SYSTEMATIC SUSTAINABILITY ASSESSMENT (SSA) FOR CONCEPTUAL DESIGN PHASE IN MALAYSIA AUTOMOTIVE INDUSTRY

FAIZ BIN MOHD TURAN
RDU160308

UNIVERSITI MALAYSIA PAHANG

ABSTRACT

Numerous companies are accepting sustainability as an organizational peremptory. There is, however, little convergence on how organizations become sustainable. The previous study suggests that a paradigm shift is necessary to incorporate more sustainable ways of thinking, while others advocate that sustainability requires only moderate behavioural changes as in attitude. In addition, it is also suggesting that sustainability develops most effectively when a singular view of sustainability is applied throughout the company; others contend that differentiated views of sustainability emerge within the various subcultures of an organization. The aim of this research is to analyse the aftermath of considering attitudinal parameter into the initial data, portraying the true nature of personality during the survey. The research presented was carried out with employees from automotive-related manufacturing companies with different branches of knowledge and attitude. Survey methodology was employed by building a questionnaire combining Likert-type items, Sustainable Development Goals (SDGs), Green Project Management (GPM) P5 Integration and multiple-option items. The results allow identifying the knowledge and attitudes of the employees of automotive-related company in Malaysia context, contributing relevant data in regard to future engagement relating to sustainability and attitudinal parameter.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

SBPWM	Simple Boost Pulse Width Modulation
ZSI	Z source inverter

LIST OF ABBREVIATIONS

GPM	Green Project Management
ZSI	Z source inverter

CHAPTER 1

INTRODUCTION

1.1 Background

Sustainability as an area of research is growing in recognition, not only in academia, but also is being embraced by corporations (Aguinis & Glavas, 2012; Norton, Parker, Zacher, & Ashkanasy, 2015). Often appeal as a notion that needs to be addressed not only at the policy level but also in business context: many companies have included sustainability in their mission, also driven by an increasing demand for sustainable products by more aware consumers (Zamagni, Pesonen, & Swarr, 2013). Sustainable development has always been an important central point for all decision makers in any organizations, it has been defined in many ways, but the most frequently quoted definition is from Our Common Future, also known as the Brundtland Report in 1987:"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability seems to be agreeable proposal because of its meeting points among environmental concerns, manufacturing, and product design activities (Abdul-Rashid, Sakundarini, Raja Ghazilla, & Thurasamy, 2017; Rusinko, 2007). The term sustainability integrates social, environmental, and economic responsibilities. Some researcher use the term to include environmental management, closed-loop supply chain and a broad perspective on the triple-bottom-line thinking that integrates profit, people and the planet into the corporate culture, strategy, and operations (Taisch, Stahl, & May, 2015).

The theme of sustainability was first addressed in a study published in 1713 by von Carlowitz (1732), which discussed the need to consider natural resource limitations (specifically in forestry) in the economic development of a region. Since then, the theme was addressed on other occasions and has been disseminated internationally, mainly in the last for decades through the concept of sustainable development. This concept was

formally introduced in the United Nations Conference on the Human Environment in 1972 (Bolis, Brunoro, & Sznelwar, 2014; Dresner, 2012) and its most widely recognized definition is the one proposed in 1987 by the World Commission on Environment and Development (Brundtland, 1987). By ensuring that the needs of the present generation are met without affecting the ability of future generation to meet their own, sustainable development can be achieved provided that environmental, social and economic aspects are dealt with jointly in the short, medium and long term.

Decision support systems, risk analysis systems and emergency response systems are playing significantly more important roles in organizations in every discipline, including health, business, engineering, education and finance (Lu, C Jain, & Zhang, 2012). Decision making is ubiquitous and is closely related to risk management. On one hand, appropriate decision making is an important task in risk management implementation; on the other hand, a risk management process in decision making is an important step for better decision making. In practice, a decision environment for a real application becomes more and more complex and uncontrollable. Making an appropriate decision is not easy. Various uncertainties, which occur in natural environments and human societies increases the possibility of making inappropriate decisions. How to effectively make a decision, therefore, is a challenging issue for organisations needing to reach their targeted achievements (Lu et al., 2012).

In principle, attitudes refer to a person's feeling, opinions and general approach towards a person or object (Funder, 2011). By contrast to personality, attitudes are often influenced by situational and circumstantial factors and hence, they are believed to be less stable than personality traits. Technically, risk and uncertainty play a role in almost every important economic decision (Dohmen et al., 2011). Therefore, the word risk refers to situations in which a decision is made whose consequences depend on the outcomes of future events having known probabilities. When it comes to the psychology of risk, "there is still a lot of room to go and businesses are only at the beginning in terms of understanding that there are coherent frameworks available that could help them improve the practice of risk management," aforesaid by Hersh Shefrin (Shefrin, 2016). Besides, psychology has likely played a larger role in crisis response than many people realize. "Every single risk management disaster in the last 15 years, including financial disasters,

has had psychological issues at the root." "Whether it's an earthquake, natural catastrophe or a financial disaster, it is often compounded by our psychological imperfections."

1.2 Motivation

One of the most ambitious goals of a society is to achieve sustainability in early design phase for automotive industry. Making sustainability operational as opposed to a grand but ambiguous idea is a challenge. For example, various definitions of sustainability exist, none of which applies to all circumstances. Even after selecting a definition, there is no universal method of measuring sustainability, which makes it extremely difficult to track progress towards sustainability.

According to the Ninth Malaysia Plan (9MP), Sustainable Development in Malaysia has always been considered adequately and made the country be ranked with regard of environmental sustainability 38th among 146 countries worldwide, and the second in Asia with regard to environmental sustainability (Saadatian, Haw, Mat, & Sopian, 2012).

1.3 Objectives

This study aimed to evaluate the influences of a persons' (designers') knowledge and attitude affected their every aspect of risk management in making the decision regarding sustainability practice of their design or company. The results allow us to identify and analyse the impact of using attitudinal parameter into the data also affected the nature of someone's personality during the survey.

1. To study the level of awareness in sustainability practice of the designers in Malaysia automotive industry.
2. To analyse the raw data of the survey in the view of attitude behaviour.
3. To apply the newly defined attitudinal resolution in solving the risk attitude of the employees toward sustainability practice and investigate of what factors that may affect these attitudes.

The general hypothesis that can be conducted in this research is:

- The implementation of sustainability in industry can has a real business benefits where it will improve the brand image and increase productivity while reducing the cost.
- It is hypothesis that when the attitudinal parameter is implemented, the nature of risk attitude of the employees will be affected whether it is entirely different or not.
- It is hypothesis that as far as the knowledge of a person is higher, the consciousness toward sustainability practiced is also expected to be higher.

Based on the research objectives, this study will address the following question.

- How can knowledge level affect the sustainability consciousness of designers in Malaysia automotive industry?
- How to systematically and quantitatively handle and represent the imprecise information (uncertainties) that provided by the employees using polynomial second order equation techniques?

1.4 Theoretical Framework and Scope of Study

As stated in the above research objectives, the present study is an attempt to investigate how the consciousness of the sustainability can be affected by the mere knowledge of a person handling it. The scope for this study is applicable suited to Malaysia context and will implement the concept of Green Project Management (GPM) P5 Standard, Sustainable Development Goals (SDG), Attitudinal Theory and Parameter, and Risk Attitude.

CHAPTER 2

LITERATURE REVIEW

2.1 Sustainable Development and Sustainability in Action

There are more than 70 definitions of sustainable development nowadays. The most commonly used definition is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" which defined by the Brundtland Commission in 1987 (Brundtland, 1987). This simple and clear definition which shows a strong people-centred ethical stance has caused many discussions among theoreticians and practitioners where many criticize the intuitiveness of SD definition and regard it as a theoretical construct rather than an explicit concept. However, despite the shortcomings of the WCED definition, including among many things a lack of consideration for equity or justice, this definition has acted as a foundation for an evolution in sustainability definitions (Magari, 2008). Accordingly, sustainability has become a wide-ranging term that can be applied to almost every facet of life on Earth, from a local to a global scale and over various time periods. It is most closely related to environmental issue which including climate change, energy sources, biodiversity and so on. It is also related to human society issues including population, agriculture, industrial pollution, public health, human settlement and so on. These issues can be generally divided into 3 dimensions: environmental dimension, economic dimension and social dimension.

Sustainable development that is locally relevant and culturally appropriate could include several goals or themes (Jaafar, 1992). The International Implementation Scheme for the United Nations Decade of Education for Sustainable Development (DESD) (UNESCO 2005) identified key areas of the concept as;

Naturally, sustainable development has been widely adopted as a policy objective by institutions, governments, businesses, and others.

2.1.1 Green Project Management (GPM)

Utilizing the United Nations Sustainable Development Goals (SDG's), GPM have architected a transformative solution that follows a five-step model that delivers sustainable competitive advantage over the long-term by improving culture, practice, product and service delivery while improving the organization's capability to innovate. The GPM Approach examines critical elements of the organization and produces a list of actions to strengthen resilience and transparency in supply chain, communications with stakeholders, portfolios, programs, and projects ("Green Project Management," n.d.). It is also takes the 17 SDGs and unpacks them in the context of respective business to help the users see what is important to the business-long term.

2.2 Risk management and Decision making

Making the link between risk and objectives moves us closer to a usable definition of risk. Risk is a type of uncertainty, but not every uncertainty is a risk. Alternatively, risk is that subset of uncertainty that matters, and we determine whether a particular uncertainty matters by considering the possibility that objectives might be affected. Certainly, the uncertainty will only actually matter in practice if it occurs and becomes reality (Hillson, 2009). So, the proto-definition of 'risk' as 'uncertainty that matters' can be expanded into:

'risk' is 'uncertainty that, if it occurs, will affect achievement of objectives'

Indeed, this form of definite can be found in most current risk management standards and guidelines, as illustrated in Table 2.1.

