the implementation of SMS. From the literature it is obvious that the current safety status of contractors working in processing plants is unknown. Therefore, this survey, which also served as a preliminary study, provided some general ideas on the safety status of Malaysian contractors working in processing plants. The findings of this survey are important, as they acted as a guide to the focus of the study.

The data reveals that management commitment and participation of contractors working in processing plants is strong in terms of the availability of a safety policy and safety plan. This response is expected because a safety plan is crucial in the construction industry (Raglan, 2003) and should be included in the tender document during the bidding process. In addition, as contractors perform work in processing plants, a safety plan is much more critical because the safety requirements of the clients are very demanding.

This result, however, contradicted the statement in The Star (2003), which claimed that only 20% of Malaysian companies involved in processing plant contracts comply with safety regulations. In addition, the results of the exploratory survey questionnaire contradict the evidence revealed in the literature about Malaysia’s safety background. Safety performance in Malaysia is still unsatisfactory (Thye, 2001; A.Rahim et al., 2003; Rampal and Nizam, 2006). For instance, to date, the number of accidents involving contractors in processing plants is still alarmingly high (Kong, 2001; Mohd Salleh, 2002; New Straits Times, 2002; Basri and Kumar, 2006; The Star, 2006; Shaluf and Ahmadun, 2006; Zainudin et al., 2006; DOSH, 2009). Hence there is a likelihood that compliance-orientation might exist; however, a lack of SMS implementation might also exist.

This contradiction might be due to several factors. One reason might be that the majority of the respondents from top management, who mostly tended to answer positively (Samman, 2000). In addition, as cited in Tam et al. (2003), many contractors put
commitments on paper but actually behave differently. Many contractors have developed SMS due to regulatory enforcement (Fitts, 1996; Hale et al., 1997; Abudayyeh et al., 2006), the client’s requirements (Fitts, 1996; Smallwood, 1998; Abraham et al., 2004; Yu and Hunt, 2004; Teo and Ling, 2005; Abudayyeh, 2006) and industry pressure (Fitts, 1996). Hence the implementation of safety by contractors is still lacking (Fitts, 1996). This is a situation that should be investigated more deeply.

According to the data, the implementation issue might be the reason that the safety record of contractors working in processing plants is so bad. The findings indicate that nearly half of the respondents do not have a specific safety department. A safety department, as a subordinate of the organisation, is important to monitor safety activities and the programme. Each subordinate is important in promoting safety (Fang et al., 2004). Failure within the system arises when the organisational structure is not clear. Safety is not the responsibility of a safety-competent person alone; however, a common misconception is that only the person holding a safety position, for instance a safety officer, will deal with safety matters. Top management will normally assign one person alone to carry responsibility for safety. In this research, many responses have revealed that safety is the sole responsibility of the safety-competent person. This means that safety is still an isolated matter where only specific safety personnel are in charge of safety matters.

The findings of this study have exposed the lack of safety information flow. Many respondents state that a themed campaign is not practised. Themed campaigns are an effective method of creating safety awareness among workers.

The survey revealed that safety training is of less concern. Training is essential to motivate contractors to increase safety awareness (Harrington et al., 2004). Previous research has discussed how critical safety training is to all parties involved in processing plants due to the advanced technology, processes and working arrangement (Tombs, 1994).

Another important finding that needs attention is the issue regarding obstacles to SMS implementation. The result of the survey suggests that despite the availability of a safety policy and plan, obstacles to SMS implementation do arise. Most respondents agree that
costs, employee attitude and lack of training are the most common obstacles. Other important obstacles are lack of time, priority to productivity, paperwork and management attitude. The data corroborates previous research that highlights the obstacles of SMS implementation by contractors. However, most research ranks the obstacles (Kartam et al., 2000; Lee, 2001; Tam et al., 2004). Little attention has been given to exploring the underlying causes of each obstacle. This important finding led to a further stage of the study, which aims to better understand the root causes of the obstacles to effective SMS.

The exploratory survey questionnaire was conducted after the literature review. This is because the literature review failed to determine the current safety status of contractors working in processing plants. The exploratory survey questionnaire is important as a preliminary study step, because the current status of SMS among Malaysian contractors working in processing plants was not clear enough to start with and required further investigation. Several issues and problems were encountered at this stage. The reason that these issues and problems arose needs further investigation. From the exploratory survey questionnaire, several issues that need further exploration have been highlighted, as shown in Figure 5.9.

1. What encourages contractors to develop SMS?
2. How effective are Malaysian contractors working in processing plants in implementing SMS?
3. What are the underlying factors of the obstacles to implementing SMS?
4. Could it be possible to allocate the issues and problems of SMS implementation according to the internal and external contingencies factors (as discussed in Section 2.4, p. 42)?

Figure 5.9: Research questions about the effective SMS implementation of Malaysian contractors working in processing plants

At this stage, the results offer no explanation but should be investigated in greater detail to discover why these issues are regarded as being important. These issues, though highlighted by the respondents, require further explanation, as the respondents’ responses on each issue were not fully gathered at this point.
5.5 Limitations and Constraints

This study covered only construction companies located in Kuala Lumpur, Melaka, Johor, Pahang and Terengganu. This was due to the location of the processing plants. The variables included in this research are based on a thorough review of the relevant literature. However, possibilities do exist that some significant variables were overlooked, or some complex interactions of variables were misinterpreted. Future research will help to determine if any factors were omitted. The researcher also encountered difficulties in gaining a good response rate for the survey, even though several measures were taken to maximise it. Previous researchers have highlighted this as a major problem in conducting survey-based research in Malaysia. This is explained in Chapter 4. Further research must clearly overcome the problem of response rate.

5.6 Conclusions

These findings have helped me to focus on the issues to be investigated during the next stage of the study, an in-depth, semi-structured interview. Having analysed the results from the exploratory survey questionnaire, the findings have helped the researcher to focus on issues that are regarded as important or relevant to the contractors, and have provided an opportunity to probe these issues in interviews with each of the individual contractors. For instance, the findings regarding obstacles to SMS implementation have provided some basic guidelines about which are the most important to give consideration to in the interview session. If the exploratory survey questionnaire had not been undertaken as an initial priority, the interviews would not have been focused and would have led to too many variations in the answers with too much influence from the literature, without knowing which issues are the most important to the contractors.

The survey questionnaire is exploratory in nature. In this study, the exploratory survey questionnaire was designed to elicit reactions from the contractors concerning SMS status. The output from the exploratory survey questionnaire was helpful in developing further issues, which were later explored with individuals via in-depth, semi-structured interviews. The result from the exploratory survey questionnaire should not be considered representative of all contractors due to the limitations of the non-random nature of respondent recruitment and the small size of the return. However, the findings from the
survey provide a great deal of insight and direction to underpin further work at the next stage of the study. In the following chapter, the findings from the in-depth, semi-structured interviews are presented, followed by my initial interpretation of the meaning and significance of these findings.
CHAPTER 6
SEMI-STRUCTURED INTERVIEWS

6.0 Introduction

After reviewing the relevant literature, and seeking the current status of safety implementation, the next step was to comprehend the problems of safety implementation within the context of Malaysian construction companies working in processing plants. This was done through semi-structured interviews. The semi-structured interview is recognised as a means of extracting a deeper and richer understanding of the issues that are being explored.

While the preceding chapter revealed the current safety status with regard to SMS of contractors working in processing plants, this chapter presents the detailed results gathered from the data collected through semi-structured interviews. This chapter is presented in two sections. The background of the respondents is presented in the first section. The major section of this chapter presents the findings of the emerging themes using the grounded theory analysis method.

6.1 Background of the Respondents

The objective of the semi-structured interview is to gather relevant data from players in the industry on the issues highlighted. The semi-structured interviews supplement the data obtained from the literature review and the earlier exploratory questionnaire survey. Conducting the semi-structured interview helped to highlight recent issues that did not appear in the published literature, therefore it was certainly a significant method of understanding and retrieving information about the latest trends, perceptions, changes and challenges in an industry that has a small number of players.

Interviews with selected respondents were conducted in Malaysia. Interviews were based on the different background of contractors on specific issues regarding safety implementation experienced by them. The approach to the interviews was of an open-ended nature and structure, although a set of standard or structured questions were prepared as a guideline to ensure focus and to ease the analysis process. The following are details of the respondents’ companies.
6.1.1 Company A (Respondent’s Code: STT)

Company A was established in 1995. The main activities are electrical testing, supervising and maintenance services and electrical consultancy. Company A is registered with a Grade 5 CIDB license. There are 20 full-time employees altogether. The company does not have specific workers due to the nature of the services it provides. If the company requires workers, they recruit them from an associate company. There is a flexible hierarchy within the company. The structure comprises directors, an engineering department, a technical department and an accounts and administration department. The organisational structure changes according to the nature of the project.

The reason for SMS development is for tendering purposes. The company does not have a job function for safety responsibility or a specific safety department.

6.1.2 Company B (Respondent’s Code: FGR)

Company B is a civil contractor company which was established in 1998. The core business is civil and maintenance work, for instance building maintenance and construction, ground surface maintenance and site clearing and preparation. Company B is registered with a Grade 3 CIDB license. There are 20 permanent employees, which hold management positions. Workers are employed on a temporary basis. The company has an operational organisational structure, which changes depending on the nature of the project. The structure consists of a managing director, a business and development department, an operations department, an administration and finance department and a site department. The company does not have a job description for safety responsibility or a specific safety department.

6.1.3 Company C (Respondent’s Code: MM)

Company C was established in 1991. Company C deals with refinery, petrochemical and power plant maintenance services such as storage tank overhaul and repair, heat exchanger maintenance, valve overhaul and testing and unfired pressure vessel and boiler overhaul. Company C is registered with a Grade 7 CIDB license. There are 13 permanent employees in the management team and 18 permanent skilled workers as a core project
team. These permanent skilled workers are in charge of supervision on the project sites. Other workers are hired by contract on a project-to-project basis. The company has a formal hierarchical structure, which consists of a managing director, an executive director, a general manager, an operations department, a finance and administration department and an engineering and technical department. There is a health, safety and environment co-ordinator and a safety supervisor working within the engineering and technical department.

### 6.1.4 Company D (Respondent’s Code: HPM)

Company D is a company whose parent company (headquarters) is based in the UK and has over 20 years of experience in providing equipment and manpower to ensure correct and controlled tightening of critical joints. Company D is an established provider of products and services to the oil and gas, petrochemical, civil and heavy engineering and power generation industries. Company D is registered with a Grade 5 CIDB license. There are 17 permanent employees.

The safety practices of Company D are based on the practices of the parent company. An SMS is developed, as it has been developed by the parent company. All safety procedures are based on the parent company, for instance PPE and training. Trainers from the UK have trained the employees.

### 6.1.5 Company E (Respondent’s Code: CW)

Company E’s parent company is based in Japan and it was incorporated in 1974. The main activities are engineering, procurement, construction and consultancy services for processing and industrial plants, primarily for oil and gas-related industries. Company E is registered with a Grade 7 CIDB license. There are more than 60 technical staff employed by the company.

The company has a formal hierarchical structure, which consists of a managing director, a general manager, a project department, a finance and administration department, an engineering department and a quality, health, safety and environment department.
6.1.6  Company F (Respondent’s Code: TIK)

Company F started in 1983. Company F specialises in industrial insulation. Other activities include fire proofing, refractory, scaffolding and direct materials sales. Company F is registered with a Grade 3 CIDB license. There are around 20 permanent employees and contract workers are hired as required by the project.

The company has a simple organisational structure which consists of managing directors, a project manager and an administration account executive. Supervisors are assigned according to projects and/or clients. There is no specific safety position or department.

6.1.7  Company G (Respondent’s Code: TT)

Company G was incorporated in 1986 as an engineering fabricator and contractor which provides services to the oil and gas, petrochemical and power generation industries. Activities range from the shop fabrication of process equipment and ancillary items to planning construction and plant maintenance. Company G is registered with a Grade 7 CIDB license. There are 130 permanent employees and the company hires between 50 and 60 contract workers during the execution of any project.

Company G has a safety department with a specific safety manager and safety officer. It has a standard safety procedure.
<table>
<thead>
<tr>
<th>Company</th>
<th>Position</th>
<th>Services Provided</th>
<th>Number of Employees</th>
<th>Years of Operation</th>
<th>License Grade</th>
<th>Safety Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Director</td>
<td>Electrical testing, supervising and maintenance service, and electrical consultancy</td>
<td>Permanent Staff: 20</td>
<td>14</td>
<td>Grade 5</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Director</td>
<td>Carrying out civil and maintenance work, for instance building maintenance and construction, ground surface maintenance and site clearing and preparation</td>
<td>Permanent Staff: 20</td>
<td>11</td>
<td>Grade 3</td>
<td>No</td>
</tr>
<tr>
<td>C</td>
<td>Project Manager, Safety Officer</td>
<td>Deals with refinery, petrochemical and power plant maintenance services such as storage tank overhaul and repair, heat exchanger maintenance, valve overhaul and testing and unfired pressure vessel and boiler overhaul</td>
<td>Permanent Staff: 13</td>
<td>18</td>
<td>Grade 7</td>
<td>Yes</td>
</tr>
<tr>
<td>D</td>
<td>Director</td>
<td>Providing equipment and manpower to ensure correct and controlled tightening of critical joints. Company D is an established provider of products and services to the oil and gas, petrochemical, civil and heavy engineering and power generation industries.</td>
<td>Permanent Staff: 17</td>
<td>Over 20 years</td>
<td>Grade 5</td>
<td>Yes</td>
</tr>
<tr>
<td>E</td>
<td>Project Manager</td>
<td>Engineering, procurement, construction and consultancy services for processing and industrial plants.</td>
<td>Permanent Staff: More than 60</td>
<td>Over 30 years</td>
<td>Grade 7</td>
<td>Yes</td>
</tr>
<tr>
<td>F</td>
<td>Director, Safety Manager, Human Resources Manager</td>
<td>Specialises in industrial insulation, fire proofing, refractory, scaffolding and direct materials sales.</td>
<td>Permanent Staff: 20</td>
<td>Over 20 years</td>
<td>Grade 3</td>
<td>No</td>
</tr>
<tr>
<td>G</td>
<td>Project Manager, Admin. Executive</td>
<td>Services to the oil and gas, petrochemical and power generation industries. Activities range from the shop fabrication of process equipment and ancillary items to planning construction and plant maintenance.</td>
<td>Permanent Staff: 130, Contract Workers: 50 to 60</td>
<td>Over 20 years</td>
<td>Grade 7</td>
<td>Yes</td>
</tr>
</tbody>
</table>
6.2 The Emergent Themes

The initial analysis was conducted to explore how Malaysian contractors working in processing plants experience safety with regard to SMS. Using grounded theory analysis, the researcher attempt to describe and develop a theory that explains the way in which Malaysian contractors working in processing plants achieve effective safety implementation. Details of the analysis process are explained in Section 4.5.6. Table 6.2 summarised the main findings from the data analysis of the semi-structured interviews. The method of presenting the emergent themes in Table 6.2 was adopted from Sharma and Vredenburgh (1998) and Carruthers et al. (2006).

Table 6.2: Main findings as categories and themes

<table>
<thead>
<tr>
<th>FIRST-ORDER THEMES (Sub-Categories)</th>
<th>SECOND-ORDER THEMES (Categories)</th>
<th>FINAL THEMES (Emerging Themes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliance on parent company</td>
<td>Organisational dependency</td>
<td>Cultural dimensions</td>
</tr>
<tr>
<td>Tender requirements</td>
<td>Management commitment and</td>
<td></td>
</tr>
<tr>
<td>Build-up rapport and reputation</td>
<td>participation</td>
<td></td>
</tr>
<tr>
<td>Formality purpose</td>
<td>Individual involvement and</td>
<td></td>
</tr>
<tr>
<td>Ignorance of safety matters</td>
<td>behaviour</td>
<td></td>
</tr>
<tr>
<td>Overlooked</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taken for granted/complacency</td>
<td>Safety resources due to size of</td>
<td></td>
</tr>
<tr>
<td>Showing off and reputation</td>
<td>company</td>
<td></td>
</tr>
<tr>
<td>Playful and negligent</td>
<td>Safety resources based on size</td>
<td></td>
</tr>
<tr>
<td>Act for superior</td>
<td>and type of project</td>
<td></td>
</tr>
<tr>
<td>Short-cut behaviour</td>
<td>Safety budget is upon request</td>
<td></td>
</tr>
<tr>
<td>Narrow-minded, shy and sensitive</td>
<td>from client</td>
<td></td>
</tr>
<tr>
<td>(courteous approach to advise or</td>
<td>Merge safety allocation with</td>
<td></td>
</tr>
<tr>
<td>warn the workers)</td>
<td>other budgets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No specific allocation for</td>
<td></td>
</tr>
<tr>
<td></td>
<td>safety</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reluctant to invest in safety</td>
<td></td>
</tr>
<tr>
<td></td>
<td>due to high costs (equipment,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>training, recruitment)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perception that “safety is</td>
<td></td>
</tr>
<tr>
<td></td>
<td>costly”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reliance on inexperienced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>temporary workers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insufficient safety personnel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-in-1 task responsibilities</td>
<td></td>
</tr>
<tr>
<td>Safety resources due to size of</td>
<td>Limited resources</td>
<td>Resource constriction</td>
</tr>
<tr>
<td>company</td>
<td>Indirect safety allocation</td>
<td></td>
</tr>
<tr>
<td>Safety resources based on size</td>
<td>Safety is costly</td>
<td></td>
</tr>
<tr>
<td>and type of project</td>
<td>Inappropriate personnel</td>
<td></td>
</tr>
<tr>
<td>Safety budget is upon request</td>
<td>Role overload</td>
<td></td>
</tr>
<tr>
<td>from client</td>
<td>Co-ordination slack</td>
<td></td>
</tr>
<tr>
<td>Merge safety allocation with other</td>
<td>Structural complexity</td>
<td></td>
</tr>
<tr>
<td>budgets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No specific allocation for safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reluctant to invest in safety due</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to high costs (equipment, training,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recruitment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perception that “safety is costly”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliance on inexperienced temporary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insufficient safety personnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-in-1 task responsibilities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

133
<table>
<thead>
<tr>
<th>Task Differences</th>
<th>Reporting and documentation workload</th>
<th>Multi-layered structure</th>
<th>Flexible structure</th>
<th>Lack of control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variations in safety prerequisites according to client</td>
<td>Documentation upon clients’ request</td>
<td>Diversity of safety qualifications (training)</td>
<td>Various safety equipment specified by client</td>
<td>Improper equipment</td>
</tr>
<tr>
<td>Task differences</td>
<td>Inconsistent requirements</td>
<td>Time constraints</td>
<td>Working conditions</td>
<td></td>
</tr>
<tr>
<td>Inconsistent safety meetings</td>
<td>Attend safety meetings handled by client only</td>
<td>Safety meeting is handle when problems occur</td>
<td>Merge safety meetings with other meetings</td>
<td>Lack of themed campaign and safety signage</td>
</tr>
<tr>
<td>Safety training is provided to permanent workers</td>
<td>Safety training is designed for the high hierarchical level of management</td>
<td>Safety training is highly dependent on clients</td>
<td>Safety training to specific personnel</td>
<td>Clients’ safety induction</td>
</tr>
<tr>
<td>Disregard safety meetings</td>
<td>Inadequate themed campaigns and safety signage</td>
<td>Communication issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety training is is insufficient</td>
<td></td>
<td></td>
<td>Training issues</td>
<td></td>
</tr>
</tbody>
</table>
The emerging themes in Table 6.2 were re-organised using FreeMind software version 0.8.0 to build up the connections between the significant themes and to categorise each theme into broad themes. The following sections address the broad themes in detail, based on Figure 6.1, and individual quotations are included to provide supporting verbal evidence.

![Figure 6.1: Broad Themes](image)

6.2.1 Theme 1: Cultural Dimension

6.2.1.1 Organisational Dependency

The characteristics and nature of construction companies appears to have some impact on SMS development. Some construction companies are branches of associate companies based overseas. Other construction companies are purely local. These characteristics of the companies have determined the level of SMS development.

Construction companies based overseas appear to have high safety standards. However, SMS development is not due to their initiative. Respondents have admitted that they have to follow the safety practices of their associate company or headquarters.
“We are actually following our parent business.” [CW02]

“As for this company, yes. We have a high standard of safety system which was adopted from our parent company. So we have to follow whatever was directed by them.” [CW125]

“Our safety management system was based on the UK. The practices were all the same.” [HPM13]

It is common that an associate company or headquarters outlines the system and procedure for their branch company to follow. Therefore, the respondents admit that it is their responsibility to follow exactly what is being practised by the associate company or headquarters.

“Well, that was the practices of our parent company, which is ABC Corporation, Yokohama Japan. They have division of SQE (Safety, Quality and Environment). So, we adopt their style and we call it QHSE.” [CW10]

“As I told you earlier, it was the practices of our parent company, which is ABC Corporation, Yokohama Japan. Thus we adopted the system here.” [CW12]

“Well, as mentioned earlier, our headquarters are based in the UK, so basically we have to conform to their safety standard.” [HPM16]

“As I mentioned earlier, I don’t compromise with safety. Our parent company is very strict on safety. We have to follow what they require.” [HPM48]

As for construction companies based locally, the main reason for SMS development is to meet safety regulations and enforcement from government bodies, such as the Department of Occupational Safety and Health (DOSH).
“Whatever the client's or any other party's request, we have to follow. Sometimes from P.P ... sometimes from the Human Resource Department ... from Department of Occupational Safety and Health (DOSH).” [MM20-21]

“Our company, of course ... because we have started the company with electrical supervision, and we are bonded by the government and law.” [STT51]

“But ... there's a bit different. The system ... if shutdown project, we will have the client requirement itself and government requirement, for example DOSH.” [MR16-23]

Apart from that, the most common reason for SMS development is to fulfil the clients’ safety requirements and standards. Many respondents claim that clients are the main influence to safety development and implementation for contractors.

