SUSTAINABILITY BALANCED SCORECARD ARCHITECTURE AND ENVIRONMENTAL INVESTMENT DECISION MAKING: THE MEDIATING AND MODERATING EFFECTS OF KNOWLEDGE AND RISK INDICATORS

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ABSTRACT

According to a survey by Bain and Company, the majority of the sustainability programs undertaken by global companies fail to meet their objectives. A part of the reason for such a dilemma is possibly due to the dearth of sufficient research on how investment and performance evaluation tools such as sustainability balanced scorecards architecture impact decisions taken by managerial decision-makers. Hence, this doctoral research endeavor extends the literature on sustainability balanced scorecards (SBSC) architecture by examining how they influence decision-makers when they attempt to achieve environmental goals of their organization through evaluation of environmental investment options.

An experimental research model is proposed in this study developed by leveraging the premise of the Adaptive Decision Maker Framework and also the loss aversion component of the Prospect Theory. The goal of the study is to determine if significant difference exists between SBSC with sustainability parameters embedded with the four BSC perspectives (referred to as SBSC-4) and SBSC with sustainability as an additional fifth perspective (referred to as SBSC-5), when decision-makers use them to make environmental investment decision-making. The study also investigates the role of SBSC knowledge as a possible mediator and risk indicators as a possible moderator in the above relationships.

The experiment was conducted on 108 managers working in multinational manufacturing companies, where the participants were selected from two different geographical regions of Asia (China and the Gulf Countries in the Middle East). The participants were divided into four separate experimental groups (SBSC-4 without risk, SBSC-4 with risk, SBSC-5 without risk, and SBSC-5 with risk). The data analysis was conducted by using Two-Way ANOVA for group comparisons in a Two-factor factorial

design approach, while the moderation effect and the moderated-mediation effect was tested through Hayes Process Macro in SPSS (model 8).

The results indicate that there is a significant difference between SBSC-4 and SBSC-5 in terms of their impact on environmental investment decision-making. The difference remains significant in presence of risk indicators. This study also finds that the relationship between the two types of SBSC architecture and environmental investment decision-making is mediated by SBSC knowledge and moderated by risk indicators. This study further examines whether a significant moderated-mediation relationship exists in an integrated model with the two types of SBSC architecture and environmental investment decision-making. The findings of this experimental research suggest that SBSC knowledge and risk indicators influence decision outcomes when the two SBSC configurations are utilized by decision-makers to evaluate environmental investment options.

Keywords: SBSC architecture, Environmental Investment Decision, Risk Indicators, SBSC Knowledge

ABSTRAK

Mengikut kaji selidik oleh Bain dan Syarikat, majoriti program kemapanan yang dijalankan oleh syarikat global gagal memenuhi objektif mereka. Sebahagian daripada sebab untuk dilema seperti itu mungkin disebabkan oleh kurangnya kajian yang mencukupi mengenai bagaimana alat penilaian pelaburan dan prestasi seperti keputusan pemulihan skor skor seimbang yang diambil oleh pembuat keputusan pengurus. Oleh itu, usaha penyelidikan doktoral ini memperluaskan kesusasteraan mengenai kadbod seimbang seimbang (SBSC) dengan mengkaji bagaimana mereka mempengaruhi pembuat keputusan apabila mereka cuba mencapai matlamat alam sekitar organisasi mereka melalui penilaian pilihan pelaburan alam sekitar.

Model penyelidikan percubaan dicadangkan dalam kajian ini yang dibangunkan dengan memanfaatkan premis Rangka Kerja Pembuat Keputusan yang Adaptif dan komponen hilangnya keengganan Teori Prospek. Matlamat kajian ini adalah untuk menentukan sama ada perbezaan signifikan antara SBSC dengan parameter kelestarian tertanam dengan empat perspektif BSC (dirujuk sebagai SBSC-4) dan SBSC dengan kelestarian sebagai perspektif kelima tambahan (dirujuk sebagai SBSC-5), apabila pembuat keputusan menggunakannya untuk membuat keputusan pelaburan pelaburan alam sekitar. Kajian ini juga menyiasat peranan pengetahuan SBSC sebagai pengantara dan penunjuk risiko yang mungkin sebagai penyederhana yang mungkin dalam hubungan di atas.

Eksperimen ini dijalankan ke atas 108 pengurus yang bekerja di syarikat pembuatan multinasional, di mana para peserta dipilih dari dua wilayah geografi yang berbeza di Asia (China dan Negara Teluk di Timur Tengah). Peserta dibahagikan kepada empat kumpulan percubaan berasingan (SBSC-4 tanpa risiko, SBSC-4 dengan risiko, SBSC-5 tanpa risiko, dan SBSC-5 dengan risiko). Analisis data dilakukan dengan menggunakan ANOVA Dua Arah untuk perbandingan kumpulan dalam pendekatan faktor faktorial

dua faktor, manakala kesan penyederhanaan dan kesan pengantaraan sederhana diuji melalui Proses Hayes Makro di SPSS.