Table 2.1 Definition of 'risk'

SOURCE OF DEFINITION	'UNCERTAINTY…'	'…THAT MATTERS'
A guide to the Project Management Body of Knowledge (Project Management Institute, 2008)	'An uncertain event or condition …'	'… that of ot occurs has a positive or negative effect on a project's objectives.'
A Risk Management Standard (Institute of Risk Management et al, 2002)	'The combination of the probability of an event …'	'… and its consequences.'

APM Body of Knowledge (Association for Project Management, 2006)	'An uncertain event or set of circumstances …'	'… that should it or they occur would have an effect on achievement of one or more project objectives.'
British Standard BS IEC 62198:2001 (2001)	'Combination of the probability of an event occurring …'	'… and its consequences on project objectives.'

Source: (Hillson, 2009).

Each of definitions shown in the table has two distinct parts: the first of these relates to some type of uncertainty, and the second part describes why it matters by linking the effect of uncertainty to achievement of objectives.

2.2.1 Risk attitude

The risk attitude is very abstract, where it has been studied by a range of academic and organizational researchers in recent years, and there is a considerable and growing body of knowledge and evidence in this area. Much of this has been obtained by studying behaviour in games of chance, financial investments, gamblers (including lottery players) and people betting on sports (especially horse racing) (Hillson & Webster, 2012). One key conclusion on which researchers and practitioners are agreed is that risk attitudes exist on a spectrum. The same uncertain situation will elicit different preferred attitudes from different individuals or groups, depending on how they perceive the uncertainty. And since attitude drives behaviour, different people will exhibit different responses to the same situation, as a result of their differing underlying risk attitudes (sometimes called 'perceptual dissonance') – a situation regarded as too risky by one person will be seen as acceptable by another. The variety of possible responses to a given level of risk is illustrated by the curve in Figure 2.1. Given the basic shape shown in figure, it is possible to distinguish a number of key regions on the curve, and to use labels of convenience to describe each area. The term 'risk-averse' is used for those who regard risk as unwelcome and to be feared and avoided. Those who see risk as a challenge to be overcome are called 'risk-seeking'. There are clearly more extreme positions which might be called 'risk-paranoid' (paralyzed by any form of uncertainty) and 'risk-addicted' (an unhealthy preoccupation with uncertainty), but these are not common and probably represent attitudes and resultant behaviours requiring corrective intervention. Between the two usual polarities of risk-averse and risk-seeking are two other common positions. A 'risk-tolerant' person or group has an attitude which is ambivalent or accepting of risk, viewing

it as a normal part of life. 'Risk-neutral' on the other hand is neither risk-averse nor risk-seeking, describing a person or group tending to view risk impartially in the short-term, but prepared to take risk if there is a significant long-term benefit (Hillson & Webster, 2012).

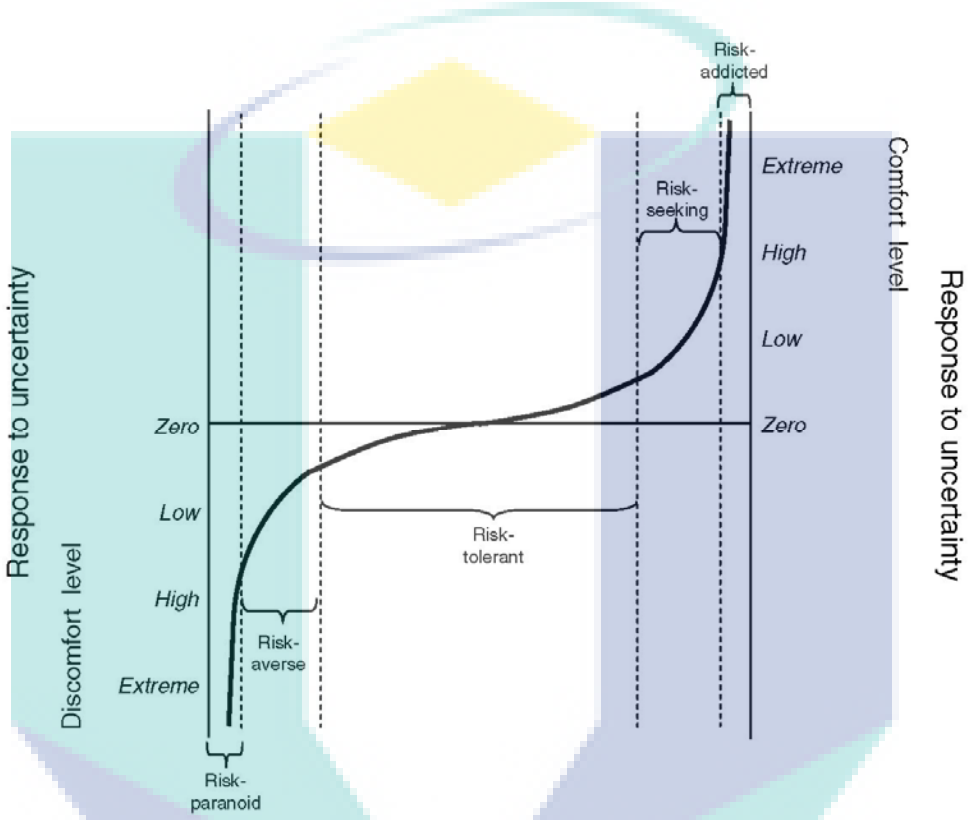

Figure 2.1 Spectrum of risk attitude

Source: (Hillson & Webster, 2012)

Over time, these risk attitudes change via the process of surprise. Surprise is the persistent, and very likely growing, mismatch between what we expect to happen and what actually happens in the real world. Because firms and individual managers have totally different risk attitudes, there is a varied and varying set of surprises that are happening all the time. Individual managers might expect a moderate market with fluctuations that follow past experiences; an uncertain market with unpredictable volatility; a market boom when everything seems to be going up; or a recession when everything seems to be going down. And business strategies are chosen because of an expectation of a market in one or the other of those states.

This process of changing risk attitudes typically takes two routes. First, individual managers will be surprised, as their unmet expectations wear away their convictions about how the world works. As these individuals then shift their risk attitudes, they will also shift their approach to their business and the risks that they're willing to take. If they are very perceptive and adaptable, they will change to a belief that aligns with the current environment and the process will begin again. If they are less adaptable and perceptive, they might shift to a different risk attitude that does not align with the environment. Their firms might then lurch along from one type of sub-optimal performance to another.

The second way that firms adapt is by changing leaders, most often when the firm has been spectacularly surprised. When the board reacts to a collapse — or even to a disappointment — by changing leaders, the new leader then faces the problem of shifting the prevailing risk attitude of the firm. Through a series of persuasions, orders, reorganizations, promotions, retirements and layoffs, the new leader will eventually get the firm's risk attitude to align with what they and the board want it to be (Ingram & Thompson, 2011).

Meanwhile, the success of the firms that have an approach that aligns with the actual real-world environment will create growth, and the firms with a misaligned approach will shrink relative to each other. The risk attitude that aligns well will eventually control more of the market's resources. That is… until the market shifts again and business leaders find themselves surprised by it (Ingram & Thompson, 2011).

2.3 Consciousness and awareness of society towards sustainability

2.3.1 Knowledge level effects on awareness and consciousness

2.4 Scope and Limitations

The scope of this research was limited to automotive-related manufacturing industry in Malaysia. Specifically, the research was limited to the issues of sustainability derived by Green Project Management which include 12 parameters under 3Ps context. Issues concerning project sustainability was not addressed unless brought forth by the interview participant. The rationale for this limitation is it was anticipated 1) organizations would be willing to provide access to this information; and 2) the selected company would be

conducting similar production, therefore, the data collected would be comparable between organizations.

The main challenge during the process of obtaining the data is the lack of cohesive understanding and language for what sustainability means for communities and the designers or employees.

2.4.1 Inclusion and exclusion criteria

2.4.2 Gap finding

A review of sustainability assessment methodologies reveals that only a few of the approaches consider the economy, society, and environment. Methodologies based on weak sustainability tend to concentrate on economic considerations while neglecting the biophysical aspects of sustainability. However, biophysical approaches are mostly concerned with environmental sustainability while neglecting socio-economic dimensions. A review of the literature on sustainability assessment revealed a number of shortcomings with existing methodologies. As shown by (Singh et al., 2009), very few of the methodologies follow an integral approach and the construction of composite indicators is often done incorrectly.

2.5 Summary

There are several theories and fields related to this study such as sustainable development, sustainable assessment tool, risk management and risk attitude, decision making, attitudinal parameter, individual consciousness and manufacturing industry development. Each field has plenty of studies and practices in Malaysia and abroad. In this study, the components of sustainability, the theory behind risk attitude and decision making and the existing sustainable assessment method in Malaysia and abroad will be the main theoretical basis and reference.

Firstly, the literature review presented a background study and evolution of sustainable development from a historical perspective. Suggesting the need for any organization in Malaysia as a developing country complying the sustainable practice into their process.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In the previous chapter, some gaps were identified in the literature which includes the need for a holistic, flexible and adjustable approach and methodology to facilitate and support the sustainability practice within the company.

This chapter includes a synopsis of the methods used to uncover the answers to main research question guiding this study, namely "*How can knowledge level affected the sustainability consciousness in Malaysia automotive industry*?". The research looks at two different management that closely related to sustainability. The chapter begins by establishing the research approach. How to tackle both quantitative and qualitative data sets into the survey checklist. The chapter then described and justified the choice of the research data sources and how they were collected.