“... By clients. It is a requirement before any job commencement.” [MR144]

“The truth is ... client is very important, client's requirement ...” [MR176]

The respondents give various reasons why they are too dependent on the clients’ safety requirements and standards. Most respondents claim that safety is important to fulfil the tender requirements. Clients view the safety performance of contractors as an important mechanism for comparison during the selection process. Clients favour contractors with good safety performance. Therefore, contractors will submit a detailed safety performance report only because it may help to secure the tender.

“Yes, if you ask me as an HSE Manager. Of course, from my experience, the first item that I have to submit is safety performance report. This is pre-qualified in the bidding process.” [CW124]

“Yes. Because ... the safety requirement is already there in the tender. Guidelines, what you can or you cannot do. So, we got no choice unless to follow the client's requirement.” [TIK17]
“No, not per se. But we have safety plan. However, it is just for tendering purpose. We normally have safety plan for tendering purpose but when people asked we have to say that we do have a safety plan. They will normally ask for safety plan when tendering time, not at any other time.”

[STT09-12]

“... If we want to win the bid, we must show to client our good performance.”

[MR178]

Safety is critical for securing the project. Many respondents fear losing their contract if safety performance is not presented during the bidding process. No safety plan means no project will be granted to the contractors.

“... Currently, we do safety because client needs us to do that. If not, it is impossible to get any contract or project.” [FGR53]

“I think it [the reason to develop SMS] is due to the client requirement. They need a company with excellent in safety. Oil and gas plant is a very dangerous site. We have to submit our safety plan to secure the bidding process. No safety means no project.” [MR08]

The SMS is essential to build up a long-lasting relationship and to maintain the reputation of the company. Working with clients in high-risk workplaces, contractors have to comply with the high safety requirements set by the clients. This is how contractors secure regular jobs from the same clients.

“Whenever clients bring up the issue on health and safety, we should take care, we should implement or we should follow, and it is constraint of the management. Because the name, the rapport. Because ... we want to have a continuous job with them. So, this is our problem. By hook or by crook, we have to follow.” [CW118-123]

“No. My staff is my asset, thus I value them. That means safety come first to me. I don't want them to compromise on safety. If anything happened to
them, it will affect my work. Effect my work means will affect the company's reputation. So, I won't compromise on that.” [HPM39]

SMS is supposed to improve the safety conditions and performance of workers. However, some respondents admit that they have SMS to show off. This practice might be related to the Malaysian culture, where contractors might fear that people will talk about them. When people talk, it might give a bad reputation to the company.

“Wow ... it is too many ... long way to go. Long way to go. Let take safety policy; we have to determine every single clause in that policy in order to implement it. We just hang it on the wall so that people can see that we have safety policy, just to let other people see the policy. There are such many thing to do in order to implement safety, but ... well ... when small company, you have to do this a bit, and that a bit.” [STT65-67]

Others stated that SMS development depends on the type of and risk associated with the project. The bigger and more risky the project, the better SMS development and implementation will be.

“Yes, because we involve with a very high risk job, so, of course we have to comply with a high safety standard.” [HPM41-41]

And as the company involved in the oil and gas industries, safety is very important to us.” [TT04]

The responses given by the respondents regarding the reason for SMS development show the actual attitude of contractors toward safety matters. It suggests that contractors are not honestly developing SMS for the benefit of their own company and workers’ safety. The contractors’ attitude that they are too dependent on the safety requirements and standards of the associate company or headquarters, government regulations and clients is obvious. It can be seen from the responses that contractors fully adopt safety training and safety equipment from their associate companies based overseas.

“Our workers have been trained by them.” [HPM16]
“We even have the same PPE which has been sent from the UK.” [HPM13]

In this case, dependency on the associate company or headquarters leaves the company vulnerable in terms of lack of initiative, non-creativity, lack of control and sometimes time concerns. This is proven by the finding that contractors need to wait for a response from the associate company or headquarters before any action can be taken. This practice, therefore, might delay the process of safety management and makes an impact if swift action is needed.

“Yes, we do. Whenever I have to re-assess, I need to report back to UK. If they say OK, then only we can proceed.” [HPM35]

“We just followed what the headquarters in T.T asked us to do. So, we just follow whatever it is. If there is any addition, we will inform the headquarters to seek feedback.” [MR13]

Another important finding of this research is that contractors are totally dependent on the clients’ responsibility for safety. If the clients stress safety during the commencement of the project, the contractors will regard safety as a serious matter. The majority of the respondents feel that it is the clients’ role to oversee their safety. Contractors still need motivation, recognition and supervision from the clients. If the client does not stress safety, contractors give less attention to it. In this research, clients are involved with high-risk workplaces; hence clients do stress safety strongly.

“It was always like that, it will depend on the client. In fact, I think, it is not only small company, even big company, I think, if the owner of the project do not enforce on safety, they do not want to implement safety.” [FGR05]

“... But then, if the clients emphasise a piece of coverall then we have to impose the coverall. If the client doesn't specify, then we just ignore.” [CW92-94]

As the purpose of SMS development is to meet the contractual requirements of the clients, there is insufficient follow-up action to monitor implementation. One respondent
confirmed that clients are the main factor in safety implementation among contractors. It is obvious that having a good safety plan and policy does not mean that contractors will be influenced to have a positive attitude towards effective SMS implementation.

“We do not implement it all. I think we just implement it only 50 percent. Unless if required by P.P or worksite, yes, definitely we will implement safety 100 percent. Safety policy is only for management. For instance, let suppose we mentioned in the manual for weekly or monthly safety meeting or briefing, but in reality, we will have safety meeting normally quarterly in a year or as per requirement.” [FGR21]

Due to the contractors’ attitude, which relies too much on the clients’ requirements, SMS is implemented as minimally as possible. Contractors will normally implement safety only to the level required by law and the clients.

“Yes, as minimum as possible, as required by the law or the client! In our case, we do have specified in our requirement here. Let say, personal protective equipment. What is the mandatory PPE? What is the mandatory PPE, when it need? I mean, non-mandatory at the beginning, but then when you do job you need gloves. So then, that becomes mandatory. So, originally, the mandatory PPE such as hat, glass, shoes, and then uniform. Uniform, if you wear long sleeve, well enough already. We don't need a piece of coverall or uniform. But then, if the clients emphasise a piece of coverall then we have to impose the coverall. If the client doesn't specify, then we just ignore.” [CW92-94]

6.2.1.2 Management Commitment and Participation

The data has indirectly revealed the negative attitude of management towards safety commitment and participation. Evidence shows that there is a disparity in the attitude to safety matters among the respondents, even though all respondents were from the management level. The data has exposed an attitude of ignorance towards safety matters by the top management.
It appears that one common attitude of top management is to put safety behind other matters. Issues other than safety, for instance productivity, quality and meeting the schedule, are given more priority than safety.

“Wow! I think top management should give full responsibility on safety. If the top management take safety seriously, I think the condition will improve. But sometime, top management were too busy dealing in other stuff.” [FGR55]

One respondent, who holds the position of safety manager in one of the companies, admitted that top management show their safety commitment by recording it in their advisory role. Top management try their best to get involved in safety; however, it appears that safety is only attended to if the top management has spare time. Interestingly, even though this condition is deemed understandable by the respondents, it is still an issue. It seems that the respondents do not feel comfortable with this condition.

“He is the chairman, advisory roles. Because, you know, sometimes due to his work commitment, he cannot involve directly. The deputy director sits in the meeting. Both of them sit in the meeting, but sometimes when they are free, they will join us. If not, they cannot. This is understandable. This is our issue. But in papers, yes, they are the advisory; they should know what's happening.” [TT15]

The way that most of the respondents answered this question has strongly demonstrated a poor attitude by top management to supporting safety implementation and the lack of commitment to safety. In some cases, top management recognised that they had the responsibility to take care of safety issues by delegating enough power to a specific person, for instance a safety manager or project manager. However, top management seem to rely too much on middle management, such as safety officers, supervisors and team leaders, to execute the safety job properly.

“Everybody ... especially top management. But supervisor ... the middle management, to enforce, much more important. They should have a strong characteristic; they have to be control. Management, of course, you cannot
go to the site all the time. You talk; do the procedure. Thus the one in the middle ... supervisor level for example. They are the key; they should not act like the normal workers.” [STT53-58]

“When there is a problem, the safety officer will then make follow-up with the top management from the headquarters in T.T.” [MR50]

Others responded that top management does not bother about safety issues in their company. When some questions were asked, they could not give the appropriate answer. They used the words ‘I think’ and ‘maybe’ in their answer, which shows that they are not really sure what exactly happens in the company.

“I think ... currently, there is no problem. Safety ... well actually, I can't say much about it.” [MR59]

“For the time being, other than P.P. project, we don't know yet. But sometimes, maybe yes.” [MR57]

Surprisingly, one respondent had failed to notice the availability of a safety policy within the company. As contractors performing work in processing plants, this is not supposed to happen. This obviously shows just how poor the attitude is to safety in the workplace.

“We do have safety policy ... I think, we have one ... but we need to find it. We just misplaced the safety policy. Normally, when there is a project, we will appoint a safety officer. So, he will in charge with all safety matter for the project. He will handle all, including the safety policy. For the normal work, we remain whatever we have.” [TIK10]

Some of the respondents revealed the perception of top management regarding providing safety knowledge to the workers. It appears that a misperception has occurred: they think that the workers already have sufficient safety knowledge. Top management believe that since contract workers have worked in several places, they already understand enough about safety.
“… but safety ... well, normally they know how to work, so, there's nothing much to worry ...” [MR131-132]

“Normally the workers were already aware on the working situation at the jobsites.” [FGR38]

“Well ... I think the workers already know how it works.” [STT48]

Based on the above, it is clear that top management certainly plays a part in poor safety implementation. It strongly demonstrates that top management overlooks safety and that they depend on the fact that the workers have prior experience. They are also unaware of their duties and thus unable to perform them. From the interviews, it is clear that top management has a ‘take it for granted’ attitude and always make the assumption that as long as the condition is under control, there is nothing to worry about.

Another misperception of top management towards implementing safety is the safety induction that is provided by the clients. Contractors always think that workers have sufficient safety knowledge due to the safety induction provided by the client before commencing any job. They think that the induction is sufficient to provide workers with safety knowledge. This perception has indirectly caused them to release their safety responsibility towards their workers.

“As I mentioned earlier, there is safety induction by the client before any job commencement. The client also provide toolbox meeting every morning.” [STT44-45]

“I don’t think it is necessary. The clients already provide safety induction.” [STT43]

One respondent affirmed that the safety induction by the client is enough to make the workers aware of safety.

“It [safety induction by client] should do.” [STT46]
It is obvious that top management does not demonstrate safety support and commitment by their actions. In this study, top management does not participate in regular safety meetings with the workers. Most think that as long as things are going well, attending safety meetings is not necessary. It appears that the traditional approach to preventative safety is still in practice, which means that action will be taken only when accidents happen.

“We normally do that [safety meeting with top management] when problems occurred.” [MR125]

“No, as long as things go well, I don’t think there is a need of safety meeting.” [FGR45]

6.2.1.3 Individual Involvement and Behaviour

Most respondents expressed their concern about individual behaviour, specifically associated with the workers. The majority of the respondents highlighted that workers in general show negative behaviour towards SMS. The common negative behaviour of workers is negligence while working. Negligence is the main contributor to accidents among workers.

“Well, normally due to negligence. Sometimes the workers take things easy. And sometimes they are not serious when working. That is why minor accident happened.” [FGR34]

“Negligence. It's normally happen due to negligence.” [TIK52]

“I'm not sure ... careless maybe ... I don't know why he climbed the valve. And he did not tie the safety valve ... He should have tie it ... It's hard to say ... but sometime that were the attitude.” [MR157-159]

It appears that negligence can easily occur because workers are not serious while performing tasks in the workplace. They often tease each other and play about on the jobsite.
“Most of the incident happened due to careless. Our worker ... you know ... sometimes it is very hard to tell. They are not serious during working time. Very hard to say! Sometimes they are playful. They should perform their job seriously, but sometimes they tease each other. Most of the workers have the attitude of 'take for granted'. ” [STT27]

Another common negative behaviour of the workers is the ‘take it for granted’ attitude. As long as nothing happens, workers tend to ignore the risks and forget to act safely. Once an accident has happened, they will work safely. However, this only lasts for a short period. Then they tend to forget about the accident and forget to act safely until the next accident happens.

“Very hard to change the Malaysian attitudes; most of the workers have take for granted attitude. When nothing happen, they tend to forget about safety.” [TIK70]

“Normally ... well ... normally ... the attitude is very hard. The problem is, the worker like to 'take things for granted'. They will only realise safety is important when any accident occurred.” [MR161]

“It’s hard to say. Even though we have the system, but sometimes, you know, we are dealing with people. Attitude ... the workers’ attitude, especially the worker who had worked with us for several years already. I think, maybe they take for granted, you know.” [TT45-47]

Other respondents commented about the negative attitude to implementing safety, which involves ‘short-cut’ practices during the execution of the job. This practice is common because workers think that safety is not important and wastes their time when they are rushing to meet the schedule.

“... When the workers are taking ‘short-cut’ action, the risk has been increased. So accident will occur. That was the second reason.” [CW109]
“Well, normally ... the worker's attitude. For instance, the form should be filled up, but sometimes the workers arrived late and ignore the form. So, we cannot implement safety in the right way.” [MR174]

Short-cut practice may happen widely, especially when the attitude of ‘act for your superior’ conquers worker behaviour. The attitude ‘act for your superior’ means that workers will only act safely when one of their superiors is present.

“Sometimes the workers did wear their PPE but they wear it just for the sake of requirement.” [FGR32]

“It's hard to say ... but sometime that were the attitude. When there was no foreman, or safety officer, they will ignore safety.” [MR158]

The researcher concludes that when there is a superior on site, the workers will implement safety properly. One respondent strongly agreed with this.

“Yes, we can say that.” [MR160]

Another critical negative culture among Malaysian workers is that they are too sensitive and easily hot-tempered if superiors talk or comment about their attitude and behaviour. They are unwilling to be corrected. They think that they are experienced enough and understand safety.

“Sometimes, the workers do not understand. But we definitely cannot use the hard way. We have to use psychology to deal with them. We can’t talk too much.” [MM06]

“Another thing our workers sometimes take things too hard, in other word, very sensitive.” [STT31]

“Safety ... well, actually, I can't say much about it. But what I can see is we cannot force into it. If we want to tell something about safety to the employee, we have to do it politely. We cannot simply ask the worker harshly. The
worker work in hot condition, well, you know, in oil and gas plant ... thus, if we talk in a high pace voice, I think the spanners will fly over the head!” [MR61]

The study also reveals the narrow-minded, shy attitude of Malaysian workers. It shows that only one-way communication exists. The workers always accept whatever explanations and instructions are given to them without arguing and asking further questions. This creates confusion for the safety officer. The safety officer is unable to determine the level of understanding by the workers of safety. It is also difficult for the top management to improve the workers’ attitude to safety.

“Yes. But the workers hardly ask question.” [MM17]

“It is quite hard to change the attitude because it already a tradition of the worker. If you want to change them, you have to start it from their childhood.” [STT30-33]

Another difficulty in implementing safety on site involves inexperienced workers. Working in high-risk plants requires experienced workers. The work requires workers that are able to assess and see possible hazards. Newcomers are normally given a safety induction before entering the workplace, but only for a short period. This, however, is not enough for them to understand the working environment and the real working situation in the plant.

“What is actually happened, sometimes, many times I think, accident happen to the new workers. It means that the accident will normally happen to people who do not know exactly what the risk for the job is. It is always happen like that.” [106-108]
6.2.2 Theme 2: Resource Constriction

6.2.2.1 Financial Constraints

The study shows that the financial implication of resources is a limiting factor. While some construction firms are capable of implementing a large proportion of applicable safety programme elements, the vast majority of firms must operate under a limited budget and are forced to select a small subset of elements. This condition is normally experienced by small and medium-sized companies. It is common that small and medium companies are inclined to neglect safety for most of the time unless there is a legal requirement for strict observance, or due to the client’s requirement. Most respondents claim that due to the small size of the company, they cannot afford to invest in safety.

“We think we don't need to stress on safety because we are small company.” [TIK27]

“In addition, as a small company, we have a very limited resource to improve the condition.” [STT36]

“We don't have safety reward due to the small size of company.” [STT36]

Furthermore, the size and value of the project also determines SMS implementation among contractors. The respondents claim that a bigger project would give them a lot of profit; therefore investing in safety is worth the money. The finding reveals that the bigger the project, the better the safety allocation will be.

“Yes, certain packages, big package, a lot of workers, which mean we should, what you call, emphasise our subcontractors to have more than one. It will depend on the work volume and the manpower. It will depend on the situation. And it will also depend on the size of the project. For instance, for a hundred million Ringgit Malaysia (RM) project, we will have Project HSE Manager. Then we will have one, two, maybe three safety and health officer. So, subcontractors will also have maybe one or two safety officers dealing with our one safety officer.” [CW37-44]
“Normally we will allocate based on project. We don’t have specific allocation. It will normally base on project.” [TIK33]

“As we mentioned earlier, safety officer will only be hired on project basis, normally by contract, no permanent safety officer within the company.” [TIK59]

Some respondents commented that financial allocation is not important unless it is required by the clients. Most of the companies interviewed do not allocate a budget for safety. Contractors will only work out a budget for safety if clients request it in the tender document.

“But if the tender specifically request us to provide detail of HSE budget, because there were normally price breakdown in tender, even though at lump sum contract, but there is a price breakdown in term of engineering how much is procurement, how much is construction and commissioning, and overhead, and profit. Normally we will put safety under construction. Direct cost or indirect cost ... so, we put under indirect cost. So if the client needs us to break down the safety allocation specifically in the tender, we will trace back what we have allocated. But normally client will not ask for safety allocation in tender document. That is what really happens!” [CW87-89]

Contractors cannot determine the exact safety allocation for each project because there is no specific budget for safety. As already mentioned, contractors normally include a safety allocation indirectly in other budgets.

“Well ... hard to say. It will depend on project. I don’t really know, maybe for RM100,000 project, the allocation is RM5000.” [MR168]

“That one is very subjective. Quiet hard to say! Actually we don’t, we do give allocation for department only, you know. This is for yearly. But when comes to project, normally, safety budget, we put under indirect cost. So, it is quite hard to produce the figure. We can’t even calculate the percentage.” [CW80-81]
“No, we don't put [it in the tender document], but, there is lump sum. We do calculate, actually. We do calculate in term of PPE, promotion, awareness, campaign, banner, safety timeout, food. And then we give such as certificate for the best worker in the month, for example. And then for the company that achieve; subcontractors that come in to work and then come out without having a single incident or accident. So we give such kind of certificate for them. We, indirectly yes, but normally the management will not expose the total amount of that in a single paragraph.” [CW82-86]

It appears that a common perception of safety among contractors is that ‘safety is costly’. Contractors are not willing to invest in safety, as they think that it could increase their operation costs.

“Safety sometimes adds up the costs. But, of course, human life, we cannot just ignore it. Yes, because we involve with a very high-risk job, so, of course we have to comply with a high safety standard. However, due to that, the cost escalates.” [HPM40]

In reality, the perception that ‘safety is costly’ could be true, as many respondents commented that everything about safety is expensive. One respondent agreed that safety could affect the operation cost. As an example, the respondent claimed that the price of personal protective equipment is expensive.

“Yes ... definitely ... especially the nomad coverall. Nomad coverall will normally cost us about RM30 each.” [TIK35]

In addition, many respondents expressed their concern on how expensive it is to hire safety personnel (i.e. a safety officer). Contractors need to pay a high salary to hire a permanent safety officer. This is why contractors favour hiring safety officers on a temporary basis.

“In addition, to hire a safety officer or anything related to safety, monthly expenses are going to be high.” [TIK29]
“In addition, to hire a safety officer is quite expensive.” [HPM22-24]

“... This is due to the high cost in order to implement safety practices. For instance, to hire a safety officer, their salary is too expensive.” [FGR11]

Due to the high costs of safety, contractors tend to implement short cuts during the implementation process. As an example, contractors choose to use improper equipment for the job. This situation normally happens where highly technical equipment is involved. Some respondents emphasised that the proper equipment is always costly.

“Another factor, this is about cost factor. In order to do the job, there is no, what do you call, proper equipment Proper equipment to carry out the job! For example, they just use a chain block to lift up. Why don't they use crane to lift up? Easier! Improper usage of equipment to carry out the work ... this is a big factor. Because ... to use crane is very expensive.” [CW112-114]

To save on operation costs, contractors tend to minimise safety implementation as much as possible.