3.2 Research Approach

One method is the following. Suppose, that after making a set of discrimination responses (at a given exposure duration), subjects rank those responses based on their confidence that the response was correct. What is expected? If subjects have no awareness or the knowledge of the stimuli; which is sustanbility, then there should be no relationship between subjects' confidence rankings and performance. On the other hand, if subjects do have some awareness of the stimuli, then higher confidence rankings should be associated with more correct discrimination responses than lower confidence rankings. Although subjects are not asked directly about their awareness, their awareness is assessed by the relationship between their confidence judgments and accuracy, under the

plausible assumption that their confidence cannot reflect their accuracy unless they are at least partially aware of the stimuli presented. As the exposure duration of the stimuli is decreased to the true awareness threshold, subjects' ability to rank the discrimination trials based on their confidence should also decrease. When stimuli are presented so briefly that subjects have no conscious awareness of them, their confidence rankings should be unrelated to their performance.

3.3 Overview of the research study

A case study is a methodology or research strategy that allows multiple perspectives in analysis, the voice of researcher and relevant actors (Magari, 2008; Yin, 1981), which in the case of this thesis includes the opinion of the leaders in two different management of the respective company. Case studies can be either quantitative or qualitative and comprise a variety of investigative methods, including field work, archival record, verbal reports, observations, or any combination of these (Yin, 1981) while (Yin, 1993) outlined three specific types of cases studies, Exploratory, Explanatory and Descriptive. The case studies in this thesis are explanatory, they outline details and facts of each city, alternative perspective of these facts is provides and explanations of these alternatives are then discussed (Yin, 1981, 1993)

3.4 Data collection and analysis

There are several methods employed by researchers in the collection of research data within the premise of inductive research designs. Some of these methods include the case or multiple case study method, observations, questionnaire surveys, literature review, interviewing, and a focus group approach (expert's opinion). However, for the purpose of this research study, a hybrid approach has been adopted which include the combination of approaches; literature review and focus group approach (data collection from the community, industry and experts)

3.4.1 Pilot run test of public awareness on sustainability

This test coming through as a survey where the main subject is the public in Malaysia on the topic of whether they heard or understand the concept of sustainability. Due to different Likert scale as compare to the GPM checklist style, the result of the survey needs

to undergo a ‘mapping’ style in order to observe the result in the view of GPM style Likert scale.

3.4.2 Case study methodology

The multiple case study approach which is a qualitative research method has been extensively used by researchers in various discipline for the investigation of a contemporary phenomenon within a real-life context (Runeson & Höst, 2009). It is found to be useful when the research investigation is attributed to some practical real-life situation (Achanga Coxwell, 2007). It allows for a lot more detail on the subject matter to be collected, that would ordinarily not be easily obtained by using other research methods.

The case study approach is similar to interviewing and focus groups approach. Interviewing and focus groups is another useful method for collecting research data within the premise of a qualitative and quantitative research designs. According to (Gill, Stewart, Treasure, & Chadwick, 2008), interviews and focus groups remain one of the most common research methods for the collection of research data.

3.4.3 “Sampling” / Data Sources Company selected

The boundary of this study is limited to the manufacturing industry, and the target population was employees who work in the top management of the industry. The manufacturing industry was chosen because they represent one of the major contributors to environmental degradation in Malaysia (Omar & Samuel, 2011) and contributes hugely to both infrastructural and economic development of the nation (Ghozali, Nordin, & Ashari, 2016). Hence, the studies from the existing research is done to analyse the frequently used parameters in sustainable assessment and the tools used to measure the sustainability. The case study will be conducted in automotive-related manufacturing company in Malaysia. In this case study, other than group of designers, owner of the company, chief executive officer, general manager and a system manager were selected as the expert decision makers. This will be assumed as an act of a field study including in-depth interviews with selected experts. The experts’ opinions are used for providing a sufficient data to fulfil the research objectives. The GPM P5 checklist is being modified with respect of Malaysia industry context for each parameter before the respective checklist is used in the interview (data collection).

The process of gathering the data has been conducted in several departments of the companies using the same research questions which are: Department of Design, Department of Production (Parts), Department of Production (Assembly), Department of Engineering, Department of Environmental Quality, Department of Quality Control. These departments come from two different managements of each company which are: Environmental Management and Operational Management.

From here, the questionnaire has been assigned at the stated departments where the results are then transmitted into the scoring board that has used the green project management as the guideline. The respondents were asked to tick their most suitable response from the options given in the section. Furthermore, this study used a 6- point Likert type scale in the development of the questionnaire in this study. The reasons for the choice of this scale lies in its ability to increase the reliability of the instrument and also reduce the potentials of social desirability bias (Krosnick, 1999). This is supported by (Chomeya, 2010) who assessed the quality of psychology test between the 5-point and the 6-point Likert scale and found that the 6-point scale has a better discrimination and reliability quality than the 5-point scale.

3.4.4 Designing Green Project Management (GPM) Checklist

The scale between +3 to -3 as depicted in Table 3.1 was developed to ease the respondents' group for rating the evaluation criteria, which initially selected by the design engineers based on technical documents and the results of a prior survey. The 7 point scale is chosen in build up the survey as it can provides more varieties of options which in turns increase the probability of meeting the objective reality of people (Joshi, Kale, Chandel, & Pal, 2015).

Table 3.1 Scale of "Weighting criteria"

Numerical Rating	Description
-3	Negative impact high
-2	Negative impact medium
-1	Negative impact low
0	Neutral
+1	Positive impact low
+2	Positive impact medium
+3	Positive impact high

Source: Rahman (2007). Use *Citation for Table UMP style* here.

The other fairly important in this method is where the questions are generated by using the green project management (GPM) that serves as a reference. The green project management (GPM) concept integration matrix is describing below:

- People – labor practices and decent work, society and customers, human rights, ethical behaviour
- Planet – material and procurement, energy, water, transport, waste
- Profit – return on investment, business agility, economic simulation.

The mentioned twelve parameters above are used as the main parameters during the survey and analysis.

3.4.5 Estimation by polynomial second order expression

The polynomial second order expression and Matlab2015rb software package are used as the main statistical tool in this study. Each expression of the result is being considered with 5% error in plotting the graph (95% confidence level).

The second order polynomial expression is chosen particularly due to the correlation between the trend of risk spectrum mentioned is Chapter 2.

3.5 Attitudinal parameter and resolution

In this section, the important of a Decision Makers attitudinal character or the risk attitudes were considered. Risk and uncertainty are constantly present in everyday life both on the small and large scale (e.g. domestic accidents and major industrial accidents). Economics has a long tradition of analyzing risk as an important and fundamental element of decision-making: most economic decisions cannot be fully addressed if we ignore risk (Concina, 2014).

Derived by Daniel, the attitudinal parameter is used as one of the main contributions for this research where the true nature of risk personality of the employees is determined. The attitudinal parameter (λ) is within the range $\lambda \in [-0.9, 0.9]$, hence, if $0.9 \leq \lambda < 0.1$, then the DMs is said to be risk-averse. If $\lambda = 0$, the DM is risk neutral and finally, if $-0.1 < \lambda \leq -0.9$, then the DM is considered to be risk-seeking.

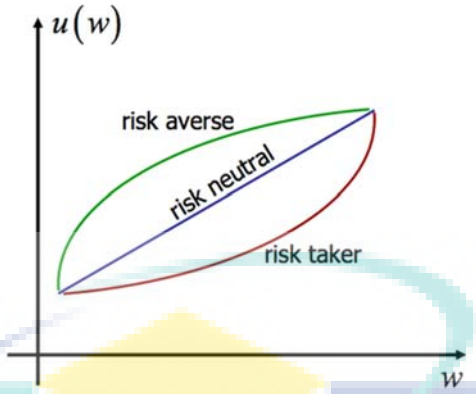

Figure 3.1 Risk-aversion (green) contrasted to risk-neutrality (blue) and risk loving (red)

Source: (Hillson & Webster, 2012); Zuli (2016).

3.5.1 Proposed resolution with regard of attitudinal function

From the derivation before, three different sets of resolution from attitudinal parameters is proposed where only one of them is chosen. All sets undergo the same analysis and set number 3 is chosen due to the most significant after 2nd order polynomial expression is done.

Table 3.2 Proposed resolution sets based on attitudinal parameter

Resolution 1	Resolution 2	Resolution 3
0.9	0.9	0.8
0.6	0.5	0.4
0.3	0.1	0.2
0	0	0
-0.3	-0.1	-0.2
-0.6	-0.5	-0.4
-0.9	-0.9	-0.8

The following Table 3.1 show the chosen proposed resolution when attitudinal parameter is being considered. It is assumed that each answer of the survey can lead to a variety meaning behind it including the attitude of the person who answered the survey. According to Shefrin, it is considered that someone with risk-seeking ability or personality tends to answer the question with high positive impact. Known as a person who have the ability to foresee the future planning of any situation (Shefrin, 2016), this kind of person is declared as a person with risk seeking attitude.

Table 3.3 Proposed resolution based on attitudinal parameter

Numerical rating	Resolution
-3	0.8
-2	0.4
-1	0.2
0	0
1	-0.2
2	-0.4
3	-0.8

3.6 Eliciting expert knowledge

A brand-new survey is formed that target on only experts or people who have the knowledge on sustainability. Expert knowledge is used widely in the science and practice of conservation because of the complexity of problems, data limitation problems, calibrating model parameters, and the imminent nature of many conservation decisions (Dalton, Brothers, Walsh, & Whitney, 2010; Martin et al., 2012). Expert knowledge is substantive information on a particular topic that is not widely known by others. An expert is someone who holds this knowledge and who is often deferred to in its interpretation (Martin et al., 2012).

3.7 Summary

Overall, these interview and data analyses were structured in such a way that patterns and connections could emerge through project comparisons within the companies, between the companies, and between companies and extant literature. The results of the analyses were used to identify factors influencing the risk attitudes of each employees as they develop and implement sustainability practice in their organizations.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

Chapter 4 presents the findings and the results of the research where it takes an in depth look at the case studies done on two different managements; Environmental and Operational Management. This research has been compared to relevant academic literature highlighted in the literature review, which provides insight into the research question that is the focus of this study, "*How can knowledge level affected the sustainability consciousness in Malaysia automotive industry*?