“But then, if the clients emphasise a piece of coverall then we have to impose the coverall. If the client doesn't specify, then we just ignore. Because that cost actually, the sub-contractors will quote us. Back to back! That was on PPE, not including welfare, health and welfare jobsites. That all counted as costs.” [CW93-94]

Some companies might also take the risk of not strictly following statutory regulations or the client’s requirements if they find it too demanding. In this study, it was found that contractors are always reluctant to provide safety training to the workers. One important factor is the small size of construction companies.

“We have to pay RM250 per person, for one day safety course. That is for NIOSH course.” [TIK41]
“Small company ... and we have small number of workers. I don’t think it is necessary. The clients already provide safety induction.” [STT41]

Another reason for the reluctance to invest in safety relates to the contractors’ fear of losing the bid to a competitor. One respondent commented that it is complicated to include safety costs during the bidding process. It is common that clients will go for a company that bids at a lower price. This practice is another reason that safety is frequently left behind by the contractor. Therefore, most contractors will sacrifice safety to lower the bidding price.

“However, due to that, the cost escalates. So when the cost escalate, I will lose to other competitor, who less care about safety. Why I say that, example on one project, PPE, no problem. But sometimes the clients require or demand fire retardant, so I have to buy. The price of one fire retardant sometimes can achieve up to RM300. Can you imagine how much it will cost for ten people? RM3000. Another example is the use of safety harness. Yes, we do have safety harness, but sometimes the clients request us to use double safety harness. So, I need to buy a new one. These are all involving costs.” [HPM43]

6.2.2.2 Manpower Constraints

The findings from the interviews reveal that there are several issues with regard to organisational structure. These are associated with personnel, the delegation of tasks and co-ordination.

Placing the right person on the right job is important for effective safety implementation. The right person should be physically and mentally capable of carrying out the assigned tasks with the right knowledge, experience and skills. The data, however, reveal that this is not happening among Malaysian contractors working in processing plants.

From the interviews, it is noted that manpower resources are mainly on a contract basis. This is a common practice in the construction industry.
“We have numbers of non-permanent workers which include the welders, foreman, fitters, blasters, painters, riggers, scaffolders and helper.” [MR05]

“Normally we hire the civil and general workers on contract basis.” [FGR04]

“In addition, most of the workers were contract worker. There is no need to train them because they work for a short period only.” [FGR40]

“Oh ... we don't have specific general worker. The general workers are from the associate company. Working in this field, if I don't have enough workers, I'll use workers from the associate company, if they don't have enough workers, they will use mine. Sometime we use part-time worker.” [STT05-08]

“From our direct payroll, we have around 130 employees. Basically, we do have contract worker. This is on contract basis, for example, the welders. And some of them are foreign workers, Indonesian. So we employed on contract basis. But they have been with us quite some times.” [TT21-23]

One reason to use contract workers is that the number of workers varies according to the project. Some projects require a small number of workers, whereas others require more. Using contract workers is less of a hassle to the contractors, as projects are located in various places. Therefore, the allocation of manpower can easily be managed through contract workers.

“It will depend on project. If shutdown, we need to hire more normally through sub-contractors. The number will vary, for example, 30 workers for P.P. shutdown recently. Total workers, in-house, within this company are around 20 including supervisors. There were standby workers, more or less around ten workers for G.P. and P.N., in O.P., around eight or nine workers.” [TIK05-07]

The use of contract workers is not limited to general workers only. In the case of safety personnel, for instance the safety officer, contractors contract out the position on a
contract or part-time basis. One important reason to hire safety personnel on a contract basis is the limited financial allocation. Most respondents commented that to hire safety personnel is very expensive.

“In addition, to hire a safety officer or anything related to safety, monthly expenses are going to be high.” [TIK29]

“In addition, to hire a safety officer is quite expensive.” [HPM22-24]

“... This is due to the high cost in order to implement safety practices. For instance, to hire a safety officer, their salary is too expensive.” [FGR11]

In addition, the law provides flexibility for small contractors, where companies that have fewer than 40 employees are not obliged to appoint a permanent or full-time safety officer. However, a part-time safety officer cannot take care of safety issues properly.

“We intend to hire one [safety officer] in future, but due to the regulation that company with less than 40 people do not need to hire safety officer, so, we do not hire one right now.” [HPM22-25]

“Another thing, the law requirement is one safety officer for 40 employees. We have less than 40 workers, thus, safety officer is not essential to us.” [TIK56-62]

“Well, mostly, if you follow the law requirement, more than 40 workers, we need one safety officer.” [FGR27]

“We think we don't need to stress safety because we are small company. Furthermore, the law require one safety officer for 40 workers and above.” [TIK27]

The utilisation of contract workers, however, has created some safety issues. The data shows that most contractors do not have enough personnel, or adequately qualified personnel, to take care of safety matters. It appears from the interviews that contractors
appoint inappropriate safety personnel to deal with safety tasks within the company. This kind of problem normally occurs when management assigns the responsibility for two tasks to one person. For instance, it is common practice to appoint supervisors or team leaders to deal with safety tasks.

“However, we do have supervisor taking care of safety matters during performing any job.” [HPM22-25]

In some companies, safety is handled by the directors or managers.

“And sometimes we do think that the director themselves can responsible on safety.” [TIK30]

“Well, in this branch, we only have 10 or 11 people. We have Mr G as an Operation Manager. I am project engineer and I have one safety officer under me, who is in charge of safety matter. We have one supervisor. Like myself, I'm more on quality. And then, I managed the supervisor, and he sometimes act as safety officer. But he is not certified by DOSH, he certified by NIOSH only.” [MR38-42]

“Right now we have Mr A. He is one of our directors. He had a safety certificate by DOSH. But, basically, sometimes, because he is one of the directors, so, when come to any specific project, we will appoint one safety officer. The safety officer will be appointed by contract, let say, for three months. So he will deal with safety work, he will follow our safety policy and then requirement from P.P.” [MR45]

Some respondents commented that due to the workload, there sometimes simply isn’t enough time to perform safety tasks. It is evident that role overload can easily happen due to an inappropriate number of safety personnel. It is common for contractors to assign several work responsibilities to one individual, such as a team leader or foreman. Besides their duties as foreman, they sometimes also have to perform the role of safety officer at the worksite. Therefore, individuals who experience role overload tend to focus on other
tasks, such as meeting the schedule, maintaining performance or completing the job as fast as they can, rather than on safety.

“In my opinion, towards the good thing. However, the workload was increased. That is the main difference. Especially after one explosion in P.T. which involved four dead, that was in 2002 if I’m not mistaken. The requirement was increased.” [MM22-24]

“Foreman, well, normally ... foreman more on works. Foreman wants to finish the job as soon as possible. That's the normal attitude of foreman. We try to control their attitude through JSA form. JSA purpose is to control the job execution. Let suppose that they have to install a valve. The foreman will brief the workers on job execution and precaution to install the valve. Then the workers will sign the JSA form first, and then foreman will sign it thereafter. That is to ensure that the foreman has already brief the workers. But in reality, I do not know whether the foreman really briefs the workers or not.” [MR86]

Sustained success in ensuring safety at work demands participation from everyone in the organisation. However, the data reveal that safety responsibilities fall on safety personnel alone, without any co-operation from others.

“It will depend on the situation. Sometimes, in one project, we appointed him as a safety officer; he will do his work alone.” [MR49]

Several respondents feel that the occurrence of a multi-layered structure in construction organisations has led to a lack of co-ordination. A multi-layered structure occurs when various subcontractors are used, including subcontractors that provide contract workers.

“Yes! ABC Corporation personnel regardless of permanent employees or outsource subcontract, civil and structural supervisor, piping supervisor, electrical instrument supervisor, so in this civil there might be a few contractors let say piling contractor. So, later on there will be infrastructures subcontractors. And maybe building construction, if there's a building. So,
one supervisor is not enough. So we have to employ a few supervisors to sit in this position. The supervisor will monitor the progress of each contractor. He is responsible to construction manager. Construction manager is responsible to project manager. Project manager will responsible to project director. It is the same in mechanical.” [CW26-33]

“Oh that's why! Safety, we are having another project safety and health officer. So, there should be one section of safety. The subcontractors should have their own safety supervisor. Their supervisors are actually dealing directly with our safety and health officer.” [CW34-36]

Safety is hardly managed in a multi-layered structure. One respondent commented that they could not monitor their subcontractors all the time. What normally happens is that they can only advise on safety but cannot urge subcontractors to follow exactly what they ask.

“Because we have lots of subcontractors, you know. So subcontractors must also duly have their own initiatives to cater for their own staff. It cannot be our responsibility. We can only give them recommendation. We are using them as a part of indirect labour in our operation. We do have a numbers of permanent staff. The subcontractors have been employed indirectly when there is a job. So, we implement the same thing to our subcontractors to follow our safety system, you know. So, like that, I mean, how police regulate the law so people tend to act on how they should behave. We are strictly followed what we enforce. I mean, I have to say that we don't have performed yet, but the implementation is there. We have toolbox meeting and so on, all this, and we do have penalising if they violating the rules ... because penalise, like when I say, subcontractors, their own finance, so, you know, it's a bit pressing, so, you have to go to our finance to deduct from their payment. So, it's a bit messy.” [TT50-61]

It is common that construction organisational structure is flexible according to the project. However, one typical issue that can be traced from the data is that most contractors can
provide the project management organisation chart, without a formal structure dedicated to handle safety issues.

“Well, in this branch, we only have ten or eleven people. We have Mr G as an operation manager. I am project engineer and I have one safety officer under me, who is in charge of safety matters. We have one supervisor. Like myself, I'm more on quality. And then, I managed the supervisor, and he sometimes act as safety officer. But he is not certified by DOSH, he certified by NIOSH only.” [MR38-42]

“Right now we have Mr A. He is one of our directors. He had a safety certificate by DOSH. But, basically, sometimes, because he is one of the directors, so, when come to any specific project, we will appoint one safety officer. The safety officer will be appointed by contract, let say, for three months. So he will deal with safety work, he will follow our safety policy and then requirement from P.P.” [MR45]

6.2.3 Theme 3: Working Conditions

Following the problem associated with financial constriction, the findings of the study illuminate a further problem faced by contractors, which is instigated by various working conditions. This issue has led to the scarcity of safety implementation among contractors.

It is the nature of the construction industry that a contractor performs work at various worksites. This creates risks to contractors, especially when contract workers are involved. As contract workers move from one location to another, unfamiliar working conditions are very common, especially when the work is for a short period. Workers thus struggle to become familiar with the working conditions in one area.

“Secondly, safety of workers. Safety in terms of location of work sometimes the workers do not understand the location of work. Because they will enter the plant once in a while, so, it is my responsibility to tell them about it.” [MM10-12]
One respondent complained about the diversity of safety requirements and the standards of clients. For instance, the requirement for safety training and qualifications is not standardised between one client and another. Some clients recognise safety qualifications from DOSH, but others recognise safety qualifications from NIOSH.

“And now they want this course ... that course. Last time they want only CIDB course. Now they want NIOSH course.” [TIK36]

“In P.M., they don't need NIOSH certification yet.” [TIK47]

The same respondent also mentioned the diversity of safety equipment between clients. Some clients require a high standard of safety equipment, such as double-lanyard safety harnesses, whereas some others are happy to use single-lanyard safety harnesses. This situation puts the contractors in a confused position.

“Well, sometimes ... I don't know how it works. Maybe it will depend on the client. For instance, the use of nomad is compulsory in P.M., but not here.” [TIK48]

It is the nature of all contractors that they work in various locations with various project conditions and numerous types of client. It appears that safety enforcement varies among clients. The respondents feel that it is the clients’ varying safety enforcement that has led to the lack of SMS implementation. Some clients stress safety while others do not. Apparently, different clients set up different safety enforcement. There is no standardisation of safety implementation among clients, even though they are from the same organisation at different locations, for example Petronas.

“But from my experience, I have work in P.T. and P.M. I think P.M. has better safety implementation compared to others. P.M. has a very simple requirement. They make safety as simple as they can. The negotiation is there, fire brigade ... everything .... It means we don't have problems.” [MM25]
Interestingly, even though contractors claim to have appropriate SMS, the implementation is rather confining according to the client’s enforcement. Contractors will only implement safety if clients stress it.

“Another thing is attitude of client, different client, and different attitude. Some client stress safety, and when we get this type of client, we will also stress safety.” [TIK72]

Working on projects is very tough. Sometimes, the safety plan is sufficient and the implementation is sufficient at the commencement of the project. However, as time goes by, and as the deadlines approach, contractors tend to ignore safety to complete the project. Since the tight schedules cannot be modified, safety is ignored to meet deadlines.

“The third one of course because you want to meet the schedule.” [CW110]

“Foreman, well, normally ... foreman more on works. Foreman wants to finish the job as soon as possible. That's the normal attitude of foremen.” [MR85]

“Okay, the client requirement is normally safety briefing. Safety briefing is provided by P.P. We have fire-watch training, and some other training, but it all under client. On our site, normally ... we ... add on technical. We normally stress technical, but not safety.” [MR127-130]

“This is one of my concerns. Yes. People normally will sacrifice safety with other important things such as quality.” [STT59]

When contractors are striving to meet a tight schedule for their clients, they are in a vulnerable position. Contractors will force workers to perform work at jobsites with pressure to meet a tight schedule; therefore short cuts are frequent.

“The third one of course because you want to meet the schedule. To meet the schedule, tendency of short cut is higher.” [CW110]
The respondents commented that safety implementation is very time consuming. For instance, one respondent raised the issue of the effect of bureaucracy on safety procedures. There are several stages of equipment checking before entrance to the jobsite, which sometimes leads to the improper use of safety equipment.

“... And it is not easy to bring in the crane to the jobsites. When the crane approaches the gate, you have to stop, carry out inspection, before entering the gate. When you enter the gate, you go to the jobsite, you park the crane, you cannot leave the crane, and there is an inspection again, before lifting. Cost and also time. So tendency of improper use of equipment is there. Normally, when there is improper use of equipment, there will be tendency of accident. This is a major factor.” [CW114-117]

Other respondents further commented that safety documentation is consuming. Small contractors feel that they cannot afford the time for documentation. However, a large company has a dedicated department that can handle safety documentation.

“... We can do it but a lot of time consume to gather data, and then, what do you call ... investigate back, you know. After you gather the data, you analyse the data, and those entire thing, you have to check with the subcontractors. So actually we don't have time for that. Maybe big company like P.P, S.S, E.S. maybe they have specific department or section to handle this. But we contractors, as far as we meet our target or objectives, there is no accident, is good enough already. But when there is accident, of course, it's going to be difficult.” [CW95]

Additionally, the data reveal that contractors are reluctant to submit reports of near misses or minor accidents to the government agency, as it is time consuming and a hassle. Furthermore, this is how contractors maintain zero lost time due to injury.

“Experienced ... just a minor accident! Last time in K.M., one of the supervisors trapped his finger in the piling machine. One accident in P.K., one of the worker's fingers cracked during pipe handling, lost time injury. It is difficult to do the report, investigation call DOSH, submit report to DOSH,
DOSH come in for investigation, a lot of time consumed. So that's why we normally specify zero lost time to injury. We don't want any, but you can avoid near miss by controlling it. That's why wherever we go, we put a qualified safety and health officer, registered officer with DOSH and years of experienced.” [CW97]

Evidence shows that the weather conditions on construction sites can influence SMS implementation. In Malaysia, certain times of the year, between May and August, are extremely hot, and this encourages workers on site to work without wearing personal protective equipment. Controlling the workers’ behaviour during such periods can therefore be difficult.

“Standard problem is PPE. They didn't wear the PPE ... normally safety glasses. Normally, when the weather is very hot ... so, if you wear a safety glass ... you really can feel it [humidity].” [MR145]

“Yes, yes ... Sometimes they took it off ... It all about their attitude. Because ... for example ourselves ... the weather is hot, if we can, we will take off everything on our body, isn't it? So can you imagine the workers have to wear PPE in hot weather condition? Some workers have to wear masks ... we knew their problems and sometimes hard to deal with ... That is the most problems we face in safety.” [MR147]

6.2.4 Theme 4: Communication Issues

The findings of this study reveal that the communication process for safety is inadequate. It appears that information does not flow efficiently from top management to middle management to supervisors and to workers. For instance, information on safety policy must flow down from top management to all different levels in the organisation. However, this is not possible due to the lack of an internal safety meeting. It has been revealed from this research that a safety meeting is held when some incident has happened or when requested by the client. This shows that the top management is dissociated from safety and fails to take ownership of it. This finding reveals that contractors fail to inspire workers on safety matters. In its commonest manifestation, top
management behave in a neutral manner towards safety programmes with no expression of intent to either contribute or detract from safety activities.

“No, as long as things go well, I don’t think there is a need of safety meeting.” [FGR45]

“We normally do that [top management involvement] when problems occurred.” [MR125]

“No ... we don't have that [internal safety meeting].” [TIK64]

Most respondents do not handle safety meetings at all or do not handle safety meetings on their own initiative. Even though they have stated that safety meetings will be held in the safety manual, very few of them do so in practice.

“For instance, let suppose we mentioned in the manual for weekly or monthly safety meeting or briefing, but in reality, we will have safety meeting normally quarterly in a year or as per requirement.” [FGR21-26]

One of the reasons that the respondents think that a safety meeting within the company is not necessary is because they claim that a safety meeting, arranged by the clients, is sufficient. Thus most of the respondents discuss safety in other regular meetings.

“We do not have safety meeting or safety briefing per se. We normally combine it with other regular meeting. Normally before any job commencement, the client will provide safety induction.” [STT49]

“Oh ... top management ... safety meeting with top management; we normally combine it with technical meeting.” [MR119]

The involvement of top management in safety meetings is very rare. However, top management will normally attend a safety meeting arranged by clients.
“Top management will only involve safety meeting with the client. Normally, in P.M., safety meeting with client is being done once a month.” [TIK63]

Apart from safety meetings, safety campaigns and signage are also lacking. One respondent stated that it is not yet the time for a safety campaign and signage within the company.

“No, not yet!” [FGR50]

When the researcher asked about the availability of a themed campaign within the company, one respondent said:

“Well, not exactly.” [TT33]

In addition, the respondents claim that signage by the client on the jobsite is sufficient.

“Safety campaign ... not really, but safety signage, yes. Normally, the client will display safety signage in the jobsite.” [MR126]

“If we took project from outside, we can see signboard of safety first ... but in reality, safety is not become the first priority.” [FGR08]

When the researcher suggested considering a safety themed campaign, one respondent replied:

“Well, we have a very small number of workers ... but in meeting ... sometimes we highlight safety matters.” [STT34]

6.2.5 Theme 5: Training Issues

Safety training is crucial to create a safe environment in the construction industry. As workers are involved in various types of project, with different types of working environment and safety requirements from the clients, it is important that workers learn the correct way of executing their tasks in a safer way. The working environment in
construction is organic in nature, and it is hard to identify all the dangers in advance. Therefore, it is important that workers are able to spot dangers and make correct decisions to avoid them. Thus there is a need to have this skill updated and refreshed constantly. However, as noted from the data, most contractors are reluctant to provide safety training, even for the most simple and basic in-house induction courses.

“No. We do not provide any safety training in this company.” [STT40]

It is apparent that safety training is time-consuming and costs a lot of money. Most contractors explain that a budget for safety is very limited; therefore contractors are unable to provide safety training.

“We have to pay RM250 per person, for one day safety course....” [TIK41]

The second reason was that contractors claim that safety induction by the clients is sufficient.

“No, no, we don’t provide safety training. This is because they just work in the workshop. In addition, before any job commences, they will have safety induction by the client. That is compulsory. No matter how many times. They will need to renew safety passport every three year; where safety training was included.” [HPM30-34]

“No. This is due to the safety briefing that was offered by the client before any project started.” [TIK53]

“Okay, the client requirement is normally safety briefing. Safety briefing is provided by P.P. We have fire-watch training, and some other training, but it all under client.” [MR127-128]

Construction work is on a project-to-project basis; therefore resources spent on safety for a particular project is a one-off liability and can seldom be continued into future projects. Given that workers are also recruited on a project and contract basis, they do not have a
long-term relationship with the workers; therefore contractors are usually reluctant to provide training for the workers.

The interviews indicate that the workforce is highly dependent on temporary workers. This is the main reason that contractors are reluctant to send their workers to safety training. One respondent claimed that safety training is not necessary because most of the workers are employed on a contract basis. Thus it is not their responsibility to provide safety training to the workers.

“If for workers ... well ... because the workers are normally contract workers, it is not necessary to send them to safety training. Sometimes, they go and work in other places, other companies. So, there is no need to send them to training by NIOSH. ...” [MR137]

One respondent admitted that top management do send the employees for safety training. However, safety training is limited to permanent staff (e.g. supervisors, team leaders) but not general workers.

“Normally, top management will send only their staff to training. They don't send workers.” [MR135-136]

6.3 Discussion of the Findings

The data reveals the issue of safety responsibility of Malaysian contractors working in processing plants. This issue emerges from the attitude of contractors, which is too dependent on their associate company or headquarters, clients’ safety requirements and compliance with government regulations (Section 6.2.1.1, p. 135). This finding clearly shows that the reason for SMS development is to fulfil other parties’ requirements. Obviously, contractors are not willing to develop SMS. Contractors are relying too much on the requirements set up by other parties (Section 6.2.1.1, p. 136).

It appears that this attitude often leaves contractors in a vulnerable position. Contractors often lack control and have less power in decision-making. For instance, feedback from
the associate company or headquarters is needed for any safety action, which can delay the SMS process (Section 6.2.1.1, p. 140).

To some extent, the findings illuminate the poor commitment to and participation of top management in SMS. The findings further highlight an issue regarding top management’s ignorance attitude (Section 6.2.1.2, p. 141). For instance, information regarding safety does not flow down to workers, because safety meetings between top management and workers are rarely conducted (Section 6.2.1.2, p. 145). Themed campaigns and safety signage are also inappropriate (Section 6.2.4, p. 165). Most contractors misperceive that the clients have done enough to provide effective communication to the workers.

With regard to top management commitment and participation, the findings obviously reveal that safety is not a priority (Section 6.2.1.2, p. 142). Safety is taken care of if top management has extra time, as other important factors such as productivity and quality of service are more important. This attitude relates to the misperception that ‘safety is costly’, is not worth spending money on and does not contribute to profit.

In addition, it is interesting to note that top management relies too much on middle management, such as supervisors, team leaders and safety officers, to implement the safety tasks (Section 6.2.1.2, p. 142). As long as everything goes well, safety is not on the agenda for top management, as they think that middle management is fully responsible for safety matters.

Evidence shows that other factors that affect SMS implementation by contractors working in processing plants can be categorised as organisational processes (Okumus, 2003). Most respondents commented that SMS implementation is lacking due to the size of the company, the size of the project and the project type (Section 6.2.2.1, p. 149). Many contractors are reluctant to invest in safety, as it may incur additional operational costs. A common misperception of contractors is that ‘safety is costly’. The implementation of safety is impracticable unless requested by clients. The common practice is to combine safety allocation with other budgets. Furthermore, the size and type of the project can also determine safety allocation by contractors. Many claim that a bigger project can give them a lot of profit; consequently, investing in safety is worth the money. In this study, the data indicate that it is a common practice in Malaysia to
discount safety purposely to win the tender. The clients who demand the lowest contract cost have influenced this scenario. As such, the contractors search for lower quality supplies and neglect safety issues. This finding may suggest that an improper safety budget may contribute to the lack of safety implementation.

Contractors tend to hire contract workers ranging from qualified personnel, such as safety officers, to general workers (Section 6.2.2.2, p. 153). Contractors favour hiring contract workers due to the nature of construction projects, which are short term and involve various locations. In addition, most contractors cannot afford the services of safety personnel and invest in other safety matters, such as buying safety equipment, resulting in little opportunity for organised safety activities. Contractors are often short of capital and under great pressure to cut costs at the expense of safety.

The utilisation of contract workers has led to the problem of inappropriate safety personnel and unequal task delegation (Section 6.2.2.2, p. 155). The findings in this study have revealed that assigning several tasks to one specific person, for instance supervisors or team leaders, is common. Moreover, safety is isolated in the hands of safety personnel and functional managers who assume all the responsibilities for safety. This leads to work overload, therefore effective implementation is difficult to achieve.

For such practices, there is often a lack of co-ordination and control of safety enforcement, which subsequently discourages the employees’ involvement in safe working practices. In addition, contractors are reluctant to provide safety training to workers (Section 6.2.5, p. 165). Contractors misperceive that contract workers should know better about safety and the working environment due to their previous experiences. Besides that, contractors misperceive that safety induction by clients is sufficient to provide them with safety knowledge.

With regard to the issue of contract workers, the findings reveal the individual behaviour of workers, which is related to national culture (Section 6.2.1.3, p. 145). Most respondents commented about the negligent behaviour of workers, because they are often not serious and play about during the execution of a job. This common behaviour relates to the workers’ misperception of risk, where they normally adopt a ‘take it for granted’ mindset. In addition, workers are normally inexperienced, narrow-minded, sensitive and
shy. They tend to use short cuts and only behave safely for the benefit of any superiors present.

One finding of this study indicates that SMS implementation fluctuates according to the uncertainty of the working conditions (Section 6.2.3, p. 159). Projects involve various locations and each location is unique and different. This has led to the alienation of workers, especially inexperienced ones.

The respondents highlighted the problems associated with the diversity of clients’ safety requirements and enforcement (Section 6.2.3, p. 160). For instance, there is no standardisation of appropriate safety equipment or safety qualification from clients. Safety requirements vary, even though contractors work with the same clients at different locations.

In the case of safety enforcement, some clients are very strict on safety enforcement, while others tend to concentrate on production (Section 6.2.3, p. 161). The strict requirement to meet the client’s schedule and targets sometimes leads to the neglect of safety factors. Clients do stress safety before work commences, however as the work progresses, their concern for deadlines becomes a priority and they tend to pay less attention to safety.

The issue of time constraints and bureaucracy are revealed from the findings (Section 6.2.3, p. 162). Apparently, contractors claim that SMS involves lots of safety documentation. They do not have a dedicated safety department that can handle safety documentation. For instance, to prepare a safety report on a near miss or minor accident involves a lot of hassle and bureaucracy. Therefore, contractors are reluctant to do it.

The implementation of safety is also influenced by the weather conditions (Section 6.2.3, p. 163). Many workers feel that it is difficult to wear safety equipment due to the extreme hot weather at the jobsite. Workers can easily become bad-tempered when working in the heat.
6.4 Limitations and Constraints

The interviews were conducted in the national language rather than in English. This could have resulted in miscommunication or the misunderstanding of certain terms used in the interviews, especially if they involved technical language or jargon. The important differences between concepts might be lost through mistranslation, as they are perceived and interpreted in different ways.

In addition, the time and length of the interviews were tied to the respondents’ availability. As the priority of the respondents is their responsibilities in completing their tasks or work schedule, the time allocated for the interviews were subject to their strict working commitments.

6.5 Conclusions

This chapter has presented the findings of the semi-structured interviews regarding the implementation of SMS among Malaysian contractors working in processing plants from the viewpoint of the owners and managers. The conclusion from the findings is that the main reason for the lack of SMS development is due to the tendency of the contractors to rely on the safety requirements set by others parties. It is also evident from the findings that the organisational characteristics, organisational structure and top management safety responsibilities have a significant impact on SMS implementation.

Contractors are faced with challenges, many of which relate to the uncertainty of the working conditions and the socio-cultural environment of the national setting in which they operate. Workers are inclined to their national cultural behaviour, which is brought to the workplace. Other shortcomings rest with the contractors, who fail to recognise that their attitude has led to a misperception of safety responsibility.

The semi-structured interview is a qualitative method used in the research after the exploratory survey questionnaire conducted earlier. It serves to provide the research with in-depth information and knowledge about the subject matter from a number of prominent players and organisations in the industry. At the same time, it allows certain issues to be answered according to the research questions (Section 1.4, p. 8). It has
successfully highlighted several critical issues and problems of SMS implementation among Malaysian contractors working in processing plants, which are presented in Table 6.2. (p. 133). The following chapter presents a discussion of the key empirical research findings expounded in Chapters 5 and 6.
CHAPTER 7
DISCUSSION OF KEY FINDINGS

7.0 Introduction

This chapter presents a discussion of the key empirical research findings, as expounded in Chapters 5 and 6. A summary of the key findings is provided to aid the discussion. The aim of this study is to inform an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS.

To achieve the aim, four key tasks were undertaken during the research study, and each and every one had its own specific function and objectives, according to the research question (Section 1.4, p. 8). Initially, the research methodology (Chapter 4) set the agenda and direction for the research. Secondly, the preliminary study of the literature (Chapters 2 and 3) and exploratory survey questionnaire (Chapter 5), which involved quantitative evaluation, were conducted. This led to the detailed research question (Figure 5.9, p. 125). On completion of this phase, results from these tasks were then used as a guideline for the third task, which involved qualitative data collection via in-depth, semi-structured interviews (Chapter 6). The results, mainly from the third task, were then incorporated and integrated into the final task of developing the theory to inform the understanding of “what is going on” (Chapter 7). The theory is then grounded and related to the existing literature before the final conclusions are drawn in Chapter 8.

This study is exploratory in nature, and data collected from the survey questionnaire was analysed using non-parametric (see Pallant, 2006) data analysis. Data from the semi-structured interviews were also analysed and discussed to gain a detailed insight. The aim of this study was achieved by developing a theory that aids the understanding and actions in the area under investigation (Heath and Cowley, 2004). It should be noted that this study is not intended to produce a predictive model which can be used to forecast SMS effectiveness under different environmental and organisational conditions. Rather, its emphasis is on understanding how the internal and external variables relate to SMS implementation.
7.1 Summary of Findings

The thesis has been constructed in a series of steps that provide increasing focus to the research. The first stage was to review the literature, which highlighted the general lack of understanding of “what is going on” to SMS implementation among Malaysian contractors working in processing plants.

The literature revealed that contractors adopt SMS to comply with safety regulations, to fulfil the clients’ safety requirements and due to industry pressure. These are the main reasons for ineffective SMS implementation. However, most of the literature does not identify the underlying causes of these practices. Furthermore, research into contractors working in processing plants, especially in the Malaysian context, has received little or no attention.

Due to the lack of empirical research into SMS in Malaysia, an exploratory survey questionnaire was conducted. The objective was to determine the availability of SMS among Malaysian contractors working in processing plants, and to list the barriers to SMS implementation. The results show that Malaysian contractors working in processing plants have appropriate safety policies and safety plans. This result was expected, because a safety plan is crucial in the construction industry (Raglan, 2003) and should be included in a tender document during the bidding process. Furthermore, many contractors merely put their commitments on paper but actually behave differently. The majority of the respondents are from top management, and most of them tended to answer positively in their responses (Samman, 2000).

The result of the study suggests that despite the availability of safety policies and plans, obstacles to SMS implementation do arise and accidents still happen due to unsafe practices. This important finding led to a further stage of the study, which aimed to develop a better understanding of the root causes of the obstacles to effective SMS. These findings helped the researcher to focus on the issues to be investigated based on the following detailed research questions:
Question 1: What encourages contractors to develop SMS?
Question 2: How effective are Malaysian contractors working in processing plants in implementing SMS?
Question 3: What are the underlying factors of the obstacles to implementing safety management systems?
Question 4: Could it be possible to allocate the issues and problems of SMS implementation according to internal and external contingency factors?

Semi-structured interviews were used to examine the contractors’ SMS to gain an understanding of how they experience safety. The interviews provided the means to obtain a rich and broad array of data that helps to answer the research questions of why contractors develop SMS and how effectively they implement it, and provided insights into the type of work environment that supports their actions toward SMS implementation.

Data from the interview sessions were analysed using the grounded theory method and themes were uncovered. The emerging themes within each concept were then discussed, resulting in five outcomes, as listed in Chapter 6. Figure 7.1 explains the research process as a whole and highlights the relationships between the objectives and the research questions, categories, themes and findings.
The findings represent the views of SMS among those involved in construction work in processing plants. This means that the picture created is not a complete explanation of all the aspects of SMS in other construction areas and how they operate; rather, it is a snapshot of experiences and perspectives in the working environment of processing
plants. The findings are therefore more likely to represent the emphases of SMS, those aspects that the interviewees find particularly relevant and important to their experiences of the everyday operation of safety practices in processing plants. The result will be a deeper understanding of the experience of safety, not an explanation or a theoretically complete framework.

The following sections discuss in detail the themes that emerge from the findings. Literature reviews were also included to confirm the findings, and to allow for the extending, validating and refining of knowledge in the area of research (Strauss and Corbin, 1998). There was a deliberate intention, influenced by the principles of grounded theory (Glaser and Strauss, 1967), to bring as little as possible in the way of predetermined views, either experiential or from literature, into this research. Therefore, much of the writing that would typically be included in a traditional literature review is revisited in this chapter. As a preliminary consideration of the background to this study, this approach is quite acceptable within the context of a grounded theory approach (Urquhart and Fernandez, 2006, as cited in Georgieva and Allan, 2008). The emergent theory would determine the level of relevance of this preliminary review, and would be supplemented by further reading and discussion.

7.2 Reliance Culture of Safety Management Systems

[Theme 1]

This study produced results which corroborate the findings of much of the previous work in this field. The findings of this study show that contractors adapt SMS only to fulfil the clients’ requirements or to comply with safety regulations. Previous research found that contractors are too dependent on the safety requirements of clients (Fitts, 1996; Hale et al., 1997; Smallwood, 1998; Baxendale and Jones, 2000; Yu and Hunt, 2002; Abraham et al., 2004; Yu and Hunt, 2004; Teo and Ling, 2006; Abudayyeh et al., 2006). However, few or no studies state that organisational culture as an important underlying factor of SMS adoption among contractors. Research by Attwood et al. (2006) confirms that organisation has a significant influence over the accident frequency process, where safety culture is the most important organisational factor.
Munter (1993) defines ‘culture’ as the dominant and continuing values, attitudes and behaviours of a group. According to Brooks (2008), culture is a dynamic concept that almost everyone within the culture comprehends at some level. The study by Brooks (2008) affirms that culture must exist as a function of the cognitive apparatus. Culture is variously represented as values, attitudes, beliefs, or sometimes ‘norms’. Hofstede (1991) contends that culture creates an orderly set of rules which allow work to be carried out in a particular way.

Most of the people who have written about organisational culture describe it as: holistic; historically determined; related to rituals and symbols; socially constructed; and soft and difficult to change (Hofstede, 1991, pp. 179-180). Hofstede's (1991, pp. 180) definition of organisational culture is “the collective programming of the mind which distinguishes the members of one organisation from another”. The culture of an organisation describes the unique way in which people act and interact within it.

In this study, the findings explain the unique way in which a contractor acts and interacts in relation to safety. This study has revealed the reliance culture of Malaysian contractors, where the aim of SMS development is to fulfil the clients’ requirements upon tender submission during the bidding process. Reliance is defined by Blois (1999, pp. 199) as “relying on somebody to do something”.

Loosemore and Andonakis (2007) use the term ‘reliance culture’ in their study. They studied reliance culture in the relationship between main contractors and subcontractors, where subcontractors were too reliant on the main contractors. Loosemore and Andonakis (2007) suggest that reliance culture might be the reason for safety regulation ignorance among subcontractors. Reliance culture, however, does not get much attention from previous studies (Mouzas et al., 2007).

The results of this study indicate that a reliance culture between contractors and clients does exist. A reliance culture has developed because the contractors’ effectiveness in SMS is being used as a means to eliminate those who do not meet the minimum established standards and requirements. Clients will only consider contractors’ safety
performance when awarding contracts (Yule and Mearns, 2004). In other words, SMS development is just a formality to secure a tender.

As an example, a safety plan is crucial and should be sufficiently developed to be part of the tender documentation. The findings of this study support this statement. The results of the exploratory survey questionnaire demonstrate the availability of safety policies and safety plans among contractors. Clients usually demand copies of safety plans and evidence of past results during the bidding process (Rechenthin, 2004). However, safety plans are used only to meet contractual requirements instead of improving the safety conditions and safety performance of the workers. What normally happens is that after the preparation and submission of the safety plan, there is insufficient follow-up action to monitor the implementation of the plan. Hence safety is ignored and the injury rate increases. The results of this study prove that this happens in reality.

Most contractors tend to comply with only the contract conditions on safety. Obviously, a reliance culture propagates because contractors just follow and accept all the terms and conditions according to the contract document from the clients to win tenders. Furthermore, contract documents and requirements are not normally negotiated (Zaghloul and Hartman, 2003), therefore the tendency to follow and accept all safety terms and conditions for the purpose of winning tenders is high.

The injury rate is at risk, as projects are competitively bid for. This study shows that contractors are struggling to cut their costs due to competitive bidding. This practice has led to an attitude of ignorance of contractors toward SMS implementation, and incidence of injury tends to be high in this kind of position. This statement is in agreement with Kartam et al. (2000), who found that the injury rate tends to be higher when projects are competitively bid for. Most contractors sacrifice safety as they claim it incurs operation costs. Contractors who take safety into account would feel uncomfortable about losing bids to other companies that ignore safety. The bidding nature of the construction industry is of extremely high-level competition and contractors win bids by lowering costs (Araya, 2006, as cited in Heng, 2006). One component of these costs is related to safety, such as safety equipment and coverage for accidents (Araya, 2006, as cited in Heng, 2006).
Apart from the competitive bidding process, the motivation to comply with the clients’ safety requirements may be influenced by an organisational need to maintain a positive image. Contractors in this study believe that to maintain their desired image they have to comply with the norms in the working environment. This is important to build up rapport and reputation with clients. Blois (1999) states that: “it can be attractive to deal with a firm which has a reputation for being a good supplier or a good customer as one has the confidence that, almost whatever the contract says, they will be anxious to treat you fairly. A reputation provides us with some information about an organisation or person before we make contact with them and is the result of the organisation’s past behaviour.” Misztal (1996, pp. 120-121) adds that reputation is useful because it “provides us with some information about the person we are dealing with before we have had the chance to have contact with that person”.

Interestingly, this study also reveals the reliance culture between contractors and their associate companies or headquarters. However, this result has not previously been described elsewhere. Most contractors that have admitted they have SMS in hand actually have not developed it on their own initiative. Contractors are too dependent on the policies and procedures of their associate companies or headquarters. Most respondents claim that it is their responsibility to follow exactly what the associate companies or headquarters outline.

Previous studies in other areas have proven that reliance can benefit the organisation (Anderson and Narus, 1990; Morris, 1993; Dunk, 1995; Haron et al., 2004). In the case of safety, however, too much reliance on another party can have a negative impact and is a dangerous attitude (Loosemore and Andonakis, 2007). The findings suggest that relying too much on associate companies or headquarters leaves the contractors in a vulnerable position. There are several explanations for this result. The high safety standard of contractors is due to the safety systems and procedures that are fully adopted from the associate companies or headquarters. Where the associate company or headquarters is based overseas, the safety systems and procedures, such as personal protective equipment and safety training, are also based overseas. Therefore, the safety system applied to the Malaysian environment might not be appropriate. In addition, contractors who rely too much on their associate company or headquarters lack control and decision-making authority. Contractors need to get feedback from their associate company or headquarters.
for any action taken. This will therefore delay the SMS process if quick action and results are needed. This finding is commensurate with the finding of Loosemore and Andonakis (2007).

The findings of this study further reveal the consequences of the reliance culture of contractors towards SMS. Details of the consequences are discussed in the following section.

7.3 The Uncertainty of Organic Types of Organisation

[Theme 3]

The external environment of construction organisation affects the contractors’ SMS implementation. The literature review shows that the environment of the contractors is an uncontrolled and high risk one, contributing to the failure of most contractors to manage the safety function effectively (Kast, 1970; Kartam and Bouz, 1998; Kartam et al., 2000; Tah and Carr, 2000; Rechenthin, 2004). This study corroborate the evidence for a frustrating external environment, leading to safety aspects being overlooked by Malaysian contractors working in processing plants.

The literature findings assert that working conditions appear to have a great effect on SMS implementation (Kartam and Bouz, 1998; Kartam et al., 2000). This statement agrees with the findings of this study, which indicate that SMS implementation fluctuates according to the uncertainty of the working conditions. The structure of the construction industry does not lend itself to equity in effective SMS implementation. The outcomes of this study suggest that the uncertainty of the working conditions is due to the diversity of the clients’ safety requirements and standards. This study reveals that there are various safety requirements and standards according to the client. Contractors have to obey all the different safety requirements of the clients. Therefore, it is hard for most contractors to put safety into practice. The current study finds that diversity of safety equipment and safety qualifications is common. For instance, the use of a safety harness depends on the client; some request the use of one-point safety harnesses while others request the use of two-, three- or four-point safety harnesses. As safety equipment is very expensive, this sort of difference will definitely incur a cost to the contractor. Contractors will choose not to provide personal protective equipment to workers unless requested by the clients.
The level of safety enforcement by clients also varies. Some are very strict on safety enforcement, while others tend to concentrate on production. The strict requirement to meet the client’s schedule and targets sometimes leads to the neglect of safety factors. Clients do stress safety before work commences, however as the work progresses, their concern for deadlines becomes a priority and they tend to pay less attention to safety. Mearns and Flin (1995), in their study of risk perception in the offshore oil and gas industry, reveal that about half of the sample agreed that production is sometimes put before safety. Their finding suggests that supervisors and onshore managers feel that there was less pressure to “sometimes put production before safety”.

Evidently, contractors in processing plants will give consideration to safety matters only after they meet the scheduled deadlines. This will often be the case, especially when the clients expect contractors in processing plants to finish the work within a specified period. The outcome of this research shows how clients can influence and be responsible for contractors’ safety. This finding is supported by Smallwood (1998), Tam et al. (2001) and Yule and Mearns (2004). It shows how important it is for clients to actively participate in the contractors’ safety enhancement programmes, as suggested by Kartam et al., (2000) and Lingard and Holmes (2001).

As contractors work under pressure to complete the task in a specified period, this study reveals the bureaucracy of safety procedures, which leads to ineffective SMS implementation. In this study, contractors claim that the procedures for bringing in equipment waste their time; therefore contractors choose to take short cuts by using inappropriate equipment for the job. This finding, however, does not get much attention in previous studies.