4.1.1 First analysis using polynomial expression

During the first stage of analysis, the mean value of the data is analysed directly using the polynomial second order expression. The curve of the graph indicated the risk attitude of the employee. Table 4.1 show the risk attitude of each parameters. This particular phase consists of raw data of each 12 sustainability elements that has been considered from the selected industry as shown in table below.

Table 4.1 Type of risk for each parameter before resolution for environmental management

Type of risk	Parameters
Risk Seeking	Labor Practices & Decent work, Human Rights, Society & Customers, Ethical behaviour, Materials and Procurement, Energy, Water, Transport, Waste, Economic Stimulation, Business Agility
Risk Neutral	-
Risk Averse	Return of Investment

Labor practices & Decent work along with Return of Investment parameters are chosen as the most significant result show in Figure 4.1 and Figure 4.2

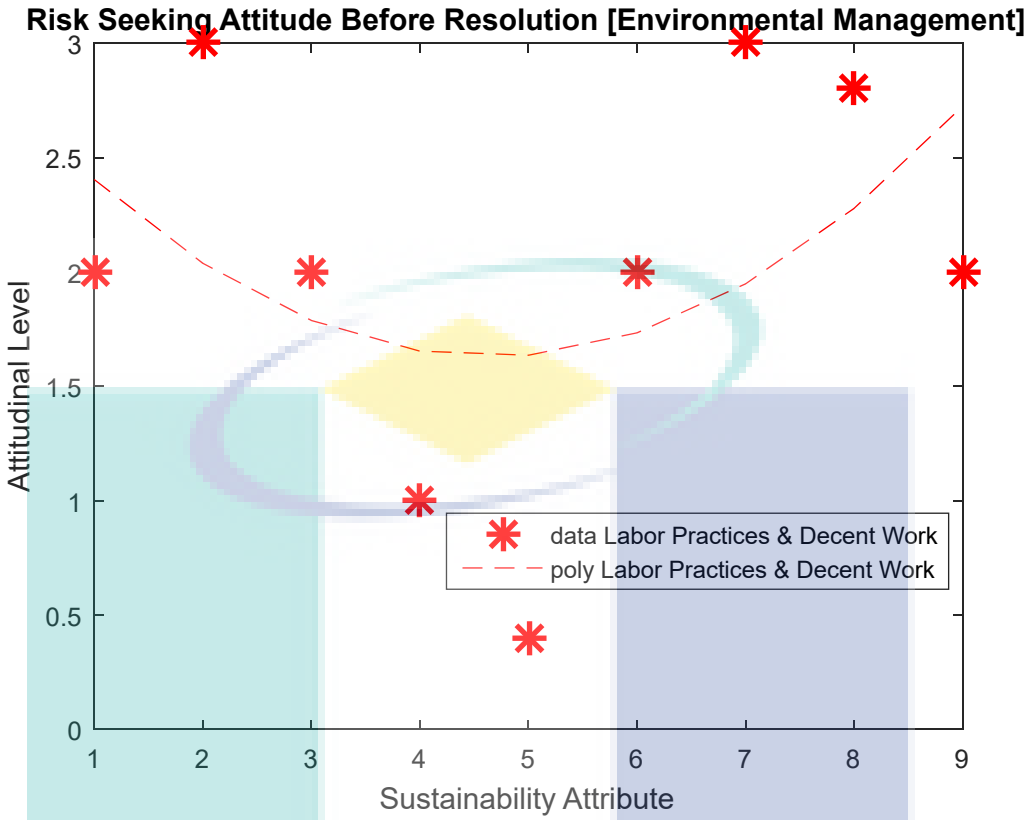

Figure 4.1 Risk seeking pattern for Labor practices and Decent work parameter before considering attitudinal function

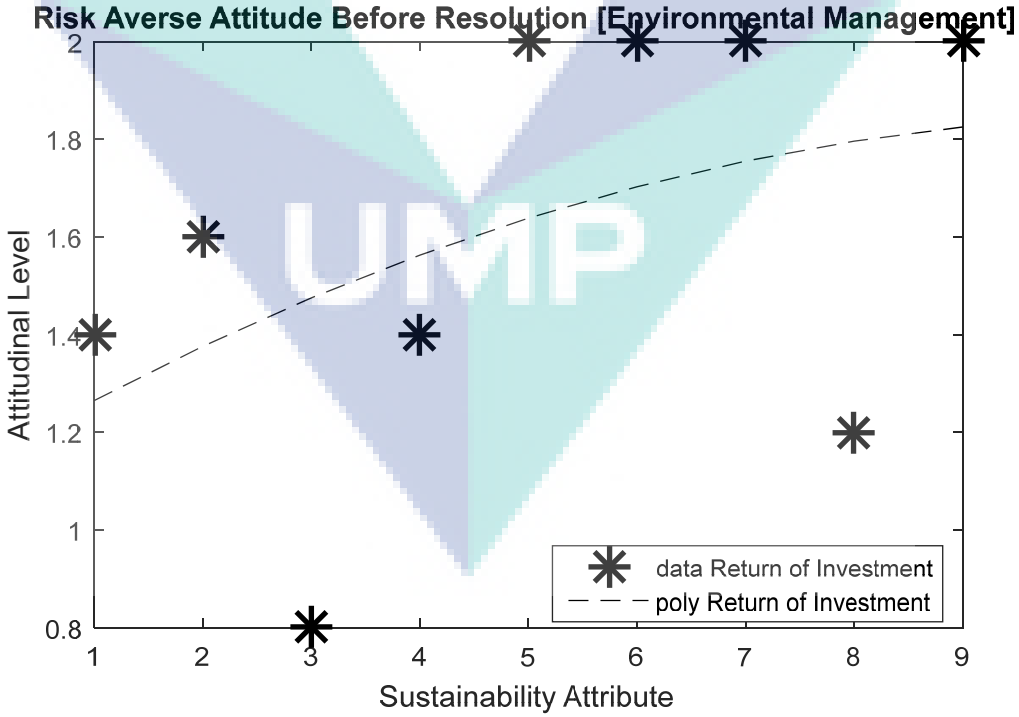

Figure 4.2 Risk averse pattern for Return of Investment parameter before considering attitudinal function

Table 4.2 show equation of polynomial expression

Table 4.2 Second order polynomial expression with raw data [Environmental Management]

Parameters	Risk Attitude	Polynomial expression (95% confidence bound)
Labor Practice & Decent Work	Risk Seeking	$f(x) = 0.05801x^2 - 0.5401x + 2.886$
Return of Investment	Risk Averse	$f(x) = -0.005844x^2 + 0.1284x + 1.143$

4.1.2 Second analysis with regard of attitudinal function

In this stage, the first data will be analysed with consideration of attitudinal function. Table 4.3 shows the type for each parameter after resolution for environmental while Figure 4.3 and 4.4 present the risk averse pattern for Return of Investment parameter before and after considering attitudinal function.

Table 4.3 Type of risk for each parameter after resolution for environmental management

Type of risk	Parameters
Risk Seeking	-
Risk Neutral	-
Risk Averse	Labor Practices & Decent work, Human Rights, Society & Customers, Ethical behaviour, Materials and Procurement, Energy, Water, Transport, Waste, Return of Investment, Economic Stimulation, Business Agility

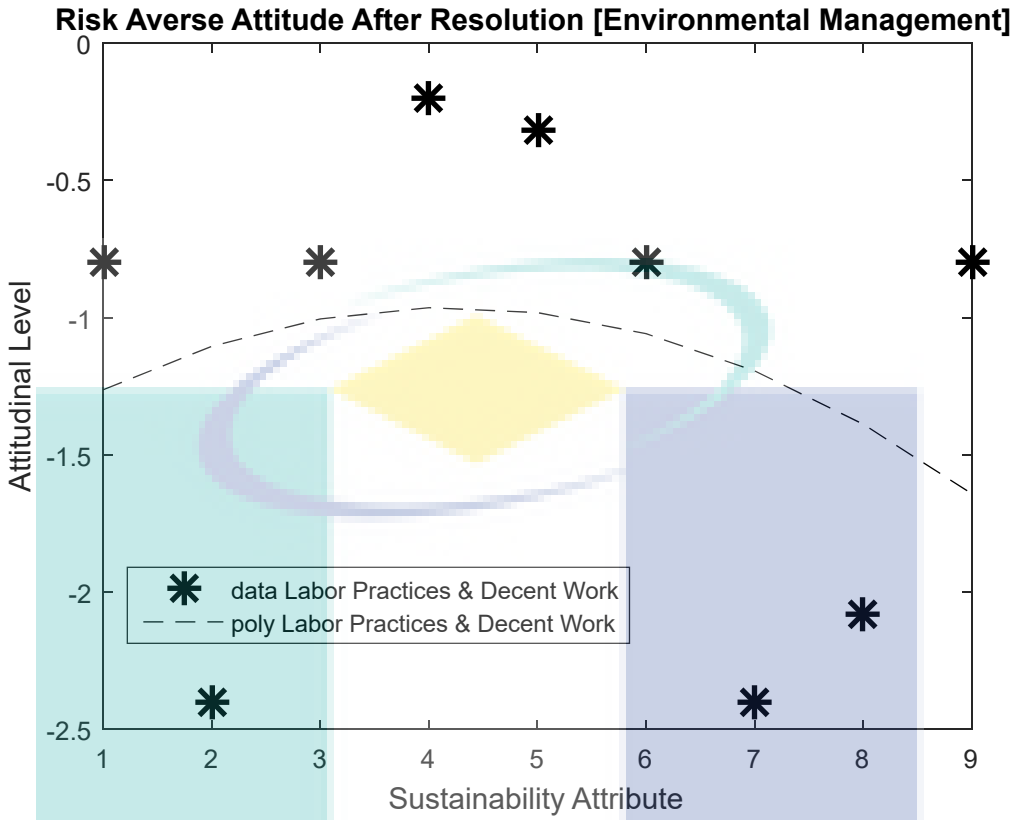

Figure 4.3 Risk averse pattern for Return of Investment parameter before considering attitudinal function