Another issue, which relates to the working conditions, is the physical environment. In this case, the physical environment refers to the geographical location and climate of the workplace. Santos-Reyes and Beard (2002, 2008) state that the physical environment might affect some aspects of SMS. It is common that contractors will frequently change their working location, and therefore the working conditions also change (Laukkanen, 1999). Safety requirements become more stringent and more and more demanding according to the project and client. SMS implementation becomes tougher due to this type of physical environment. This corresponds with the statement by Dessler (1976).
It is undeniable that workers have a rich working experience and are skilled in construction work, however the workplace is changing, which contributes to uncertainty, thus leaving workers to work in less safe environments (Tombs, 1994). A constantly changing working environment leads to alienation of the workers. Workers can get confused by and be unfamiliar with advanced technology, processes and working arrangements in processing plants. Furthermore, it is common for workers to stick to the traditional ways of working and thinking. Workers normally refuse to gain better safety knowledge because they have been engaged in the construction environment for many years. Through SMS, many modifications are made, for instance documentation or paperwork is required before or after job execution. Workers are reluctant to accept this kind of change. This result confirms the research findings of Raglan (2003).

In addition, contractors often misperceive that uncertainty about the working conditions does not affected workers’ safety. The findings of this study reveal that contractors make the assumption that workers already know and are familiar with the working conditions. This assumption indirectly puts the workers in a vulnerable position.

Another factor of the physical environment is extreme hot weather in the workplace. The findings reveal that due to the extreme hot weather, workers are reluctant to use personal safety protective equipment such as coveralls and facemasks. Hazards also arise in extreme hot weather, which often adversely affects the workers’ state of mind and attention (Kartam et al., 2000).

7.4 Disintegration and Inconsistency of Organisational Processes

[Theme 1, Theme 2, Theme 4 and Theme 5]

The literature survey reveals that organising is critical to ensure the effectiveness of SMS implementation and has a significant influence upon it (Fitts, 1996; Rundmo et al., 1998; McDonald, 2000; Santos-Reyes and Beard, 2002; Basso et al., 2004; Attwood et al., 2006). The findings of this study are in agreement with the literature findings.

The result of the exploratory survey reveals that implementation might be an issue, as nearly half of the respondent state that their company does not have a specific safety department. This means that the organisational structure for safety is unclear. One
important underlying factor of this issue is the characteristics of the organisation. Many respondents in this study claim that safety is not an important aspect due to the small size of their company. It is common that small businesses have difficulties with SMS implementation due to their limited financial and manpower resources. A study by Holmes et al. (1999) and Lin and Mills (2001) of Australian contractor companies found that small construction companies do not manage safety as effectively as larger companies.

Most contractors consider safety a waste of money, since they may be unaware of the effectiveness of safety prevention programmes in reducing costs and increasing productivity. This is proven in the study, where the findings demonstrate that contractors do not have specific safety allocation. Contractors will normally allocate the safety budget indirectly by combining safety with other matters. Most contractors do not consider safety costs in their tender unless it is recognised or required by the contract documents. This finding may suggest that an improper safety budget contributes to a lack of safety implementation.

According to Kartam et al. (2000), safety specifications and budgets should be itemised in the contract document, and should receive the full support of clients. King and Hudson (1985), as cited in Kartam et al. (2000), stated that “lost-time accident frequency rates, which range from 2.5 to 6 per 100,000 man-hours worked for contracts where no provision for safety costs has been made in the tenders, could be reduced to a range of 0.2 to 1 per 100,000 man-hours worked on projects where proper safety planning and costing has been done and the costs are accepted by the client”.

The main concern of a contractor is how to save money and reduce costs. Thus safety is usually considered a secondary priority in the company’s plans. In this study, the interviewees’ views indicate that it is common practice in Malaysia to discount safety purposely to win the tender. The clients who demand the lowest contract costs have influenced this scenario. As such, the contractors search for lower quality supplies and neglect safety issues.

Holmes et al. (1999) suggests that risk should be identified prior to construction and that the costs of safety should be included in the tender. Companies that allow safety costs in
their tenders have a much higher standard in all elements; on average one standard level higher. It is not surprising to find that the majority of contractors in this study do not allow for safety costs in their tenders. This seems to suggest that these contractors find it difficult to implement the most effective safety during the construction phase of their projects.

Another factor which influences the implementation of SMS is the size of project. Many respondents claim that safety is important in bigger projects. Furthermore, safety allocation can be made in a bigger project because the profit margin is higher. Therefore, smaller projects have more risks because contractors try to cut costs, and safety is one thing that is overlooked.

There is an extremely high level of competition in the construction industry and contractors win bids by lowering their costs. One major component of these costs is manpower. Thus the winning tender may well be the one which pays the lowest wages, does not provide safety equipment or have coverage for accidents and which has the largest proportion of contract workers, for whom less benefit is paid.

This finding lends some support to the proposition that financial constraint is the main reason why work is contracted out to temporary, inexperienced, poorly trained and poorly paid workers. Contractors tend to hire contract workers ranging from qualified personnel, such as safety officers, to general workers. Contractors favour hiring contract workers due to the nature of construction projects, which are short term and involve various locations. In addition, most contractors cannot afford the services of safety personnel. Contractors are often short of capital and under great pressure to cut costs at the expense of safety. A study by Lee and Sivananthiran (1996) reveals that economic interests dictate the use of contract workers in the Malaysian construction industry.

The use of contract workers contributes to several drawbacks in term of safety issues. Obviously, contract workers work under less comprehensive SMS when compared to permanent employees. For instance, Dole (1990) states that “contract workers are often treated as a segregated, compartmentalized work force in petrochemical facilities and are less likely to have direct employee involvement in safety issues”. This study has been able to demonstrate that this is the case. Contractors have the mindset that investing
money in safety training and equipment to contract workers is an unnecessary cost. Most contractors use contract workers because they are not assured continuity of work, therefore investing money on training and equipment for contract workers is not necessary. This finding is in agreement with that of Kartam (2000).

Moreover, contract workers hold a significantly more negative safety attitude and view the organisation as less committed to safety (Cox et al., 1998). Tam and Fung (1998) contend that the use of contract workers, who are less loyal to contractors and less familiar with site conditions, have a direct impact on ineffective safety. Most respondents in this study complain that the workers are not concerned and serious about safety. They play about and always take things easy. Negligence always occurs, which leads to near misses. In addition, in line with Malaysian culture, contract workers are sensitive and shy. It is common for Malaysians to do anything to avoid losing face, for example they will not raise their voice at anyone or comment about someone. This finding is commensurate with the research by Dohlner and Grom (2006).

It is clear from this study that workers normally tend to act safely for the sake of their superiors. This finding is in line with that of Hayes et al., (1998) and Simard and Marchand (1995), who state that the safety compliance of workers is higher when supervisors are involved with workers in the conduct of accident-prevention activities and when employees influence management decisions regarding safety.

Worker attitude appears to have a great effect on the implementation of safety (Kartam et al., 2000). The involvement of workers in safety practices is found to have positive results. The study by Attwood et al. (2006) confirms that the workers’ behaviour is the most important element in effective safety practices.

In connection with the lack of training investment for contract workers, the contractors in this study are reluctant to spend money on safety courses, particularly as part of the Green Card Program organised by CIDB. This is due to the short-term nature of the workers’ employment. Therefore, it is hard for these workers to comprehend safety instructions, signs and manuals, and this renders them vulnerable to accidents. Contract workers are often present on a site for no more than a few days, thus making training difficult to arrange. This naturally creates obstacles to effective SMS. As a result, contractors are not
willing to make such an investment. Furthermore, some contractors comment about the high cost of the Green Card and that it overlaps with a similar programme offered by other agencies such as NIOSH.

Within overall resource constraints, a key and specific area of likely problems is the provision of safety training. The results of this research show that contractors perform badly in this element. The findings indicate that Malaysian contractors working in processing plants are reluctant to send their workers for certification or formal training. Workers are usually employed on a project-to-project basis, or a task-to-task basis, or even on a daily basis, and it is not considered worth offering them safety training. This situation is consistent with the findings of Lingard and Rowlinson (1997), who report: “the existence of so many small groups on site for short periods of time is a major obstacle to good project management”.

Construction has a particularly high labour turnover compared to other industries (Kartam, 2000). This is partly due to the mobility required of construction workers, who may be engaged on several widely separated sites in any one year, and partly to the short duration of most jobs. High labour turnover in any job is not conducive to a good safety record. On many sites, training programmes for workers do not exist; therefore workers are required to learn from their own experience and mistakes. The extensive knowledge and experience of those who are responsible for safety is deemed an important aspect to achieve a reliable, effective and efficient SMS (Knegtering, 2002). Thus proper knowledge is required among the workers.

If safety training is organised, it is normally the middle management, front-line supervisors and safety staff who are the major groups of people involved. Most contractors tend to target the training to more senior personnel. This shows the misunderstanding of SMS concepts where all staff should be involved in the SMS transformation process. General support staff and general workers are being overlooked. Thus safety training is normally provided for supervisory staff rather than for workers, who are not directly employed. The results obtained coincide with previous research studies in that sharing the provision of more detailed and higher level training generates better safety performance.
Training can boost the safety knowledge of employees; hence individuals are more likely to engage in safe practice. Most researchers consider safety training as an important safety tool in mitigating site accidents (Duff et al., 1994; Lingard and Rowlinson, 1994).

A study by O’Toole (2002) found that if workers do not have proper training on safety, they might not be able to recognise potential hazards at a site. This shows that safety and health training plays a significant role in the enhancement of safety in construction. However, the awareness level of contractors of the need for such training is not satisfactory. They often believe that their money is better spent on meeting necessities than to allocate it for training. Some contractors even believe that safety awareness only comes directly from experience.

In this study, it appears that most contractors hire safety personnel, such as a safety officer, on a project-to-project basis. Several respondents complain about how expensive it is to hire safety personnel. This leads to the appointment of inappropriate safety personnel and unequal task delegation. Yu and Hunt (2004) assert that safety is managed and executed by separate individuals with different technical disciplines. They further state that safety is not integrated throughout the organisation. Instead, it is isolated in the hands of safety personnel and functional managers who assume all the responsibilities for safety. In line with the findings of that study, it was discovered in this study that assigning several tasks to one specific person, for instance a supervisor or team leader, is normal.

There is often a lack of co-ordination and control of safety enforcement, which subsequently discourages the employees’ involvement in safe working practices. Equal and appropriate delegation of authority and responsibility is important to encourage better safety. This finding is consistent with the findings of Abudayyeh et al. (2006) and Anton (1989), as cited in Aksorn and Hadikusumo, 2007).

In addition, as SMS involves lots of paperwork and documentation, the lack of safety personnel has resulted in role overload. Role overload is defined as the degree to which performance is affected by inadequate resources, training and time to perform one’s role (Jones and James, 1979, as cited in Mullen, 2004). In addition, workers are under pressure to conform to the social norms. SMS means that a new procedure is attached to
the regular activities of workers, for instance to fill in forms. Role overload as a factor is discussed by Flin et al. (2000) and Raglan (2003).

It is undeniable that the function of middle and lower management (supervisor, team leader, foreman) in SMS has long been recognised (Flin et al., 2000). However, problems occur when too much unclear responsibility is given to middle or lower level management. The results of this study demonstrate that top management transfers safety responsibility to middle or lower level management. The obscure scope of responsibility with regard to safety makes the safety condition worse.

The construction organisational structure appears to influence the way individuals perceive safety. Therefore, it is crucial to clarify and determine people’s roles and responsibilities (Donald and Young, 1996). Supportive organisational structures should be established by top management and are essential for effective SMS. Assigning responsibilities is a fundamental component of SMS. If something must be done, someone must be assigned the responsibility to ensure that it gets done (Fitts, 1996). The organisational structure should determine and define the responsibility, accountability and authority of each subordinate at all levels (Burrage, 1995). This is also an excellent way to involve more people in the safety programme (Schaechtel, 1997). Each subordinate is important in promoting safety (Fang et al., 2004), and it is not the responsibility of the safety personnel alone.

The major finding of this research is that organisational characteristics have a significant influence on safety implementation. This result is consistent with the research by Hinze and Raboud (1988) and Holmes et al. (1999). In addition, research studies have suggested that organisational characteristics have a significant influence on the effectiveness of the organisation system (Faniran et al., 1994; Attwood et al., 2006).

In conclusion, the findings of this study suggest that successful safety should have sufficient resource allocation. This result is consistent with the research by Tam et al. (2004), Rechenthin (2004), Abudayyeh et al. (2006) and Erikson (1997), as cited in Aksorn and Hadikusumo, 2007).
The literature review explains that management commitment and involvement is the core element of SMS (Hinze and Raboud, 1988; Gun, 1993; Jannadi and Bu-Khamsin, 2002; Tam et al., 2003; Aksorn and Hadikusumo, 2007). Several studies have shown that the lack of management involvement and commitment to SMS is a stumbling block to its successful implementation (Hinze and Rabound, 1988; Jaselski et al., 1996; Kartam et al., 2000; Lin and Mills, 2001). In this study, it appears that management shows a positive attitude; the results of the exploratory study show that most of the companies have appropriate SMS. However, the semi-structured interviews reveal the real attitude of management towards SMS. The findings of the main study clearly show the lack of management commitment to and poor participation in safety. The management attitude towards safety was obvious during the interviews. The way the interviewees responded to several questions indirectly showed their ignorance and a ‘take it for granted’ attitude towards safety.

Misperception was detected from the management point of view, where most of the respondents think that safety might be an issue of the construction industry, but it is certainly not the key one in processing plants. Some managers were persistent in believing that they have done enough towards safety. Most of them think that safety is not profitable and is not worth any more effort and resources. As a result, most managers overlooked SMS, and this became a hazard to other people because of their incorrect attitude.

The management perception of the general level of workers’ safety qualifications, skills and knowledge is the essence of SMS implementation. In this study, it appears that they misperceive that contract workers have sufficient safety qualifications, skills and knowledge. This misperception has led to a lack of SMS implementation. For instance, some respondents claim that safety training is not necessary within the companies because clients have already provided a safety induction and safety briefing before any job commencement or every morning before the workers are allowed to enter the jobsites.

Previous research indicates that management plays a very important role in SMS. Management sets up appropriate environments for safety by defining the safety policy and allocating resources. The attitude of top management is crucial in cultivating a good safety culture (Seppala, 1995). However, in practice it is hard to get top management’s
attention on safety, because they need to allocate their time and resources to other business objectives (Hakkinen, 1995). This statement is true and can be seen from the interview response that most contractors are reluctant to provide effective safety communication to workers.

Communication is crucial as a mechanism that sends formal and informal safety messages. In an organisation, communication is an ever-present activity because it is the means by which people relate to one another. Most experts on organisation, management and leadership assert that effective communication is the foundation for effectiveness in any type of organisation. For instance, Appelbaum and Gallagher (2000) assert the importance of communication in gaining a competitive advantage.

Communication with different parties and operating as a team are essential to provide the best performance (Wong and Fung, 1999). The breakdown of communication, however, is a significant contribution to ineffective safety (Ahmed et al., 1999). Accidents are often the consequence of miscommunication (Perin, 1995). The findings of this study reveal that safety information tends to be unevenly communicated, distributed late or not transmitted at all throughout the organisation. Most contractors do not impart up-to-date safety programmes and issues to workers.

The main problem in the delivery of information and services in construction management is that the information passed on is often wrong or inaccurate (Barber et al. 1999), there are differences in the interpretation of the information and a lack of information from previous project data (Fathi et al., 2007). Furthermore, Burrage (1995) states that safety committees are vital aspects in generating and maintaining the safety practices of an organisation. The safety committee will usually develop safety promotion campaigns, which can take various forms from simple poster campaigns through to reward for safety achievements. The findings in this study, however, reveal that safety promotion campaigns are lacking. In addition, safety meetings between management and workers are not common. The respondents state that there is no need for safety meetings as long as everything is fine.

Those in management must provide the initiative for successful SMS and must support safety programmes for them to be successful. Furthermore, management must have the
capacity and willingness to introduce and support the SMS process if it is to succeed. Continuous management commitment and participation is a critical part of effective SMS. Management support for safety is an important component of any successful safety programme (O’Toole, 2002; Rechenthin, 2004). The findings of this study agree with the statement by Vecchio-Sadus and Griffiths (2004) that management commitment and participation will be reflected by the employees’ involvement and behaviour towards safety. Safety should not only be viewed as OSHA regulations that need to be adhered to, but must also become a value and a culture with clear commitment from all levels of management and involvement from the workers.

7.5 Model Development: Misperception of Safety Responsibility

The third objective of this study is to investigate the issues relating to safety implementation, with regard to SMS, and determine the main obstructions that hinder effective SMS and, if appropriate, represent this through a suitable model. In the previous section the issues and main obstructions to SMS implementation were discussed. Therefore, this section is dedicated to the development of a model that represents the main themes that have emerged from the findings and captures the overall experiences of contractors in acquiring SMS.

It is not intended in this study to develop a model that merges all the different perspectives of SMS implementation or the approaches to implementation development, as these are not the main concerns of the study. However, it is important to be able to illuminate the main findings which are regarded as critical with reference to understanding the issues pertaining to SMS implementation in the particular workplace studied, and the real experience of attempting effective SMS by Malaysian contractors working in processing plants.

The initial model (Figure 7.2) was produced taking into consideration the main themes arising from the findings, based especially on the in-depth, semi-structured interviews with Malaysian contractors working in processing plants. Figure 7.2 describes the root causes of the barriers to SMS implementation among Malaysian contractors working in processing plants.
The findings of this study have determined three important issues surrounding SMS implementation among Malaysian contractors working in processing plants: a reliance culture, the uncertainty of working conditions and organisational processes. These issues have influenced contractors’ perception in determining their safety responsibility during SMS implementation.

According to Baron and Greenberg (1990, pp. 116), “perception is the process through which we actively select, organise, and interpret information brought to us by our senses in order to understand the world around us.” Durrell and Kleiner (1990) further elaborate that perception “is influenced by our motives, attitudes, and past experiences. We constantly attempt to combine, integrate and interpret information about other persons to form useful pictures of them, categorising them in a somewhat preconceived manner.” Perceptions shape the feelings, decisions and behaviour of individuals (Baron and Greenberg, 1990). However, error in perception (hereinafter call ‘misperception’) can easily happen due to various factors, including the internal and external environment (Durrell and Kleiner, 1990; Baron and Greenberg, 1990). Boyd et al. (1993) state that misperception in organisation occurs when uncertainty is perceived to be more than...
actually occurs or when uncertainty in the environment is not noticed. Misperception is common due to deep-root entrenched in society (Durrell and Kleiner, 1990).

Harland (1996) introduced a misperception mismatch tool (Figure 7.3) to identify and measure the size of the gaps in perception between the customer and supplier. Four types of mismatch were introduced. Mismatch one represents the gap between what the customer claims to require and what the supplier perceives that the purchaser requires. This gap can be closed by clearly understanding the customer’s requirements. Mismatch two represents the perception of performance gap, which is the difference between the supplier’s view of performance and the customer’s view of supplier performance. Mismatch three represents the most serious gap. It represents customer dissatisfaction, as it is the difference between their perception of their requirements and their perception of the performance they receive from the supplier. Mismatch four indicates in what direction the supplier may be motivated to improve, as it is the difference between the supplier’s perception of what the customer requires and the supplier’s perception of performance.

Figure 7.3: Misperception mismatch tool (Harland, 1996)
In this study, the findings have clearly demonstrated that misperception of safety responsibility occurs by the parties involved in the construction supply chain. A supply chain is defined as “the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer” (Christopher, 1992). Wong and Fung (1999) describe a supply chain of a construction project as consisting of owner, consultants, general contractor, subcontractors and suppliers. This study, however, will only discuss a three-way construction supply chain, as illustrated in Figure 7.2: the client (owner), the contractor and its contract workers (subcontractor or supplier). This study explains the relationship between clients and contractors, clients and contract workers and contractors and contract workers. As a complex organisation, the construction industry is composed of different interest groups with differing sets of priorities (Dawson et al., 1983).

According to Borys and Jemison (1989), each party involved in the supply chain may misperceive each other’s action. Misperception normally rises at the dyadic level or two-party relationships (Harland, 1997). Figure 7.2 was developed in such a way as to describe the current status of misperception during SMS implementation. A two-way arrow between clients and contractors demonstrates that the level of misperception from both parties is low. However, the dotted lines express the occurrence of misperception. These conditions suit with mismatch one from the misperception mismatch tool in Figure 7.3. In this case, contractors close the gap by fulfilling the safety requirements set up by the clients. Obviously, the purpose of closing the gap is to secure the contract. However, a reliance culture has emerged. In other words, the reliance on the clients’ safety requirements acts as an important mechanism for effective SMS implementation. Therefore, a communication and feedback process from both parties has emerged. The contractors’ lack of safety responsibility is due to a culture of reliance. Contractors are too dependent on the clients’ safety requirements. As safety requirements and enforcement vary from one client to another, contractors will only implement SMS according to what the clients have stressed. Some clients stress safety while others stress project performance. Therefore, contractors implement the SMS as minimally as possible.

On the relationship between clients and contract workers, one-way communication is emerging. Clients have their own safety responsibilities to ensure that their jobsites are
safe and keep workers aware of risks and hazards in their plants. Therefore, it is the clients’ responsibility to take safety action, for instance to provide a safety induction before any job commencement. However, it appears that this type of communication offers only one-way communication, where contract workers hardly raise any safety issues to discuss during the safety induction session. This relates to the culture of contract workers, who are shy and reserved. Misperception could occur in this relationship due to the unclear safety responsibility between the clients and contractors, as discussed in Section 2.2.2 (Chapter 2).

The misperception of safety responsibility between contract workers and contractors is high. This finding agrees with that of Harland (1996), who revealed that misperception is greater and worsened in upstream relationships. Two main reasons led to this condition: (1) contractors rely heavily on clients’ safety actions (e.g. safety induction) and assume that it is sufficient for contract workers; (2) contractors assume that contract workers have the ability to perform work safely due to their experience of working in previous jobsites.