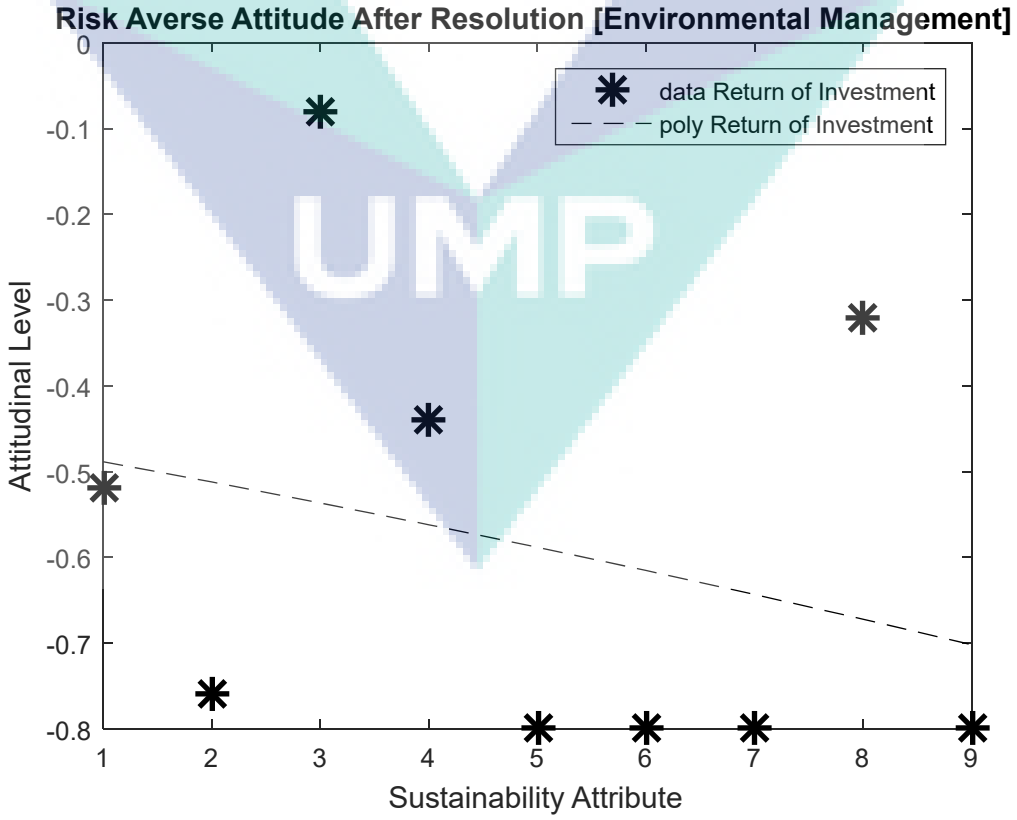

Figure 4.4 Risk averse pattern for Return of Investment parameter after considering attitudinal function

Table 4.4 depicts the second order polynomial expression after considering attitudinal function for Environmental Management.

Table 4.4 Second order polynomial expression after considering attitudinal function [Environmental Management]

Parameters	Risk Attitude	Polynomial expression (95% confidence bound)
Labor Practice & Decent Work	Risk Averse	$f(x) = -0.02939x^2 + 0.2466x - 1.48$
Return of Investment	Risk Averse	$f(x) = -0.0004x^2 - 0.02234x - 0.4657$

4.2 Operational Management Case Study

Studying sustainability from the Operations Management (OM) field is essential for two fundamentals reasons: First, firms must account for the energy and other resources they use and the resulting footprint they leave behind. Second, companies need to operate in a prudent and responsible manner and take care of employee health and safety and the quality of life of the external community.

4.2.1 First analysis using polynomial expression

Table 4.5 shows the type of risk for each parameter before resolution for operational management. Figure 4.5 until 4.8 depict risk averse pattern for related sustainability criteria before considering attitudinal function.

Table 4.5 Type of risk for each parameter before resolution for operational management

Type of risk	Parameters
Risk Seeking	Materials and Procurement, Energy, Water, Waste, Return of Investment, Economic Stimulation
Risk Neutral	-
Risk Averse	Labor Practices & Decent work, Human Rights, Society & Customers, Ethical behaviour, Transport, Business Agility

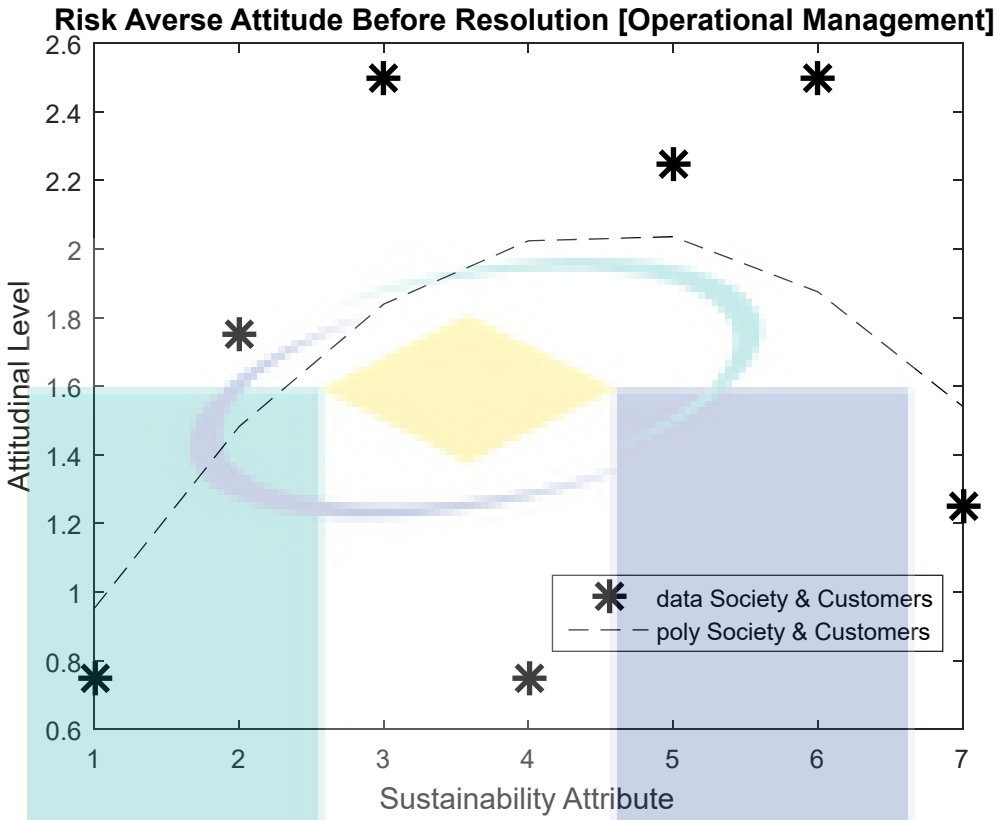

Figure 4.5 Risk averse pattern for Society & Customers parameter before considering attitudinal function

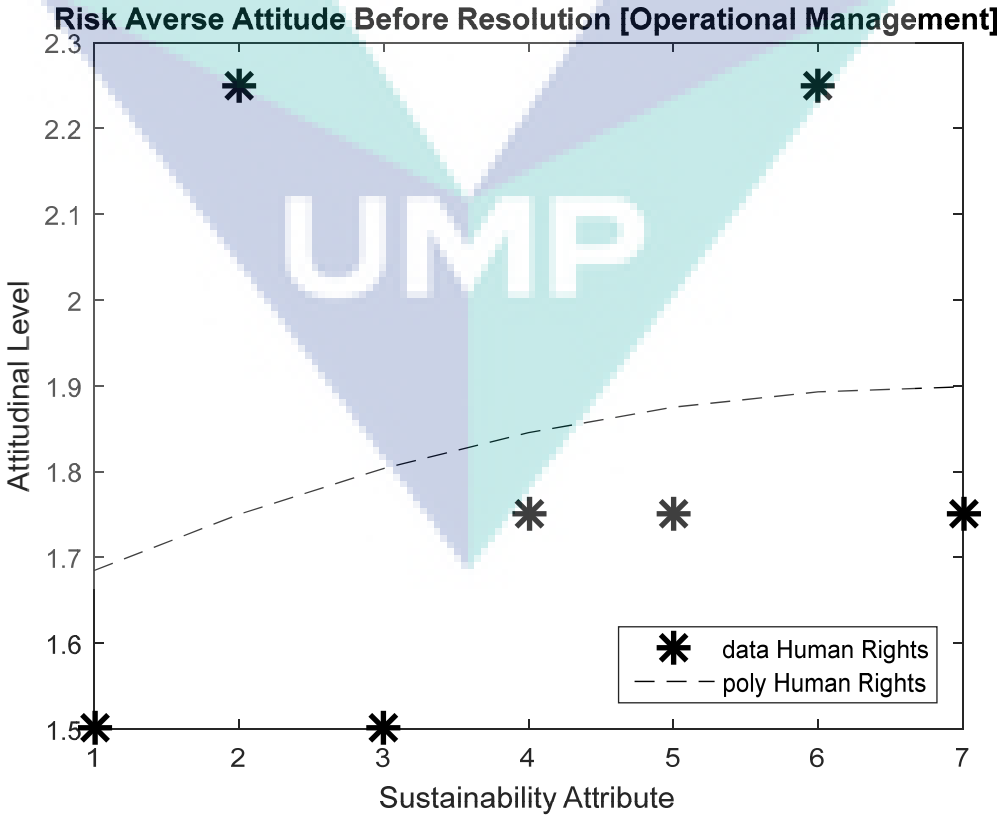

Figure 4.6 Risk averse pattern for Human Rights parameter before considering attitudinal function