In this case, the contractor may perceive that the contract worker has appropriate safety experience and knowledge, whereas the contract worker perceives that it is the contractors’ responsibility to provide them with knowledge of sufficient safety practices (training, awareness, etc.). This finding is supported by Holmes et al. (1999), who comments on the lack of safety focus in small businesses (including contractors) and the fact that they often believe that safety responsibility lies with the workers. Contractors are supposed to provide safety information to contract workers through proper communication and safety training. However, workers are always left largely to their own discretion. As an example, in this study, the misperception of contractors of contract workers occurs because contractors think that the safety induction and toolbox meetings provided by the clients is sufficient. This kind of attitude shows that contractors see things quite differently and often fail to recognise the need to increase workers’ satisfaction gained through safe behaviour and through positive reinforcement involving recognition and reward for safe acts.

Another interesting finding relates to the contractors’ perception of the workers’ ability to perform work safely. Most contractors appear to overestimate the workers’ ability by assuming that their knowledge and safety practice is sufficient. Misperception happens
when contractors think that contract workers are experienced and should know better about how to work safely. However, the reality is that the uncertainty of the working conditions in processing plants leaves contract workers alienated.

Management gives safety responsibility to safety personnel. A common misperception is that only the person holding a safety position, for instance a safety officer, will deal with safety matters. Top management will normally assign one person alone to carry out responsibilities for safety. This is not supposed to happen, as safety is the responsibility of all people in the organisation (Fitts, 1996; Burrage, 1995).

This research has categorised safety responsibility according to the clients, contractors and workers. Based on the research findings, the barriers to effective SMS implementation can be divided into external factors (clients) and internal factors (contractors and contract workers). Several distinct misperceptions of safety responsibility between clients, contractors and contract workers emerged from these barriers. These misperceptions are responsible for the poor communication and training during the SMS implementation process.

Figure 7.4 is a proposed approach for effective SMS implementation for Malaysian contractors working in processing plants. According to contingency theory (refer to Section 2.3.4 in Chapter 2), organisations have to deal with different situations in different ways. The internal functioning of an organisation should co-relate to the demands of the external environment. Therefore, as found in this study, contractors need to cope with the external factors that arise from the clients and contract workers. Accurate perception of the environment is essential for organisational success (Boyd et al., 1993), therefore pre-empting misperception is essential for SMS implementation success. However, this change should also come from all parties. As safety is always a shared responsibility (Walters, 2002), the success of SMS implementation will depend heavily on the preparedness of all parties to co-operate and improve their own role (Harland, 1997). It is important, therefore, to provide continuous support for safety motivation and the commitment of all parties (Laukkanen, 1999).
To begin with, contractors should change their mindset. Contractors should deal with their own misperception of safety responsibility. As management is responsible for the prevention of accidents (Schaechtel, 1997), the findings support the fact that management involvement and participation is essential for effective SMS implementation. This statement is supported by various previous research (Jaselskis et al., 1996; Marsh et al., 1998; Pankratz et al., 2003; Fang et al., 2004).

Unsafe conditions and accidents are usually a sign that something is wrong in the management system itself. Therefore, as the responsible party, contractors should put full commitment into improving the condition. According to Dawson et al. (1983), management commitment can be expressed in many different ways.

Effective implementation of SMS can occur when it is integrated into the company’s structure and function. The tendency to segregate safety from other functions in the organisation appears to be a recipe for failure. Contractors should design a fair and equal task delegation through organisational structure. An organisational structure must be set up that defines accountability at all levels and gives guidance on priorities when conflicts occur. This coincides with Burrage’s (1995) research, where design of the organisation in
terms of structural responsibilities and management has very great consequences for the management of safety. The objective of clearly defined roles and responsibilities is to establish for the organisation a system for continual measurement and appraisal of administrative oversights and to ensure the best utilisation of available resources.

The key to effective SMS is a strong commitment from the top management, which must cascade down to lower levels of the organisation with clearly defined roles and responsibilities. This can only be done by providing proper communication through safety meetings and themed campaigns as a means of information flow. If the employees of an organisation are left on their own, do not share ideas, are not informationally integrated, do not participate in decisions and do not receive support, the effectiveness of any criterion will be below average.

In addition, it is suggested that contractors should provide in-house safety training to tackle the specific problem areas and safety situations which the company experiences. Training material should discuss issues related to safety, for instance the consequences of accidents and the influence of good safety performance, and should stress the safety objectives of the company. The relevant laws and legislation and contractual relationships with clients on safety matters should also be covered.

To get employee involvement, contractors need to improve their relationship with contract workers. O’Dea and Flin (2001) suggest that managers are keenly aware of their role as leaders in safety and believe that the best way to promote safety is by developing good quality participative and open relationships with subordinates.

Clients, as the owner of the project, play a significant role in reducing construction costs and rates of accident occurrence (Kartam et al., 2000). Clients have a greater role to play to ensure project success. Clients need to make sure that contractors follow what is stated in the tender document. Clients need to give priority to safety, not performance over safety. Clients should also take the initiative to co-operate and standardise basic safety requirements for the contractors.

It is apparent that if SMS is to be implemented successfully among contractors working in processing plants, the findings that have been identified from this study need to be
addressed on a comprehensive and integrative basis. The success of SMS will ultimately be determined by the commitment, competence and attitude of everyone in the organisation.

Wilson and Koehn (2000) highlight that safety cannot be enforced by legislation alone but needs the responsibility of the contractors as well as workers to make it successful. A commitment by the workers would also help to reduce the occurrence of accidents at construction sites. Workers can discuss with their management ways to make their worksite safer. In addition, safety information must become strategic through a communication approach so that it can be delivered to both parties.

The principles of SMS should be applied beyond management levels and include workers. These workers must be empowered, involved and trained in problem solving. Contractors need to work on improving worker relationships in the same way they do for clients. Through effective communication and improved co-ordination, workers must be motivated to improve their safety condition. Contractors must move away from their obsession with the bottom line. They need to bind all parties together by mutually set and internalised goals. However, any attempt to bring about meaningful change with respect to implementing SMS will only succeed if management really commit and are involved in the SMS process. This finding serves to confirm the pivotal role of top management in SMS implementation.

It is undeniable that prior work on the implementation of SMS has concentrated mainly on management (leadership, commitment and involvement). However, this research has revealed the misperception of safety responsibility of contractors during SMS implementation. It is proposed that the relationship between contractors and clients and contractors and contract workers be improved.

7.6 Industry Validation

A brief industry validation of the model was conducted. The validation process is especially important for studies that will have an impact on the overall welfare of the public. Since this study focuses on construction safety, the validation of the results is
extremely important. The relevance of the model requires the consent of and feedback from the industry involved. Validation enables the model application to be tested within a contemporary real-life context. The validation approach for this model was pursued through seeking peer review (Bock, 2001), involving an industry expert and practitioner’s judgment and feedback. The McGraw-Hill Encyclopedia of Science and Technology (2002), as cited in Mohammad (2006), suggests that validation of a model can be achieved if it is accepted as reasonable for its intended purpose by people who are knowledgeable about the system under study, termed face validity.

The validation exercise was performed using a validation sheet, as shown in Appendix G, which was sent to the experts and practitioners in the industry for their feedback. The validation sheets were sent and completed through e-mails to 20 respondents. Five e-mails failed to reach the respondents. Out of 15 respondents, only three responded to the validation e-mail.

The objectives of this task were:

- to validate whether the key elements of the major issues are appropriate to the current safety conditions in Malaysia;
- to validate the usefulness of the model to their respective organisations and the industry;
- to validate the user friendliness of the model and whether it is easy to understand and complete or sufficient to assist related parties in the improvement stages.

The model (Figure 7.2), which emerged from the findings of this research, was developed to explain the barriers to effective SMS implementation. The model was designed and developed to use as a guideline by players in the industry, particularly on aspects of implementation. It was designed to assist the parties involved to understand the issues of SMS implementation.

The industry’s validation of the model was conducted only to test the validity of the findings on safety experience with regard to SMS and the implementation approach to effective SMS. It was discovered that respondents in this validation exercise, however, may have misunderstood the key aspect of the model and thus were expecting more from it. Details of the validation results are in Appendix H.
7.7 Conclusions

This chapter presents the results obtained from the study. Five main themes were discovered and have been plotted into the model as barriers to effective SMS implementation. Constructing a model as a research topic can best be approached by studying the players, in this case the contactors. The model was constructed using inputs ‘closer to the phenomenon’ to assist and offer guidelines to Malaysian contractors working in processing plants to help them understand their own dilemma in implementing SMS and to achieve effective SMS implementation.

The following chapter discussed the final reflection of the research process, a summary of the research findings and identifies the research contributions and implications to both academics and practitioners. It also acknowledges any limitations in the research and provides recommendations for future researchers.
CHAPTER 8
CONCLUSIONS

8.0 Introduction

Chapter 7 discussed and summarised the major findings of the research. This chapter will therefore briefly highlight the conclusions drawn and outline the researcher’s own view on the strengths and weaknesses of the research approach. A clear statement of contribution to knowledge and practice will be made and the chapter will end with recommendations for future research.

8.1 Summary of Findings and Main Conclusions

The principal aim of the research, as elaborated in Chapter 1, was to inform an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS. This was done by identifying and formulating (as in Chapters 2 and 3), linking and evaluating (Chapters 5 and 6) and finally incorporating the result into the development of the model of barriers and the approach to effective SMS implementation (Chapter 7), which will help to create awareness for contractors in processing plants with regard to effective SMS implementation.

The research was designed, as explained in Chapter 4, to meet the research aim and objectives. An inductive approach to the research was undertaken with the aims to develop a theory as a means to inform an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS.

A review of the relevant literature about current SMS challenges within the industry, discussed in Chapter 2 and Chapter 3, led to the discovery of critical gaps in the knowledge that confirmed the research aim. The overview of construction in processing plants aimed to highlight the nature, complexity, key players and safety responsibilities which in one way or another could be of great influence to the area of the research topic.

Further research was conducted through an exploratory survey questionnaire of contractors in the industry, as discussed in Chapter 5, pertaining to issues highlighted in
the overview of the industry and literature review, as in Chapters 2 and Chapter 3. Research questions were developed as a result of the exploratory survey questionnaire. The research questions resulting from the findings of these tasks later became the foundation of further research and analysis through empirical evaluation, i.e. semi-structured interviews, as described in Chapter 6.

Chapter 7 depicted an integrated model for effective SMS implementation comprising the major issues and key elements found during the research process. This model was developed to inform related parties of the issues and problems surrounding the contractors of SMS implementation. The final conclusions of the research are discussed in this chapter, Chapter 8, which includes research contributions; limitations and recommendations for future work in the research area.

8.2 Achievement of the Research Aim and Objectives

The aim of the research was to inform an understanding of how Malaysian contractors working in processing plants experience safety with regard to SMS. In pursuing the aim of this research, four research objectives were established. The fulfilment of each of the four research objectives is set out in the following section.

8.2.1 Fulfilment of the First Objective

The first objective was to review the literature concerning SMS. The thesis began with a thorough review of the literature, tracing the history of SMS and major changes within it. The literature covers topics related to the background of safety management systems (SMS), contractors’ safety, the approach to effective SMS and SMS implementation and the environment. The literature review also covers the background to SMS in general and in the Malaysian context.

The analysis of the literature revealed that under the self-regulation of SMS, contractors are still able to enjoy great flexibility in setting them up. Evidently, contractors’ safety performance is poor and contributes to the high rate of workplace accidents. Contractors working in processing plants, however, are bonded with strict safety
standards. As a consequence, contractors set up SMS just for the sake of winning contracts from clients.

The literature review explored the factors influencing contractors’ safety and recognised several approaches to effective SMS implementation. Several gaps were recognised, underpinning the aim and objectives of this study.

In the context of Malaysia, little or no attention has been given to contractors’ SMS. Given the high rate of accidents among Malaysian contractors in general, and realising the important role of contractors in processing plants, it is then doubtful how contractors cope with clients’ safety requirements. This study is crucial to investigate the way in which SMS has been adopted in Malaysia, and whether or not it reflects the realities of the dynamics of contractors in processing plants.

8.2.2 Fulfilment of the Second Objective

The second objective was to explore the existence and availability of safety practices based on SMS elements among Malaysian contractors working in processing plants. This objective was achieved through an exploratory survey questionnaire. Due to the lack of an empirical study in the Malaysian context, the exploration of the existence and availability of safety practices on SMS elements among Malaysian contractors working in processing plants was necessary. This was to determine whether the area is worth studying. It also generated rough ideas about what the current status of safety is among contractors in processing plants in the Malaysian context.

The exploratory survey questionnaire also acted as a mechanism for the researcher to focus on the subject under investigation. Research questions were developed, which helped the researcher to narrow down the topic during the main study, i.e. the semi-structured interviews.

The first research question intended to seek what encourages contractors to develop SMS. This question is important to discover whether SMS development is compliance oriented. The findings of this study revealed that a reliance culture is the main factor that encourages contractors to develop SMS.
The second and third questions focus on the effectiveness of SMS implementation and the underlying factors of the obstacles to SMS implementation among Malaysian contractors working in processing plants. These questions were answered through in-depth, semi-structured interviews, from which data was analysed using the grounded theory approach. The findings of this stage revealed that the culture of reliance, uncertainty of the working conditions and organisational processes have a significant influence on SMS implementation. The results of this finding were plotted into a model, which explains that the internal and external environment of the organisation has led to a misperception of safety responsibility, which influences the implementation of SMS.

The final question was about allocating issues and problems of SMS implementation according to the internal and external contingency perspectives to recommend a suitable approach to improve SMS implementation within the Malaysian context. The literature review revealed that as an organic type of organisation, construction companies face a lot of complexity and are tough to manage. Previous research (as described in Chapter 2) claims that the approach to effective SMS is dependent on a mechanistic type of organisation; therefore this question is crucial to gain a deeper insight into an approach that is appropriate for an organic type of organisation.

8.2.3 Fulfilment of the Third Objective

The third objective of the research was to investigate issues relating to SMS implementation, to determine the main obstruction that hinders effective SMS and represent this process through a suitable model according to contingency perspectives.

The findings of this research provide some interesting and helpful insights with regard to the internal and external factors of organisational impact on the implementation of SMS. Although the SMS of contractors is developed as required by the clients during submission of the tender document, implementation is only partial, as several areas of organisational impact occur. The important issue arising from this research is the way in which the three influential factors (a reliance culture, uncertainty of the working conditions and organisational processes) lead to a misperception of safety responsibility. This then contributes significantly to the problems of safety communication and training among Malaysian contractors working in processing plants. All three factors, to a greater
or lesser degree, relate to the ‘way in which safety is managed and implement around here’.

The importance of these findings is that it has identified the aspects of contractors’ SMS that lead to their attitude and behaviour towards implementation. By paying attention to these factors, it should be possible for contractors to provoke positive safety attitudes.

### 8.2.4 Fulfilment of the Fourth Objective

The final objective was to suggest improvements that could be made for effective SMS implementation and ways in which contractors can improve SMS implementation. The suggested improvements were based on the outcome of the preceding objective.

### 8.3 Research Contributions to Knowledge and Practitioners

This section presents the research contributions and the implications of this study from a broader perspective, and especially the implications of the results for a wider audience. The objectives of the study were to examine the issues around the process of acquiring effective SMS implementation, as well as investigating the reason for SMS development among Malaysian contractors working in processing plants. These objectives have been successfully achieved and the findings have been presented in-depth in the previous chapters. This section offers a broader discussion of the contributions of the study towards an understanding of the issues.

From a theoretical standpoint, the development of empirical research in SMS has lagged far behind the fast growing acceptance of SMS as a management philosophy for improving organisational effectiveness. The problem is even more acute outside the developed world where knowledge of SMS is almost non-existent. The research described in this study has attempted to bridge the gap between the existing theories and knowledge and the approaches required for increased effectiveness of SMS implementation in a developing country like Malaysia.

Chapter 2 reviewed the literature, bringing together diverse fields and approaches to the study of SMS implementation. At the end of this chapter, an approach to the view of
contingency perspectives was synthesised into a research framework, as shown in Figure 2.6. This framework conceptualised the internal and external factors of organisation that affect the implementation process of a system. Little attention has been given in previous studies to the impact of internal and external factors on SMS implementation. Therefore, the contribution of this study to knowledge cannot be denied.

Previous research has tended to focus on the application of priori assumptions based on existing theory and has explored the factors contributing to effective SMS by ranking or listing the variables. Despite the breadth of research in the area, it is apparent that little has been covered of the root causes of ineffective SMS implementation. The main study therefore investigated the root causes of ineffective SMS implementation from the perspective of those involved, providing a rich, grounded understanding of some of the key elements of SMS implementation and how they are experienced in the Malaysian context.

The results indicate that misperception of safety responsibility issues has a strong influence on contractors’ SMS implementation. This finding is an interesting one, as previous studies of SMS give little or no attention to this issue. Most studies concentrate on the perception of workers and risk control, for example the study by Holmes et al. (1999). Addressing this issue is essential to create awareness by the parties involved to improve SMS implementation.

Previous research has tended to focus on the perspective of contractors in general. This research has explored the perspectives of contractors working in processing plants, enabling comparison and discussion of the viewpoints of contractors’ views and increasing the relevance of the outcomes to overall SMS implementation. In Malaysia, there is a lack of published data on SMS implementation of contractors working in processing plants. Moreover, the exploration of the underlying causes of ineffective SMS implementation in the Malaysian construction setting has not been explored, which is a major gap, as the implementation approach based on the internal and external environment has clear potential to improve SMS implementation.

This research has contributed to furthering the understanding of the main factors influencing safety implementation by Malaysian contractors working in processing
plants. It has identified factors that are peculiar to, or exacerbated by, the internal and external environment of the organisation. Factors such as financial constrictions, cultural dimensions and working conditions are prominent influences.

Potentially, the measurement suggested in the model can be used to satisfy a variety of parties involved in identifying the factors, values and further improvements in SMS implementation. The model, which is presented in Chapter 7, provides a comprehensive measurement framework and helps to facilitate a regular view of contractors’ SMS implementation issues and problems.

The research has placed an emphasis on the experience of safety among Malaysian contractors working in processing plants and how this is formed through the attitude of top management, the role of clients and the behaviour of workers. It forms a safety relationship between the parties. This is in contrast to much of the existing literature, which focuses on one party only.

The findings of this research enable Malaysian contractors and other parties involved (clients and workers) to have a better understanding of the issues and problems surrounding SMS implementation. This research can assist contractors in their search for improvements in SMS implementation.

This study should be of particular interest to policymakers and related government or private bodies (DOSH, NIOSH, CIDB, NCOSH), as it identifies the key elements of SMS implementation issues and problems. Consequently, the study’s findings provide important insights for the policymakers and related government or private bodies into where they need to concentrate their efforts to ensure that SMS implementation by contractors is successful. For instance, the literature revealed the lack of construction accident statistics, and the data hides the root of the safety problem in Malaysia. The finding of this research, therefore, provides information and enables policymakers and related government or private bodies to better understand the reality and root causes of the issues and problems of SMS implementation among contractors. Policy makers should realise that even though the safety requirements in processing plants are high, safety among contractors is still an issue.
The finding of this research can serve as a basis to improve current safety policy and develop structured SMS implementation strategies. Current safety policy places the stress only on the people who create the risk, which in this case is the employer. The finding of this study reveals that unclear safety responsibility is an important issue in the construction industry. A thorough safety policy, which explains in detail the clear safety responsibilities of each party involved in the construction industry, is therefore needed.

The study provides detailed and in-depth understanding for the policy maker of the duplication of the safety requirements and safety standard issues among government and private safety agencies. Some of the important issues are safety training and the green card program. It is hoped that this revelation will open policy maker’s eyes to the fact that the duplication of safety requirements and safety standards has contributed to the ineffective SMS implementation among contractors working in processing plants.

From an application standpoint, it is hoped that the finding of this study will result in a better working environment among the supply chain of construction (client/contractor/workers) through an improvement in the SMS implementation process. The finding of this study is aimed at increasing the degree of effectiveness in SMS implementation by helping Malaysian top management to develop a step-wise implementation roadmap. The outcome of this study is to assist contractors to determine the areas for improvement, which are communication and safety training.

The finding of this study clearly demonstrates that clients can influence contractors’ SMS implementation. Therefore, the findings of this study can provide a deeper insight into the contractor’s dilemma of SMS implementation, and clients really need to understand the situation. Clients can influence the aspects of safety by standardising the safety requirements and standards among themselves.

From the standpoint of strategic human resource management, this study has useful implications not only for those responsible for selection and development of workers, but also to workers themselves. This study hopes to highlight areas for improvement to workers’ safety behaviour. For an employer, the workers selected for a job should be those whose locus of control is appropriate for the implementation strategy. Likewise, workers themselves, reviewing potential future assignments, should attempt to change
their safety behaviour. Workers are entitled to work in an environment in which the risks of hazards are properly controlled. Workers need to understand what is expected of them while on site and how they can contribute to a safe working environment. Workers need to understand that their poor attitude can pose danger to their safety and that of other workers.

**8.4 Limitations and Recommendations for Future Research**

Numerous problems and limitations were encountered during this study. Secondary data collection proved to be problematic due to the difficulty involved in gaining current Malaysian safety statistics and information. Regulations pertaining to the release of official government documents require formal letters of request, but in most cases, the necessary information was simply not available. Time also proved to be a limiting factor, as the sources of information were located at different places and many channels of communication had to be approved before any information was released.

During the fieldwork, the researcher encountered some non-responsive interviewees who were reluctant to offer any real options to some questions, which they perceived to be sensitive or may have negative repercussions. Respondents sometimes appeared to provide answers that they felt the researcher would like to hear, thus casting doubt on the validity and reliability of some of the data elicited. Most of the respondents felt comfortable communicating their answers in Malay, which meant that some of the meanings were lost in translation into English. The researcher accepts that all data collected were subject to personal interpretation. This may have affected to some extent the results of the findings and any conclusions drawn.

This study cannot guarantee that the findings reported are representative of all contractors working in processing plants. This is because the number of respondents involved in this study is not large. However, the sample was sufficient for a qualitative design. In future, more respondents should be interviewed to ensure that the results are generalised. The study has been conducted primarily within the context of Malaysia, and the interviews and surveys have focused on Malaysian construction industry practitioners. Thus, the importance of attributes is strongly influenced by the local environment and culture. In the event that the model is to be implemented or utilised in other countries, further
research would be needed to modify the attributes to suit the conditions and culture in that country.

This study has its limitations in that it only investigates the issues of SMS implementation from the perspective of the contractors. Further research into the topic should incorporate the view of the clients and contract workers, so that the varying views of effective SMS implementation can be uncovered.

This study does not differentiate respondents according to the size and age of their firm. All types of contractors involved in processing plants were invited to participate in the case studies. Future research should adopt the case studies of contractors that have successfully implemented SMS, and determine what factors contribute to being successful. It is also suggested that a comparison of large, medium and small contractors be explored.

There are a number of areas identified from this research that could usefully be explored further. In future, a detailed case study of SMS implementation among the construction supply chain needs to be conducted. The integration of SMS and supply chain management might be an interesting topic to study. This research has provided a significant contribution by identifying the misperception of the safety responsibilities in the SMS implementation process. The identification of this variable is particularly significant, as it appears to perform an important mediating role in the achievement of effective SMS implementation. The importance of this variable does not appear to have been widely recognised in the existing literature and consequently this study has provided a valuable insight into a new issue that affects effective SMS implementation. In future, a more rigorous investigation into the relationship between the misperception of safety responsibilities and SMS implementation could be interesting and potentially helpful when considering how the parties involved in the construction industry cope with it.

8.5 Concluding Remarks and Recommendations

This chapter has outlined the research objectives and findings. The aim of this study was to explore the nature and extent of the problems faced by Malaysian contractors working
in processing plants in implementing SMS. The results indicate a significant level of difficulty. The findings have revealed that the main barriers to effective SMS implementation are culture dimensions, resource constriction and working conditions. Addressing these barriers is essential to improve levels of SMS implementation by contractors in processing plants and thereby improve SMS performance in the construction industry. From the main barriers, a theory was developed which shows that misperception of safety responsibility has led to communication breakdown and poor safety training. Developing the theory is important to aid understanding and action in the area under investigation.

This study has generated findings from the contractors’ experience of safety with regard to SMS, with specification on contractors working in processing plants. The research attempt is based on multiple case studies with the hope of allowing generalisation of the findings. The main purpose of this approach was to provide meaningful data and more resources.

In the traditional view, safety is always regarded as an independent function in the management system. Safety is wrongly assumed by the top management to be a specialist function that is separate from their normal management activities. Given that safety is an integral part of the management’s function, the SMS tells everyone in the organisation what their responsibilities are and provides guidelines to develop a safer workplace. To achieve this, a change of mentality is needed, starting from the top management. At the level of the firm, positive attitudes can be encouraged by the organisational policy of a firm to safety, the behaviour of management and supervision and equipment management in stimulating good practice.

It is believed that this study provides a positive contribution to the field. Several recommendations have been outlined for future research into the effectiveness and robustness of effective SMS implementation.
REFERENCES


Ahmad, R. (2008), *Best practices in safety management for conventional civil construction industry in Malaysia*, Thesis (Master of Science), University of Technology, Malaysia.


Anonymous (2000), *Malaysia’s recovered petchem industry is expanding*, *Oil and Gas Journal*, 98(38), 58-60.


Attwood, D., Khan, F. and Veitch, B. (2006), *Occupational accident models—where have we been and where are we going?* *Journal of Loss Prevention in the Process Industries*, 19(6), 664-682.


Christenson, Dale. (2007), *The role of vision as a critical success element in project management*, Thesis (PhD), School of Property, Construction and Project Management, Royal Melbourne Institute of Technology University.


Department of Occupational Safety and Health (DOSH). (2009). Available from: http://www.dosh.gov.my/wps/portal!ut/p/kcxml/04_Sj9SPykssy0xPLMnMz0vM0Y_QjzKLN4g3sfQASYGYxqb6kWhCjgiRIH1vfVP_NxU_QD9gtzQiHJHR0UA6x_o5A!!/delta/base64xml/L3dJdyEvd0ZNQUFzQUMvNEIVRS82XzBfNjg0?WCM_GLOBAL_CONTEXT=/wps/wcm/connect/JKKP+Site/Laman+Utama/Safety+Alert/3+bkf_02_2008. Retrieved on: 17/05/09.


Edwards, D.J. and Nicholas, J. (2002), The state of health and safety in the UK construction industry with a focus on plant operators, *Structural Survey*, 20(2), 78-87.


Maxwell, P. (2004), Safety management system, Charles Stuart University, Australia.


Raglan, L.H.C. (2003), *An investigation into the implementation of safety management systems by Hong Kong construction contractors*, Thesis (PhD), University of Hong Kong.


Shabha, G. and Rudge, D. (1997), The long-term importance of education to raise safety levels and the implementation of the CDM regulations in the European building industry, Structural Survey, 15, 2, 87-91.


Utusan Malaysia Online. (2009a), Seorang mati gas bocor di loji LNG Bintulu. Available from:
Utusan Malaysia Online. (2009b), 1,300 kematian kemalangan tempat kerja tahun lepas. Available from:
Utusan Malaysia Online. (2009c), Kemalangan di tempat kerja membimbangkan. Available from:


Dear Sir or Madam,

SURVEY OF SAFETY MANAGEMENT SYSTEMS (SMS) PRACTICES OF CONTRACTORS IN PROCESSING PLANTS

I am a research student (PhD) in the Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, England. I am currently undertaking a research on the above subject.

The purpose of this survey is to examine the current SMS practices of contractors performing works in the processing plants. The information provided in this survey will be treated in strict confidence and will be used for academic purpose only. I will be grateful if you would take the time to answer the attached questionnaire at your earliest convenience. Please return your reply in the enclosed, stamped envelope.

Thank you for your co-operation.

Yours sincerely,

Norfaridatul Akmaliah Othman
APPENDIX B: QUESTIONNAIRE

Wolfson School of Mechanical and Manufacturing Engineering
Loughborough University Leicestershire LE11 3TU
United Kingdom

SURVEY OF CONTRACTORS IN OIL, GAS AND PETROCHEMICAL INDUSTRY’S ON SAFETY MANAGEMENT SYSTEMS PRACTICES

GENERAL INSTRUCTIONS AND INFORMATION

1. The objective of this research are to examine the current practice in safety management system within your company.

2. All individual responses to this questionnaire will be kept STRICTLY CONFIDENTIAL.

3. Based on your experience, please give your honest impressions and to the best of your knowledge on safety management systems practices in your company.

4. Kindly return the completed questionnaire in the enclosed self-addressed, stamped envelope at your earliest possible convenience.

5. If you would like to receive the Summary of Results of this survey, please write down your e-mail address below or enclose a business call card.

   Your e-mail address:...........................................

~THANK YOU FOR YOUR PARTICIPATION~

N.A. Othman (Researcher)
Wolfson School of Mechanical and Manufacturing Engineering
Loughborough University Leicestershire LE11 3TU UK
Tel: +44 1509 556351/+44 7887 802065
Fax: +44 1509 227513
E-mail: N.A.Othman@lboro.ac.uk
SECTION A: ABOUT ORGANISATION

Please tick [/] where appropriate

1. What is your position in the company?

2. Where do you perform your job?
   [ ] Head office  [ ] Site-project

3. Which grade of contractor are your company’s in?
   a) Construction Industry Development Board Malaysia

<table>
<thead>
<tr>
<th>Tick as Appropriate</th>
<th>Grade</th>
<th>Tendering Capacity (RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G1</td>
<td>Not exceeding 100,000</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>Not exceeding 500,000</td>
</tr>
<tr>
<td></td>
<td>G3</td>
<td>Not exceeding 1 million</td>
</tr>
<tr>
<td></td>
<td>G4</td>
<td>Not exceeding 3 million</td>
</tr>
<tr>
<td></td>
<td>G5</td>
<td>Not exceeding 5 million</td>
</tr>
<tr>
<td></td>
<td>G6</td>
<td>Not exceeding 10 million</td>
</tr>
<tr>
<td></td>
<td>G7</td>
<td>No limit</td>
</tr>
</tbody>
</table>

4. Your company is a ......................
   [ ] Main Contractor  [ ] Sub-contractor

5. Which project/s does your company involved in?
   [ ] Maintenance  [ ] Shutdown
   [ ] New Project  [ ] Other, please specify

6. How many employees does the company have?
   [ ] Less than 100  [ ] Between 101 to 250
   [ ] Between 251 to 500  [ ] More than 500
### SECTION B: SAFETY MANAGEMENT SYSTEMS

Please tick [ ] YES or NO, as appropriate.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>YES</th>
<th>NO</th>
<th>DON’T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy/Planning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Does your company have H&amp;S policy?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Is the policy available to all staff?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Do you understand the H&amp;S policy of your company?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Does the policy really affect the way you work?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Does your company have safety plan?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Organising/Implementation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Does your company have department responsible for H&amp;S?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Does your company allocated responsibilities for H&amp;S to specific people?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Are these people dedicated to H&amp;S tasks alone?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Do these people have any specific training or qualifications in H&amp;S?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Are goals for accident rates set and monitored?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Does your company have accurate records of injuries, ill health and accidental loss?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Are follow up reports required for accident reports?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Are employees informed of accident rates and progress?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Does your company handle risk assessment?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Does your company informing workers of the risks present and the necessary control measures?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Do your directors/managers monitor H&amp;S?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Auditing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Does your company carry out H&amp;S audits?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Do the audits involve staff at all levels?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SECTION C: SAFETY AWARENESS AND IMPLEMENTATION

**Please tick [ ] YES or NO, as appropriate.**

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>YES</th>
<th>NO</th>
<th>DON'T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>25. Do you aware about OSHA 1994?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Is the legislation regarding H&amp;S difficult to interpret?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Are you well informed about H&amp;S issues in your company?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Do you satisfied with the H&amp;S situation in your company?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. Are themed campaigns ever held?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. Does your organisation use external H&amp;S consultants at all?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. Do you know who was responsible for H&amp;S in your organisation?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. Does your employer promote safety on-the-job?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. Have you received on-the-job safety training?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. Did you receive formal H&amp;S training?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35. Have you learned anything about safety at work?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. Any obstacle for H&amp;S improvement? If YES, what is/are the obstacle/s?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Costs-----------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Paperwork/Documentation----------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lack of Training-------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Priority to Production-------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lack of Time----------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lack of Staff----------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Employee Attitudes-----------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Employee Demands--------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Top Management/Manager Attitudes--------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Planning Difficulties-------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Not Profitable----------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Others, please specify-------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C: SEMI-STRUCTURE INTERVIEW QUESTIONS GUIDELINE

Section A: Background
1. Can you brief the background of the company?
2. What is the job nature of this company?
3. What is your CIDB grade license?
4. Do you work as a main contractor or sub-contractor?
5. What project do you normally involve in processing plant? Is it turnaround/shutdown project, maintenance work or else?
6. Where do you perform your job the most? Onshore? Offshore?
7. How long you have been with this company?
8. What is your task? Daily routine?
9. How many employees in this company?
10. Do you have safety management system in this company?

*note: If respondents answer ‘YES’ to Q10, proceed to section B and C. If respondents answer ‘NO’ to Q10, proceed to section D.

Section B: Safety Management Systems (Development)
1. What make you develop the system?
2. How do you develop safety management systems?
3. What is the objective of safety management systems?

Section C: Safety Management Systems (Implementation – Critical Success Factors and Problems)
1. How do you manage safety management systems in this company? What are the steps/processes to implement the system?
2. Do you include the safety process in tender document?
3. Do you have specific safety organisation chart or department in this company?
4. Who will normally responsible on safety?
5. Do you appoint any safety supervisor or safety officer?
6. Do you record/document your safety process? Any safety record? What happen to the report and record/documentation?
7. Do you do risk assessment in this company?
8. What about the controlling process?
9. Any auditing?
10. Are there any barriers in implementing the system? What are the problems of implementing safety? Any precaution taken to cope with the problems?
11. In your view what are the critical success factor of the implementation? What factors influence the implementation?

Section D: Other Safety Matters
1. Why don’t you have safety management systems in this company?
2. So how do you manage your safety?
3. How do you communicate safety within this company?
4. What about the requirement of safety officer?
5. Do you have a specific allocation for safety? How much do you spend on safety?
6. Do you provide PPE to the workers?
7. Have you ever experienced any accident? How many accidents per year? Is the accident affecting absenteeism? Is there any cost of lost time due to the accident?
8. In your view, why did the accident happen?
9. Do you provide safety training to the workers? Are there any safety training provided by the company to workers, especially to the new workers?
10. What about safety induction?
11. Do you have safety meeting?
12. What is the management commitment of safety in this company? Any safety reward? Theme campaign?
13. Do you think safety is a burden to you?
14. Do you think safety can act as a competitive advantage?
15. As a concluding remark, do you satisfy with the safety condition in this company?
APPENDIX D: TRANSCRIBE INTERVIEW AND CODING

Respondent 1 [CODE – CW]
Company : CIDB Grade 7
Date : 15 June 2005
Time : 2pm
Place : Kuala Lumpur

<table>
<thead>
<tr>
<th>QUESTION AND ANSWER</th>
<th>CODE</th>
<th>OPEN CODING</th>
<th>CONCEPT</th>
<th>THEMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>What make you develop the system? As I told you earlier it was the practices of our parents company [“adopt system”] which is Chiyoda Corporation, Yokohama Japan. Thus, we adopted [“adopt system”] the system here [“growing system”].</td>
<td>CW12</td>
<td>Adopt system Growing system</td>
<td>Available adoption system</td>
<td>Systems and procedures</td>
</tr>
<tr>
<td>How do you manage safety management system in this company? What are the steps/processes to implement the system? When we carried out job, okay, this is first document on health, safety and environment, first document [“manual”]; we should come out with a HSE management plan [“management plan”] for such job. We do have HSE policy [“policy”], of the project. Then, organisational structure [“organisational structure”] of the project, roles and responsibilities of the people inside here [“delegation”], and what is our plan [“management plan”] of the job. HSE meeting, training, inspection, JSA, PPE, housekeeping, health and welfare, environment protection, and so on [“available approach”], promotion and we should have our own HSE audit, incident investigation, and rules and regulation [“available approach”]. So this is what we produced.</td>
<td>CW13</td>
<td>Manual Management plan</td>
<td>Documentation Planning Organising</td>
<td>People and organisation</td>
</tr>
<tr>
<td>Do you include the safety Brief</td>
<td>CW14</td>
<td>Documentation People and organisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CW15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CW16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CW17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**process in tender document?**
For tender, actually we submit the same thing but, very general ["brief documentation"]. When we secured a job, then we should have, first of all, we issued for approval and then the client will comment ["client's feedback"], and then we issued for execution for construction. The content in the tender is very brief ["brief documentation"], that was standard document ["brief documentation"]. We do have proposed organisation chart ["organisational structure"] for the whole project.

<table>
<thead>
<tr>
<th>CW18</th>
<th>CW19</th>
<th>CW20</th>
</tr>
</thead>
<tbody>
<tr>
<td>documentation</td>
<td>Client's feedback</td>
<td>Organisational structure</td>
</tr>
<tr>
<td></td>
<td>Client's responses</td>
<td>Organising</td>
</tr>
<tr>
<td></td>
<td></td>
<td>organisation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Client's orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>People and organisation</td>
</tr>
</tbody>
</table>

**So, the entire subcontractors have to follows this?**
We did our construction such a way ["different system"]. We don't have anything ["service"]. We are managing ["sense of control"] the sub-contractors only. We don't have a single building machine ["service"] on our own. We do construction management ["service"]. So, the layer, this is construction, so, we have construction manager ["delegation"], and under him, there are a few supervisors ["level of power"].

<table>
<thead>
<tr>
<th>CW21</th>
<th>CW22</th>
<th>CW23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different system</td>
<td>Service</td>
<td>Sense of control</td>
</tr>
<tr>
<td></td>
<td>Delegation</td>
<td>Level of power</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>organising</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Systems and procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>People and organisation</td>
</tr>
</tbody>
</table>

**Chiyoda supervisor?**
Yes! Chiyoda personnel ["delegation"] regardless of permanent employees ["permanent workers"] or outsource sub-contract ["temporary workforce"], civil and structural supervisor, piping supervisor, electrical instrument supervisor ["delegation"], so in this civil there might be a few contractors ["layers of structure"] let say piling contractor. So, later on there will be infrastructures sub-

<table>
<thead>
<tr>
<th>CW24</th>
<th>CW25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delegation</td>
<td>Layers of structure</td>
</tr>
<tr>
<td>Delegation</td>
<td>Sense of control</td>
</tr>
<tr>
<td>Delegation</td>
<td>Superior control</td>
</tr>
<tr>
<td></td>
<td>Permanent workers</td>
</tr>
<tr>
<td></td>
<td>Temporary workforce</td>
</tr>
<tr>
<td></td>
<td>organisation</td>
</tr>
<tr>
<td></td>
<td>Human resource</td>
</tr>
<tr>
<td></td>
<td>People and organisation</td>
</tr>
</tbody>
</table>
contractors ["layers of structure"]. And maybe building construction ["layers of structure"], if there's a building. So, one supervisor is not enough ["delegation"]. So we have to employ a few supervisors ["delegation"] to sit in this position. The supervisor will monitor ["sense of control"] the progress of each contractor. He is responsible to construction manager ["superior control"]. Construction manager is responsible to project manager ["superior control"]. Project manager will responsible to project director ["superior control"]. It is the same in mechanical ["delegation"].

### Is the supervisor qualified in safety?
Oh that's why! Safety, we are having another project safety and health officer ["separation by power"]. So, there should be one section of safety ["growing system"]. The contractors should have their own safety supervisor ["separate system"]. The supervisors are actually dealing directly ["liaise"] with our safety and health officer ["level of power"].

### So no matter how many workers they have, right?
Yes, certain package, big package ["size of project"], a lot of workers ["number of workers"], which mean we should, what you call, emphasize our sub-contractors to have more than one ["sense of control"]. It will depend on the work volume ["size of project"] and the manpower ["number of workers"]. It will depend on the situation ["situation of project"]. And it will also depend on the size of the project ["size of project"]. For instance, for a

<table>
<thead>
<tr>
<th>CW31</th>
<th>Separation by power</th>
<th>Organising</th>
<th>People and organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW32</td>
<td>Growing system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW33</td>
<td>Separate system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW34</td>
<td>Liaise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW35</td>
<td>Level of power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW37</td>
<td>Size of project</td>
<td>Human resource</td>
<td>People and organisation</td>
</tr>
<tr>
<td>CW38</td>
<td>Number of workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW39</td>
<td>Situation of project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW40</td>
<td>Value of project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW41</td>
<td>Sense of control</td>
<td>Organising</td>
<td>People and organisation</td>
</tr>
<tr>
<td>CW42</td>
<td>Liaise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW43</td>
<td>Problem solver</td>
<td>Documentation</td>
<td>People and organisation</td>
</tr>
<tr>
<td>CW44</td>
<td>Report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW45</td>
<td>Superior control</td>
<td>Approval from client</td>
<td>Client's orientation</td>
</tr>
<tr>
<td>CW46</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
hundred million RM project, we will have Project HSE Manager ["value of project"]. Then we will have one, two, maybe three safety and health officer ["value of project"]. So, sub-contractors will also have maybe one or two safety officers ["value of project"] dealing with our one safety officer ["sense of control"]. So, safety officer from subcontractors will liaise ["liaise"] with our HSE manager ["sense of control"]. And our HSE manager will liaise with the client ["superior control"]. So safety officer from subcontractors is not allowed to deal directly to the client ["sense of control"]. So we are here to settle everything ["problem solver"]. And we do have all kind of report ["report"]. We have weekly safety statistics, and monthly safety performance ["report"].