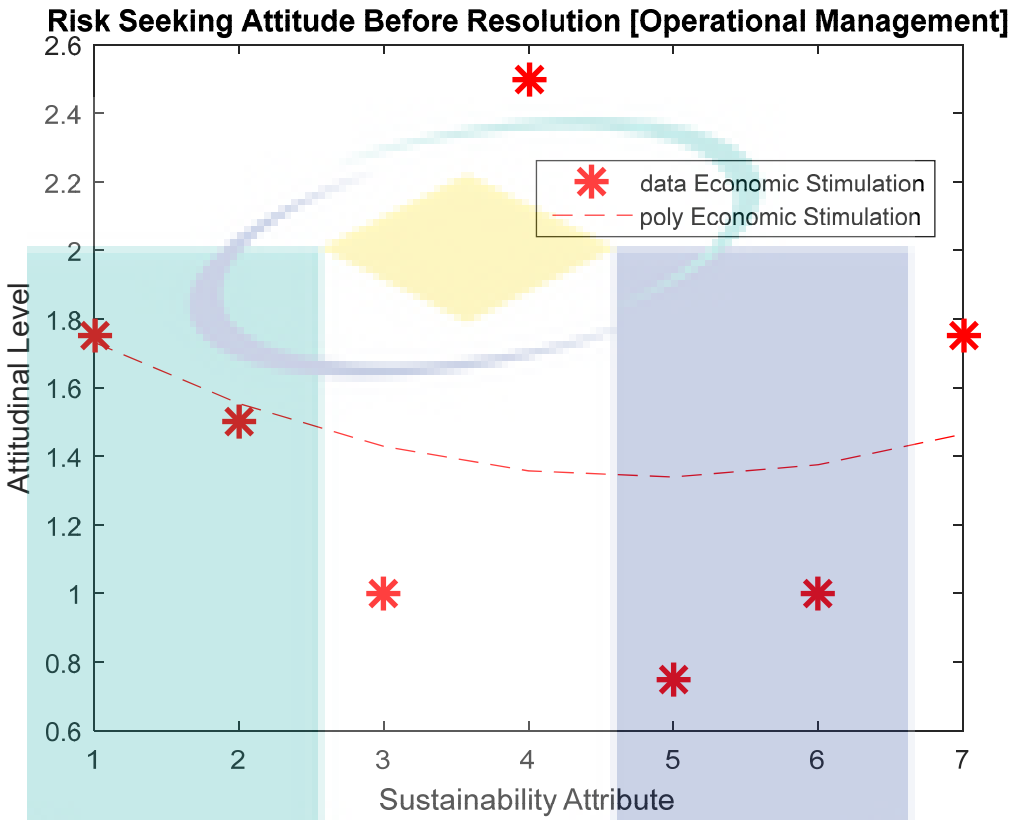

Figure 4.7 Risk seeking pattern for Economic Stimulation parameter before considering attitudinal function

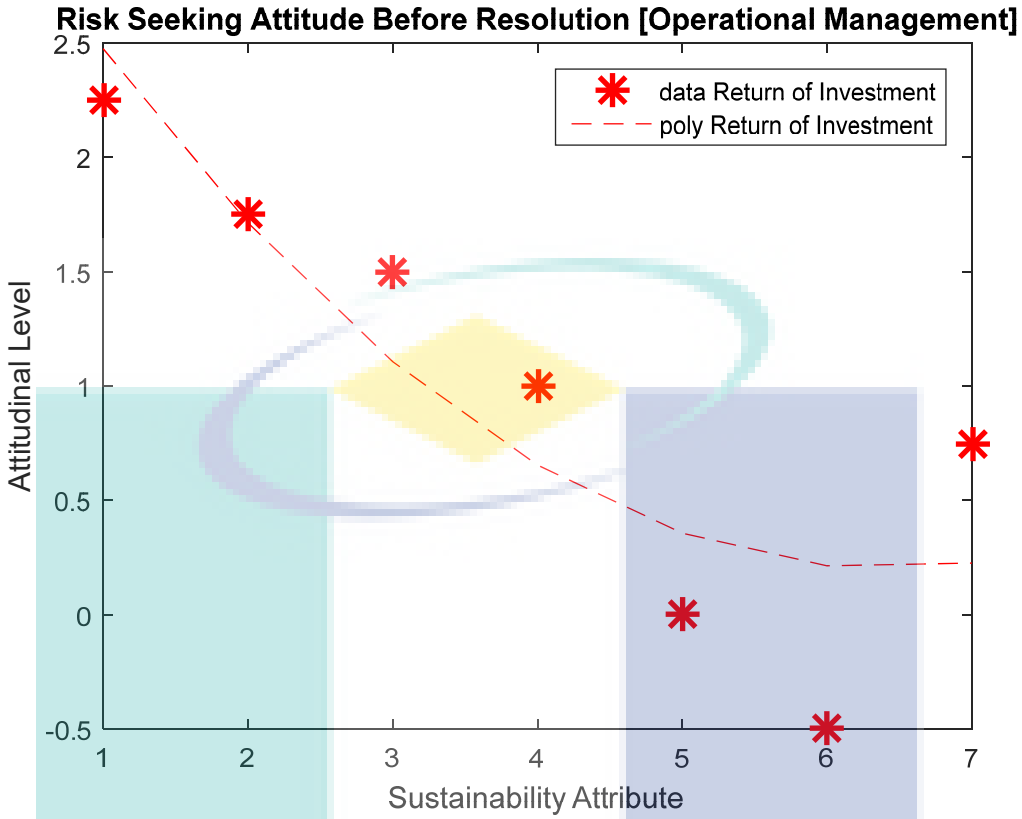

Figure 4.8 Risk seeking pattern for Return of Investment parameter before considering attitudinal function

Table 4.6 Second order polynomial expression with raw data [Operational Management]

Parameters	**Risk Attitude**	**Polynomial expression (95% confidence bound)**
Society & Customers	Risk Averse	$f(x) = -0.08631x^2 + 0.7887x + 0.25$
Human Rights	Risk Averse	$f(x) = -0.006x^2 + 0.08333x + 1.607$
Economic Stimulation	Risk Seeking	$f(x) = 0.02679x^2 - 0.2589x + 1.964$
Return of Investment	Risk Seeking	$f(x) = 0.0774x^2 - 0.994x + 3.393$

4.2.2 Second analysis with regard of attitudinal function

This section shows the result of type of risk for each parameter after resolution for operational management.

Table 4.7 Type of risk for each parameter after resolution for operational management

Type of risk	Parameters
Risk Seeking	Labor Practices & Decent work, Society & Customers, Ethical behaviour, Transport, Return of Investment
Risk Neutral	-
Risk Averse	Human Rights, Materials and Procurement, Energy, Water, Waste, Economic Stimulation, Business Agility

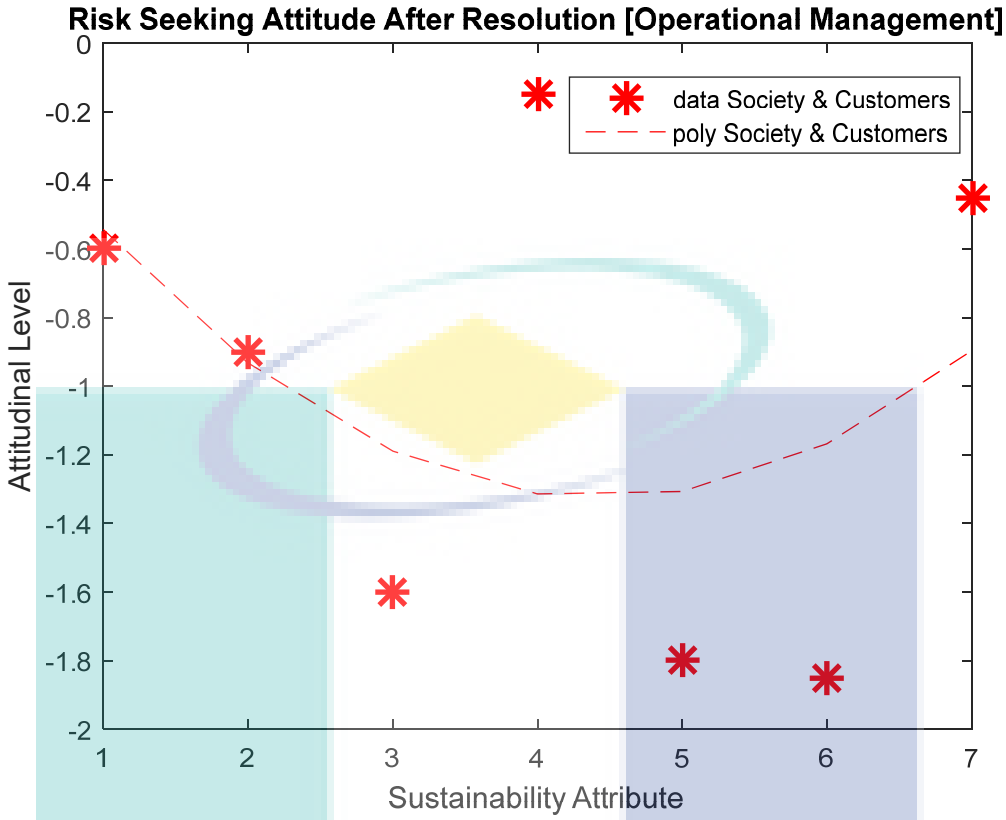

Figure 4.9 Risk seeking pattern for Society & Customers parameter after considering attitudinal function

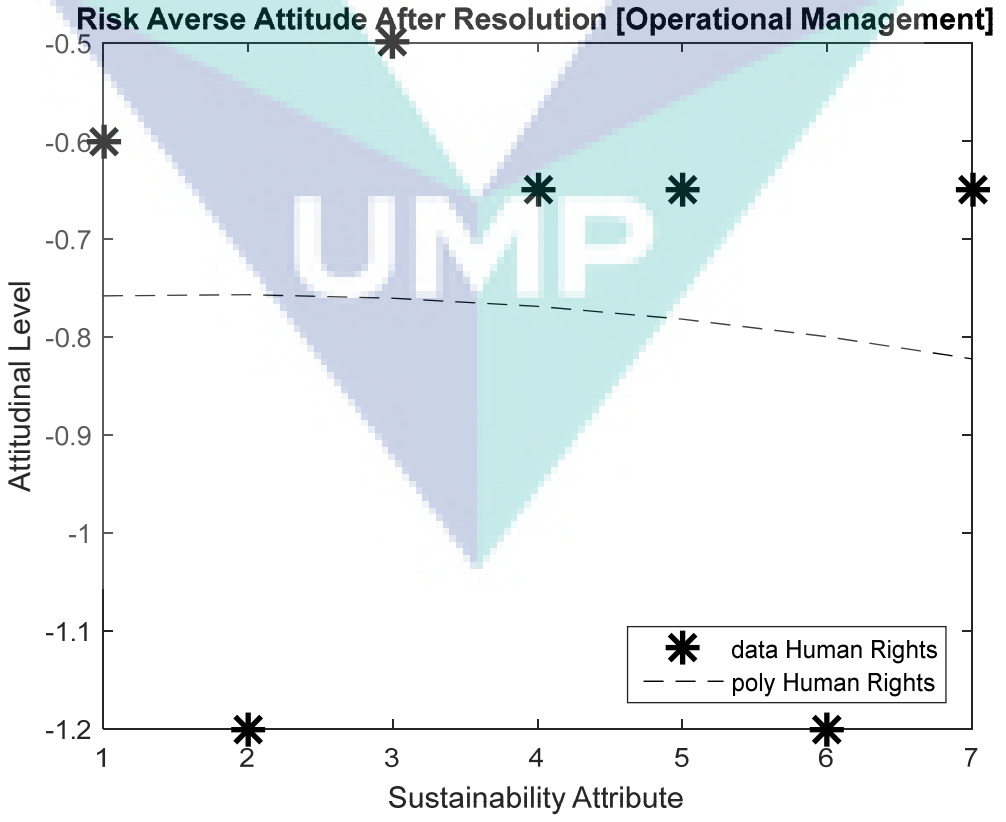

Figure 4.10 Risk averse pattern for Human Rights parameter after considering attitudinal function

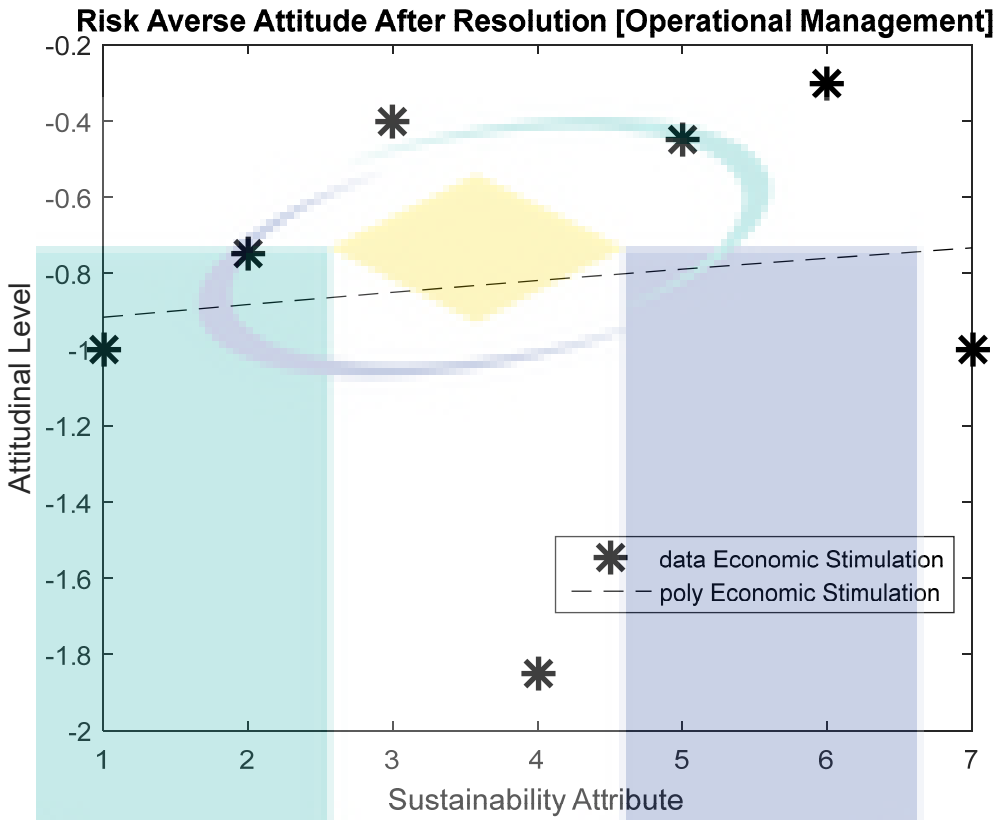

Figure 4.11 Risk averse pattern for Economic Stimulation parameter after considering attitudinal function

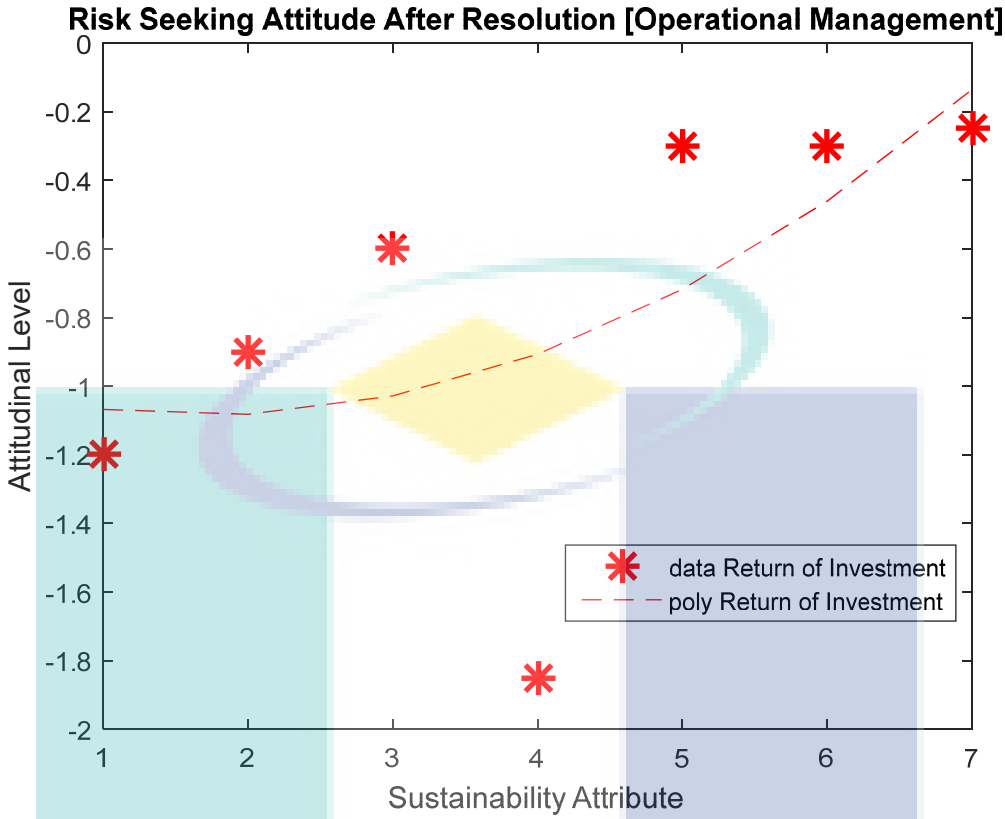

Figure 4.12 Risk seeking pattern for Return of Investment parameter after considering attitudinal function

Table 4.8 Second order polynomial expression after considering attitudinal function [Operational Management]

Parameters	**Risk Attitude**	**Polynomial expression (95% confidence bound)**
Society & Customers	Risk Seeking	$f(x) = 0.06607x^2 - 0.5875x - 0.021$
Human Rights	Risk Averse	$f(x) = -0.002381x^2 + 0.008333x - 0.7643$
Economic Stimulation	Risk Averse	$f(x) = -0.0006x^2 + 0.03512x - 0.95$
Return of Investment	Risk Seeking	$f(x) = 0.03393x^2 - 0.1161x - 0.9857$

Source: Rahman (2007). Use *Citation for Table UMP style* here.

4.3 Overview of both management after applying attitudinal parameter.

A look at case studies from both management department; operational and environmental, indicate that there are some general trends between the initial's trend of curve and afters' when the attitude resolution is being considered. Both department show the alternate risk attitude between before and after attitudinal parameter was concerned.

However, as far as attitudinal parameter was concerned; after multiplying by the resolution, most of the employees seemed to be more on risk averse personality, where 7 out of 12 parameters indicate the trait by considering the risk utility function as shown in Figure 4 (thus indicated by 58.33%), and each of the parameter under the respective trait is totally different compare with the trait before undergoing the resolution. In economic theories, it is assumed that risk aversion is a typical human attitude toward risk, where someone will find themselves immediately leaning toward the guaranteed results/success, and the differences between risk lover and risk averse are determined by the curvature of the utility function. Moreover, another 5 over 12 parameters (indicated 41.67%) show the trait of risk seeking personality. Risk seeker is assumed that someone who is naturally find themselves drawn to situations where they could win or lose in the end. The results during the first polynomial analysis showed that before considering attitudinal parameter, the employee who is said to be a risk seeker, in reality is not the same as the mentioned personality, where it is originally risk averse and vice-versa.