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Organising</th>
<th>People and organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this report compiled by safety officer?</td>
<td>Own your own</td>
<td>Organising</td>
<td>People and organisation</td>
</tr>
<tr>
<td>Actually, compiled by me [&quot;on you own&quot;].</td>
<td>CW51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>But from the site? Site? They only use it! [&quot;system utilise&quot;]</td>
<td>CW52</td>
<td>System utilise</td>
<td>People and organisation</td>
</tr>
</tbody>
</table>
APPENDIX E: NODE

<p>| act for superior | [R4] This is one of the workers attitudes. They will only pretend to act safely when there were superior (i.e.: supervisor, safety officer) at the workplace. |
| act for superior | [R4] -as above- |
| act for superior | [R4] -as above- |
| adding system | [R4] Headquarters will be acknowledged on any changes from client. The headquarters will then add in the system. |
| adding system | [R4] Manual from client has been used as support of current company’s safety policy. |
| adding system | [R4] Client has provided safety guideline. The company followed the guideline and add it with other thing for example award to the best workers. |
| adding system | [R4] The client will provide safety induction every time when there is a new project commencement. The company, however, do not provide any safety training to the workers. The company only provide technical training to the workers. |
| adding system | [R4] -as above- |
| adding system | [R4] -as above- |
| adding system | [R4] -as above- |
| adding system | [R4] -as above- |
| adding system | [R4] -as above- |
| adding system | [R6] One of the barriers to implement safety is there were no adding system within the organisation. Safety system cannot work alone. There should be the right person to enforce safety. |
| ad-hoc project | [R2] One type of project. |
| adopt system | [R1] The company adopted the safety system from their parents company. The company believes that they have high standard of safety system due to this reason. |
| adopt system | [R1] -as above- |
| adopt system | [R1] -as above- |
| adopt system | [R1] -as above- |
| adopt system | [R1] -as above- |
| adopt system | [R2] The company adopted the safety system from their parents company. |
| adopt system | [R2] -as above- |
| adopt system | [R2] -as above- |
| adopt system | [R4] The branch will just follow the safety system from the headquarters. |
| adopt system | [R4] -as above- |
| adopt system | [R7] Sub-contractors will adopt safety system from the main contractors. |
| advisory roles | [R7] The main contractors have no power to enforce safety to the sub-contractors. What they can do is only provide some guidelines and advice to the sub-contractors. |
| annual budget | [R1] Annual budget for safety is very subjective. This is because the company only allocated annual budget for each department, and not for safety per se. |
| available approach | [R1] The company have safety manual, safety policy and the implementation is in hand. However, the practices were due to the adaptation of safety practices from the parents company. |
| available approach | [R1] -as above- |
| available approach | [R5] The safety approach is not very clear. |
| available approach | [R5] -as above- |
| available approach | [R7] Safety become into play in the selection process. |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>available approach</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available PPE</td>
<td>[R2] The company will replenish PPE every year. However, the type of PPE has not been recognised</td>
</tr>
<tr>
<td>available PPE</td>
<td>[R2] -as above-</td>
</tr>
<tr>
<td>available PPE</td>
<td>[R4] Basic PPE are on the worker responsibility. The company will only provide other type of PPE (critical or special type of PPE)</td>
</tr>
<tr>
<td>available PPE</td>
<td>[R4] -as above-</td>
</tr>
<tr>
<td>available system</td>
<td>[R2] Available safety system but due to adaptation from parent company (overseas).</td>
</tr>
<tr>
<td>available system</td>
<td>[R2] -as above-</td>
</tr>
<tr>
<td>available system</td>
<td>[R3] There were availability safety systems of client. However, different client have different safety practices and requirement.</td>
</tr>
<tr>
<td>available system</td>
<td>[R4] Availability of safety system.</td>
</tr>
<tr>
<td>available system</td>
<td>[R4] -as above-</td>
</tr>
<tr>
<td>available system</td>
<td>[R7] Displayed safety policy.</td>
</tr>
<tr>
<td>available system</td>
<td>[R7] Safety committee.</td>
</tr>
<tr>
<td>available system</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available system</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available system</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available system</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available training</td>
<td>[R2] Training was available due to the adaptation of safety system from parents company. The workers have been trained by professionals from the parents company.</td>
</tr>
<tr>
<td>available training</td>
<td>[R2] -as above-</td>
</tr>
<tr>
<td>available training</td>
<td>[R4] Training is provided by client. Training provided by workers is limited to staff (level supervisor and above) only, not to general workers.</td>
</tr>
<tr>
<td>available training</td>
<td>[R4] -as above-</td>
</tr>
<tr>
<td>available training</td>
<td>[R5] The training is not clear.</td>
</tr>
<tr>
<td>available training</td>
<td>[R7] HR will in charge safety training based on requirement, in-house or external training.</td>
</tr>
<tr>
<td>available training</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available training</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>available training</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>bidding process</td>
<td>[R1] A part of contractor’s selection process in order to secure job in processing plants.</td>
</tr>
<tr>
<td>brief documentation</td>
<td>[R1] Safety process in the tender document was a very basic document.</td>
</tr>
<tr>
<td>brief documentation</td>
<td>[R1] -as above-</td>
</tr>
<tr>
<td>brief documentation</td>
<td>[R1] -as above-</td>
</tr>
<tr>
<td>budget</td>
<td>[R2] Allocation on safety specifically on PPE.</td>
</tr>
<tr>
<td>budget</td>
<td>[R4] Budget is as per project. No specific safety budget. The project manager is the person who will in charge on the budget for the whole project.</td>
</tr>
<tr>
<td>budget</td>
<td>[R4] -as above-</td>
</tr>
<tr>
<td>bureaucracy</td>
<td>[R1] Investigation of accident will consume a lot of stages and time from the Department of Safety and Health (DOSH). Company would rather not to submit any accident report due to this.</td>
</tr>
<tr>
<td>bureaucracy</td>
<td>[R1] -as above-</td>
</tr>
<tr>
<td>bureaucracy</td>
<td>[R7] Tendency of improper equipment was due to bureaucracy. There were a lot of stages to dealt with in order to bring in equipments to the oil and gas plants.</td>
</tr>
<tr>
<td>bureaucracy</td>
<td>[R7] -as above-</td>
</tr>
<tr>
<td>bureaucracy</td>
<td>[R7] It is quite hard for the main contractor to penalise any sub-contractor that do not implement safety. They have to go several stages to do that.</td>
</tr>
</tbody>
</table>
### APPENDIX F: CUTTING, PASTING AND GROUPING PROCESS

#### MANAGEMENT SYSTEM

<table>
<thead>
<tr>
<th>Safety System</th>
<th>Documentation</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>adding system</td>
<td>brief documentation</td>
<td>combine meeting</td>
</tr>
<tr>
<td>adopt system</td>
<td>checklist</td>
<td>communication</td>
</tr>
<tr>
<td>available approach</td>
<td>daily report</td>
<td>consult</td>
</tr>
<tr>
<td>available system</td>
<td>filing system</td>
<td>courteous approach</td>
</tr>
<tr>
<td>centralised system</td>
<td>form</td>
<td>daily meeting</td>
</tr>
<tr>
<td>different system</td>
<td>internal record</td>
<td>explanation</td>
</tr>
<tr>
<td>emergency procedure</td>
<td>lack of record</td>
<td>gain information</td>
</tr>
<tr>
<td>expand system</td>
<td>manual</td>
<td>inform</td>
</tr>
<tr>
<td>growing system</td>
<td>policy</td>
<td>information</td>
</tr>
<tr>
<td>joined system</td>
<td>procedure</td>
<td>instruction</td>
</tr>
<tr>
<td>misplaced</td>
<td>proof</td>
<td>proper approach</td>
</tr>
<tr>
<td>occasional reminder</td>
<td>record</td>
<td>quarterly meeting</td>
</tr>
<tr>
<td>on your own</td>
<td>replacement form</td>
<td>reminder</td>
</tr>
<tr>
<td>overlook</td>
<td>report</td>
<td>safety briefing</td>
</tr>
<tr>
<td>own initiatives</td>
<td>safety review</td>
<td>safety induction</td>
</tr>
<tr>
<td>separate system</td>
<td>weekly report</td>
<td>signage</td>
</tr>
<tr>
<td>size of project</td>
<td>work procedure</td>
<td>theme campaign</td>
</tr>
<tr>
<td>system failure</td>
<td></td>
<td>weekly meeting</td>
</tr>
<tr>
<td>system not utilise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>system utilise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>take for granted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tender requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>unsure status</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### HUMAN RESOURCE

<table>
<thead>
<tr>
<th>Selection and Training</th>
<th>Recognition</th>
<th>Worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>available approach</td>
<td>incentive</td>
<td>act for superior</td>
</tr>
<tr>
<td>available training</td>
<td>insurance coverage</td>
<td>good collaboration</td>
</tr>
<tr>
<td>centralised system</td>
<td>recognition</td>
<td>human nature</td>
</tr>
<tr>
<td>client's requirement</td>
<td></td>
<td>ignorance</td>
</tr>
<tr>
<td>costly</td>
<td></td>
<td>inappropriate workforce</td>
</tr>
<tr>
<td>enforcement</td>
<td></td>
<td>experienced workforce</td>
</tr>
<tr>
<td>lack of training</td>
<td></td>
<td>inexperienced workers</td>
</tr>
<tr>
<td>limited training</td>
<td></td>
<td>major injury</td>
</tr>
<tr>
<td>on your own</td>
<td></td>
<td>minor injury</td>
</tr>
<tr>
<td>overlook</td>
<td></td>
<td>negligence</td>
</tr>
<tr>
<td>size of company</td>
<td></td>
<td>numbers of workers</td>
</tr>
<tr>
<td>size of project</td>
<td></td>
<td>offhand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>own experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>permanent workforce</td>
</tr>
<tr>
<td></td>
<td></td>
<td>playful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>qualified workforce</td>
</tr>
<tr>
<td></td>
<td></td>
<td>postulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>take for granted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>temporary workforce</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unsure status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>worker's attitude</td>
</tr>
<tr>
<td></td>
<td></td>
<td>worker's culture</td>
</tr>
<tr>
<td>FINANCIAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Budget</strong></td>
<td><strong>Process</strong></td>
<td></td>
</tr>
<tr>
<td>annual budget</td>
<td>bureaucracy</td>
<td></td>
</tr>
<tr>
<td>budget</td>
<td></td>
<td>time consuming</td>
</tr>
<tr>
<td>client's requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>financial burden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>financial support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>indirect cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>project basis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>resource limitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>separate budget</td>
<td></td>
<td></td>
</tr>
<tr>
<td>unsure status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>value of project</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLIENT</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td><strong>System</strong></td>
<td></td>
</tr>
<tr>
<td>available training</td>
<td>available system</td>
<td></td>
</tr>
<tr>
<td>bureaucracy</td>
<td>bureaucracy</td>
<td></td>
</tr>
<tr>
<td>client's recognition</td>
<td>unsure status</td>
<td></td>
</tr>
<tr>
<td>client's approach</td>
<td>client's requirement</td>
<td></td>
</tr>
<tr>
<td>client's feedback</td>
<td>client's system</td>
<td></td>
</tr>
<tr>
<td>liaise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>manual from client</td>
<td></td>
<td></td>
</tr>
<tr>
<td>recognition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>safety priority</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GOVERNMENT</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td><strong>System</strong></td>
<td></td>
</tr>
<tr>
<td>bureaucracy</td>
<td>government's requirement</td>
<td></td>
</tr>
<tr>
<td>overlook</td>
<td>law's requirement</td>
<td></td>
</tr>
<tr>
<td>time consuming</td>
<td>unsure status</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORGANISATIONAL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td><strong>Manage</strong></td>
<td><strong>Purpose</strong></td>
</tr>
<tr>
<td>centralised system</td>
<td>delay</td>
<td>client's requirement</td>
</tr>
<tr>
<td>delegation</td>
<td>indirect involvement</td>
<td>company's requirement</td>
</tr>
<tr>
<td>expand organisation</td>
<td>lack of control</td>
<td>formality purpose</td>
</tr>
<tr>
<td>layers of structure</td>
<td>lack or enforcement</td>
<td>reputation</td>
</tr>
<tr>
<td>level of power</td>
<td>lack of expertise</td>
<td>show off</td>
</tr>
<tr>
<td>on your own</td>
<td>act by incident</td>
<td></td>
</tr>
<tr>
<td>organisational structure</td>
<td>liaise</td>
<td></td>
</tr>
<tr>
<td>promoted</td>
<td>management plan</td>
<td></td>
</tr>
<tr>
<td>responsible</td>
<td>overlook</td>
<td></td>
</tr>
<tr>
<td>retention</td>
<td>separation by location</td>
<td></td>
</tr>
<tr>
<td>sense of control</td>
<td>synchronisation</td>
<td></td>
</tr>
<tr>
<td>separate committee</td>
<td>unsure status</td>
<td></td>
</tr>
<tr>
<td>separation by power</td>
<td>advisory roles</td>
<td></td>
</tr>
<tr>
<td>situation of project</td>
<td>joined task</td>
<td></td>
</tr>
<tr>
<td>size of company</td>
<td></td>
<td></td>
</tr>
<tr>
<td>size of project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>superior control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>value of project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>Equipment</td>
<td>Work Process</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>ad-hoc project</td>
<td>available PPE</td>
<td>lack of implementation</td>
</tr>
<tr>
<td>design stage</td>
<td>costly</td>
<td>lack of safety</td>
</tr>
<tr>
<td>development project</td>
<td>handling problem</td>
<td>bidding process</td>
</tr>
<tr>
<td>high risk workplace</td>
<td>improper equipment</td>
<td>bureaucracy</td>
</tr>
<tr>
<td>location of project</td>
<td>lack of PPE</td>
<td>client's requirement</td>
</tr>
<tr>
<td>low risk workplace</td>
<td>on your own</td>
<td>inspection</td>
</tr>
<tr>
<td>nature of project</td>
<td>overlook</td>
<td>investigation</td>
</tr>
<tr>
<td>preliminary stage</td>
<td>retention</td>
<td>job priority</td>
</tr>
<tr>
<td>project schedule</td>
<td>short-cut problem</td>
<td>lack of safety priority</td>
</tr>
<tr>
<td>turnaround project</td>
<td>time consuming</td>
<td>problem solver</td>
</tr>
<tr>
<td></td>
<td>extreme weather</td>
<td>reputation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>safety timeout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>work process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>workload increased</td>
</tr>
</tbody>
</table>
VALIDATION SHEET
EFFECTIVE IMPLEMENTATION FOR SAFETY MANAGEMENT SYSTEMS

Section A – Respondent Particulars

Company Type: Main Contractor/Sub Contractors/Others [          ]

Company Grade (CIDB): [          ]

Project Type: Maintenance/Shutdown/Other [          ]

Position: [          ]

Section B – Barriers to Effective SMS Implementation
Please refer to Figure 1 on “SMS Implementation Experienced by Contractors” (referred to hereafter as the “Model”) and kindly answer the following questions. (Please tick X where appropriate).

Figure 1: Barriers to Effective SMS Implementation Experienced by Contractors
Figure 1 illustrates the barriers to effective safety management systems (SMS) implementation. Based on the research finding, the barriers to effective SMS implementation can be divided into external factors (clients) and internal factors (contractors and contract workers). Several distinct misperceptions of safety responsibility between clients, contractors and contract workers emerged from these barriers. These misperceptions are responsible for the poor communication and training during the SMS implementation process.

A two-way communication shows that misperceptions of safety responsibility between clients and contractors are low. It appears that SMS implementation of contractors dependent too much on clients’ requirement and enforcement. As safety requirements and enforcement vary from one client to another, contractors will only implement SMS according to what clients has stressed. Some clients stress on safety while other stress on project performance.

In the case of contract workers, it appears that only one-way communication emerged. Clients have their own safety responsibilities to ensure their job sites are safe and keep workers aware on risks and hazards in their plants. Therefore, it is the clients’ responsibility to take safety action, for instance, to provide safety induction before any job commencement. However, it appears that this type of communication offers only a one-way communication, where contract workers hardly raise up any safety issue to discuss during safety induction session. This relates with the culture of contract workers.

Misperception of safety responsibility between contract workers and contractors are high. Two main reasons led to this condition: (1) Contractors rely heavily on clients’ safety action (e.g. safety induction) and assume that it is sufficient for contract workers; (2) Contractors assume that contract workers have the ability to perform work safely due to their experience of working in previous jobsites.

<table>
<thead>
<tr>
<th>Q1</th>
<th>Do you AGREE that the Model:</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>is easy to understand</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>is appropriate with current SMS condition in your company</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>is appropriate with current SMS condition in other company</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>can improve management’s understanding on SMS condition</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>can improve employees’ understanding on SMS condition</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>can improve clients’ understanding on SMS condition</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
</tbody>
</table>
Section C – Approach to Effective SMS Implementation

Please refer to Figure 2 on “Approach to Effective SMS Implementation” (referred to hereafter as the “Model”) and kindly answer the following questions. (Please tick X where appropriate).

Figure 2: Approach to Effective SMS Implementation

Figure 2 is a proposed approach for effective SMS implementation for Malaysian contractors working in processing plants. In order to cope with the internal and external factors, strong commitment from contractors is needed for effective SMS. Contractors need to improve their relationship and coordination with contract workers. This can be done through effective communication (e.g. safety meeting and theme campaign) and in-house safety training. Therefore, contract workers’ involvement can be improved. Apart from that, clients as the owner of the project play a significant role to prioritise safety enforcement, in addition to project performance, as project progress. Safety policy and procedure need regular revision from clients, and taking account contractors’ background and condition for safe execution of work.

Q1 Do you AGREE that the proposed Model:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>is easy to understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>could be fully adopted and used by your company <strong>without</strong> modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>could be fully adopted and used by your company <strong>with</strong> modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
d. needs total change and approach altogether

Q2 Please RATE the following aspects/impact of the proposed Model:

<table>
<thead>
<tr>
<th></th>
<th>Not Useful</th>
<th>Least Useful</th>
<th>Useful</th>
<th>Very Useful</th>
<th>Most Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. the usefulness of the Model to decision makers in your company</td>
<td>[          ] [          ] [          ] [          ] [          ] [          ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. the usefulness of the Model to other companies decision makers</td>
<td>[          ] [          ] [          ] [          ] [          ] [          ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. the Model useful contribution to the industry</td>
<td>[          ] [          ] [          ] [          ] [          ] [          ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q3 Do you AGREE that the proposed Model:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. will improve top management’s commitment toward SMS implementation</td>
<td>[          ] [          ] [          ] [          ] [          ] [          ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. can assist safety personnel to effective implementation of SMS?</td>
<td>[          ] [          ] [          ] [          ] [          ] [          ]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. can be used as a guide for clients in identifying key issues on contractors’ safety?</td>
<td>[          ] [          ] [          ] [          ] [          ] [          ]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q4 Are there any suggestions for the Model on :

a. Additional items or elements that have been left out?

b. Improving the approach or layout/format?

~THANK YOU FOR YOUR PARTICIPATION

N.A. Othman (Researcher)
Wolfson School of Mechanical and Manufacturing Engineering
Loughborough University Leicestershire LE11 3TU UK
Tel: +44 1509 214511/+44 7983 484735
Fax: +44 1509 214511
E-mail: N.A.Othman@lboro.ac.uk
APPENDIX H: VALIDATION RESULT

Table 7.1 illustrates the general perception of the model from the responding organisations. The results show that the model is easy to understand and appropriate to current SMS conditions in the respondents’ companies and other companies. The model can improve the understanding of SMS condition for management and clients but not the employees.

Table 7.1: Responding organisations’ general perception of the model

<table>
<thead>
<tr>
<th>Item</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. is easy to understand</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>b. is appropriate to current SMS condition in your company</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>c. is appropriate to current SMS condition in other companies</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>d. can improve management’s understanding of SMS condition</td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. can improve employees’ understanding of SMS condition</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>f. can improve clients’ understanding of SMS condition</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Another model (Figure 7.3) was developed to recommend an appropriate approach to improve SMS implementation of contractors, based on the research findings. Table 7.2 illustrates the general perception of the model from responding organisations. The result shows that the model is easy to understand. However, it needs modification before it can be adopted and used in companies. Most of the respondents agree that the model needs modification before it can be fully adopted and used by their company. Overall, the model was accepted by the majority of the respondents in its present form, but need further upgrading or modification to suit companies of different types, size and specialisation.
Table 7.2: Responding organisations’ general perception of the guidelines

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. is easy to understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. could be fully adopted and used by your company without modification</td>
<td>1</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>c. could be fully adopted and used by your company with modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. needs a total change and approach altogether</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7.3 shows the usefulness of the model to decision makers in the respondents’ own companies, other companies and to the industry. Overall, all respondents agree that the model is useful for that purpose. The high ratings illustrate and prove that the model can be very useful to decision makers, not only within their company or organisation, but also within the industry. This is mainly because apart from identifying and highlighting the key issues and critical elements that need to be considered by decision makers, the model will also help to establish a standard or consistent approach to effective SMS implementation in the industry.

Table 7.3: Responding organisations’ rating of the model

<table>
<thead>
<tr>
<th></th>
<th>Not Useful</th>
<th>Least Useful</th>
<th>Useful</th>
<th>Very Useful</th>
<th>Most Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. the usefulness of the Model to decision makers in your company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. the usefulness of the Model to other companies’ decision makers</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. the Model is a useful contribution to the industry</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

One important purpose of the validation was to find out whether the model has managed to meet its objectives (Table 7.4).
Table 7.4: Responding organisations’ perception of the guidelines’ objectives

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. will improve top management’s commitment toward SMS implementation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>b. can assist safety personnel to effective implementation of SMS</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. can be used as a guide for clients in identifying key issues on contractors’ safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Some of the additional suggestions/remarks made by some of the respondents about the model include the following:

- The proposed model addresses the majority of the issues. However, it does not say how the implementation process is going to work between workers and management.

- A performance review should be done to identify the strengths and weaknesses of SMS implementation.