Nevertheless, these trait of personality as seen in the result can also fit roughly in the risk-neutral area while still being slightly averse or slightly risk-seeking if and only if the pattern of graph is to be considered. Likewise, they could be a risk seeker who leans toward neutrality, or a risk-avoider who tends toward neutrality as well. In addition, they also could have a measurable difference between instinct and behaviour where he/she for example be a natural risk-seeker who forces himself or herself to make more neutral decisions in order to live responsibly. Or they could be a natural risk-avoider who trains himself or herself to take more risks to get more out of life. Lastly, the results of psychological studies have indicated, however, that people differ in how they make decisions under uncertainty and what motivates them to take economic risks.

4.4 Reliability of risk attitude

Risk attitudes are known to be inconsistent and unreliable. As a matter of fact, a man can never be consistent in his feeling, and the risk attitude is only a particular kind of human feeling. However, the human feeling in general, cannot be changed drastically overnight. For instances, if a man loves the colour orange today, he cannot hate it the next day, but he may love the orange a little less. Similarly, the risk attitudes of a man cannot be drastically changed from one type of risky situation to another.

This study has constructed the risky choices that an employee may choose during the survey regarding the practice of sustainability in the company. Nevertheless, this situation are not exactly what employees are really facing in actual time. Therefore, the result of the study may not be exactly what the employee will do in their real manufacturing operations.

4.5 Factors affecting risk attitude

Economic theory suggests only two factors that affect the risk attitude, the level of the organization income, and the variance of the net organization income. These two suggested factors are well-integrated into the attitudinal utility functions. Besides these two, there can be many more factors that affect risk attitude, but they go beyond economic theory, i.e psychology. In this study, consideration will be given to some relevant factors as follows:

i. Age of employee: One may hypothesize that the younger employee is less risk averse than the older one. Another may argue that the gamblers are not necessarily the young.
ii. Years of knowledge and experience: This factor will likely affect the attitudes of employees, but it is not known whether it affects positively or negatively upon the risk averse. One may think that more experience makes an employee understand the risky problems, i.e., he/she less risk averse. One may argue the other way around too.
iii. Gender of employee: Willingness to take the risks appears to decrease steadily with the age for men, whereas for women willingness to take risks decreases more rapidly from the late teens to age 30, and then remains flat, until it begins to decrease again from the mid-50s onwards.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter presents a review of the research problem, and purpose, the results achieved and summary of the most important scientific contributions of the research together with some suggestions for future work.

5.2 Implications of the study

The findings of this study provide insight on the relationship between sustainable practices and the knowledge of the employees in Malaysia's automotive-related manufacturing industry, which may be different from any other countries with different demography. The findings from this study can be used by policymakers to identify and prioritize which of the sustainable elements currently implemented by automotive-related manufacturers in Malaysia require support in terms of policies, regulations, as well as financial and technical assistance.

Once and for all, the results of this study is expected to assist any organizations including design engineers or project managers in producing a better sustainability product or reporting while incorporating the attitudinal parameter based on GPM P5 integration without neglecting the major pillar of sustainability standard. In addition, it portrays on how a company need to consider the attitude of the employee to determine the level of sustainability's practice for their organization. From this research, the expectation of the employees' personality from the first place is not true after attitudinal parameter is considered into the raw data.

Meanwhile, due to the diverging comprehension about the sustainability compliance gained from the feedback including their diametrical attitude during the survey, their ideas regarding this assessment are restricted on the existed sustainability tool. Thence, since this assessment method not only based on triple bottom line principle, but also include process and product elements, the outcomes of the research certainly sweeping of the current assessment in the sustainability practices.

5.3 Suggestions for future work

There are many more work can be done and improve with this research. One of the idea is to develop new systematic assessment model for sustainability edge by assessing sustainability performance profile, and includes all main economic sectors in Malaysia.

REFERENCES

Abdul-Rashid, S. H., Sakundarini, N., Raja Ghazilla, R. A., & Thurasamy, R. (2017). The impact of sustainable manufacturing practices on sustainability performance. *International Journal of Operations & Production Management*, *37*(2), 182–204. https://doi.org/10.1108/IJOPM-04-2015-0223

Achanga Coxwell. (2007). Development of an Impact Assessment Framework Lean Manufacturing SMEs within for Academic Year 2006-2007 Development of an Impact Assessment Framework Lean Manufacturing SMEs within for Supervisors : Dr Essam Shehab & Professor Rajkumar. *PhD Thesis*.

Aguinis, H., & Glavas, A. (2012). What We Know and Don't Know About Corporate Social Responsibility: A Review and Research Agenda. *Journal of Management*, *38*(4), 932–968. https://doi.org/10.1177/0149206311436079

Bolis, I., Brunoro, C. M., & Sznelwar, L. I. (2014). Mapping the relationships between work and sustainability and the opportunities for ergonomic action. *Applied Ergonomics*, *45*(4), 1225–1239. https://doi.org/10.1016/j.apergo.2014.02.011

Brundtland, G. H. (1987). *Our Common Future: Report of the World Commission on Environment and Development*. *United Nations Commission*. https://doi.org/10.1080/07488008808408783

Chomeya, R. (2010). Quality of Psychology Test Between Likert Scale 5 and 6 Points. *Journal of Social Sciences*, *6*(3), 399–403. https://doi.org/10.3844/jssp.2010.399.403

Concina, L. (2014). Risk attitude & economics.

Dalton, A., Brothers, A., Walsh, S., & Whitney, P. (2010). Expert Elicitation Method Selection Process and Method Comparison, 1–9.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, *9*(3), 522–550. https://doi.org/10.1111/j.1542-4774.2011.01015.x

Dresner, S. (2012). *The principles of sustainability*. London.

Ghozali, M., Nordin, N., & Ashari, H. (2016). The Impact of Social Well-being on Sustainability Practice among Malaysian Manufacturing Firms, 4–11. https://doi.org/10.15405/epsbs.2016.08.121

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in

qualitative research: interviews and focus groups. *British Dental Journal*, *204*, 291–295. https://doi.org/10.1038/bdj.2008.192

Green Project Management. (n.d.). Retrieved from https://www.greenprojectmanagement.org/

Hillson, D. (2009). *Managing Risk in Projects* (1st ed.). England: Gower Publishing Limited.

Hillson, D., & Webster, R. M. (2012). *Understanding and Managing Risk Attitude (second edition)*. Gower Publishing Limited. Retrieved from https://books.google.com.my/books?id=jnCfhHpD1LwC&printsec=frontcover&dq=Understanding+and+Managing+Risk+Attitude&hl=en&sa=X&ved=0ahUKEwjN3_CBmenYAhUfSo8KHS_BCewQ6AEIKDAA#v=onepage&q=Understanding and Managing Risk Attitude&f=false

Ingram, D., & Thompson, M. (2011). Changing Seasons of Risk Attitudes. *The Actuary*, *8*(1).

Jaafar, N. (1992). Sustainable Development in Perspective Definition, Concept and Policies Issues.

Joshi, A., Kale, S., Chandel, S., & Pal, D. (2015). Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology*, *7*(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

Krosnick, J. A. (1999). SURVEY RESEARCH. *Annual Review of Psychology*, *50*(1), 537–567. Retrieved from https://doi.org/10.1146/annurev.psych.50.1.537

Lu, J., C Jain, L., & Zhang, G. (2012). *Handbook on Decision Making: Vol 2: Risk Management in Decision Making*. (J. Kacprzyk & L. C Jain, Eds.). Springer US. https://doi.org/10.1007/978-3-642-25755-1

Magari, M. (2008). *Implementing Strategic Sustainability Planning Processes: Lessons from Three US Cities*.

Martin, T. G., Burgman, M. A., Fidler, F., Kuhnert, P. M., Low-Choy, S., Mcbride, M., & Mengersen, K. (2012). Eliciting Expert Knowledge in Conservation Science. *Conservation Biology*, *26*(1), 29–38. https://doi.org/10.1111/j.1523-1739.2011.01806.x

Norton, T. A., Parker, S. L., Zacher, H., & Ashkanasy, N. M. (2015). Employee Green Behavior: A Theoretical Framework, Multilevel Review, and Future Research Agenda. *Organization and Environment*, *28*(1), 103–125. https://doi.org/10.1177/1086026615575773

Omar, R., & Samuel, R. (2011). Environmental Management amongst Manufacturing Firms in Malaysia. *3rd International Symposium & Exhibition in Sustainable Energy &*

Environment, (June), 1–3. https://doi.org/10.1109/ISESEE.2011.5977123

Runeson, P., & Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. *Empirical Software Engineering*, *14*, 131–164. https://doi.org/10.1007/s10664-008-9102-8

Rusinko, C. (2007). Green Manufacturing: An Evaluation of Environmentally Sustainable Manufacturing Practices and Their Impact on Competitive Outcomes. *IEEE Transactions on Engineering Management*, *54*(3), 445–454. https://doi.org/10.1109/TEM.2007.900806

Saadatian, O., Haw, L. C., Mat, S. Bin, & Sopian, K. (2012). Perspective of Sustainable Development in Malaysia. *International Journal of Energy and Environment*, *6*(2), 260–267.

Shefrin, H. (2016). *Behavioral Risk Management: Managing the Psychology that Drives Decisions and Influences Operational Risk*. United States of America. https://doi.org/10.1057/9781137445629

Taisch, M., Stahl, B., & May, G. (2015). Sustainability in manufacturing strategy deployment. *Procedia CIRP*, *26*, 635–640. https://doi.org/10.1016/j.procir.2014.07.106

Yin, R. K. (1981). The Case Study Crisis: Some Answers. *Administrative Science Quarterly*, *26*(1), 58–65. https://doi.org/10.2307/2392599

Yin, R. K. (1993). *Application of Case Study Research*. SAGE Publications.

Zamagni, A., Pesonen, H.-L., & Swarr, T. (2013). From LCA to Life Cycle Sustainability Assessment: concept, practice and future directions. *The International Journal of Life Cycle Assessment*, *18*(9), 1637–1641. https://doi.org/10.1007/s11367-013-0648-3