Hasilnya menunjukkan terdapat perbezaan yang signifikan antara SBSC-4 dan SBSC-5 dari segi impak mereka terhadap membuat keputusan pelaburan alam sekitar. Perbezaannya kekal signifikan dengan adanya penunjuk risiko. Kajian ini juga mendapati bahawa hubungan antara kedua-dua jenis SBSC dan membuat keputusan pelaburan alam sekitar dimediasi oleh knowledeg SBSC dan disederhanakan oleh penunjuk risiko. Kajian ini juga mengkaji sama ada hubungan sederhana-mediasi yang signifikan wujud dalam model bersepadu dengan dua jenis SBSC dan pembuatan keputusan pelaburan alam sekitar. Penemuan kajian eksperimen ini menunjukkan bahawa pengetahuan dan penunjuk risiko SBSC mempengaruhi keputusan keputusan apabila dua konfigurasi SBSC digunakan oleh pembuat keputusan untuk menilai pilihan pelaburan persekitaran.

Kata kunci: *Reka Bentuk SBSC, Keputusan Pelaburan Alam Sekitar, Petunjuk Risiko, Pengetahuan SBSC*

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LIST OF SYMBOLS AND ABBREVIATIONS

BSC	:	Balanced Scorecard
SBSC	:	Sustainability Balanced Scorecard
SBSC-4	:	Sustainability Balanced Scorecard with Four Perspectives
SBSC-5	:	Sustainability Balanced Scorecard with Five Perspectives
ISO	:	International Standards Organization
ERM	:	Enterprise Risk Management
COSO	:	Committee of Sponsoring Organizations
ADMF	:	Adaptive Decision Maker Framework
IMM	:	Index of Moderated Mediation

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

This chapter explains the background of the study and thereafter, presents an elaborate discussion on the basic research problem that led to the pursuit of this experimental study. The next section describes the research questions and research objectives that are the foundation of this study. The penultimate part of the chapter illuminates the theoretical and practical contribution of this experimental research endeavor. Finally, the chapter ends with the structure of the thesis chapters.

1.1 Background

In line with contemporary global focus on the triple bottom-line concept (Hubbard, 2009), investors and corporate managers are becoming aware of the links between their investments and ecologically sustainable development (Baker and Schaltegger, 2015; Fayers et al., 2000; Hahn and Figge, 2011). This has led to the development of concepts such as environmental investment, which is also referred to as sustainable investment or green investment (Wicki et al., 2015). Conceptually, sustainability can be defined as processes that consider the drawbacks and benefits of the social and environmental consequences of investments, within the context of rigid financial analysis and meeting the basic standards of corporate social responsibility (Hahn et al., 2016; O'Rourke, 2003).

Over the past decade, environmental investment has expanded to include the simultaneous consideration of economic growth, environmental protection, and social equity in business planning and investment decision-making (Jano and Crawford, 2017; Journeault, 2016; Schaltegger et al., 2013). With the growing importance of environmental investment as a means towards future organizational viability, researchers and government policy-makers have shown increasing interest in understanding the individual environmental investment decision-making process, and

the factors influencing the process (Schaltegger et al., 2016a; Tsai et al., 2009). Increasingly, stakeholders are beginning to emphasize the role of environmental investments and to identify the potential role of their investments in assisting moves towards ecologically sustainable development (Disatnik and Steinhart, 2015; Schaltegger and Horisch, 2017).

To date, there is a very modest shift towards environmental considerations among investment professionals in business and only some forms of environmental risks are being assessed (Burchman, 2018; Sarker and Monroe, 2012). However, there are constraints to the inclusion of environmental performance, most of which relate to the nature and availability of reliable information (Schaltenbrand et al., 2018).

There are a number of studies that examine the usefulness of environmental accounting information in investment decision-making (e.g., Alewine and Stone, 2013; Sarker and Burritt, 2008; Schaltenbrand et al., 2018; Tsai et al., 2009). These studies find that environmental risk recognition, through the concepts and tools of environmental accounting, can play a role in incorporating environmental consideration in investment decision-making. They posit that environmental information has the potential to help improve not only the environmental practices of a firm, but to also help in drawing attention to places where cost-savings can be made (Lamach, 2017).

Literature asserts that such types of information strategy will have a strong influence on the way managers make environmental investment decisions to lessen a company's future environmental risks (Disatnik and Steinhart, 2015; Sarker and Monroe, 2012; Schaltenbrand et al., 2018). Accordingly, Sustainability Balanced Scorecard (SBSC) provides a bird's eye view of key sustainable performance parameters based on the integration of environmental and social considerations into organizational strategic planning and management. SBSC attempts to integrate a more inclusive view of short and long-term goals in all three dimensions of company

performance (economic, environmental and social) in order to achieve environmental objectives and ensure sustainable business performance (Gomes and Ramao, 2017; Hansen and Schaltegger, 2016). Moreover, SBSC plays a significant role in evaluating the potential benefits of investments and initiatives, which may impact cognitive processing and investment decision-making (Alewine and Miller, 2016; Alewine and Stone, 2013; Bento et al., 2017; Jiangtao and Pin, 2010; Kaplan, 2009).

Scorecard performance measures pertaining to sustainability may be organized in one of two ways: (i) they may be embedded into the balanced scorecard (BSC) with four perspectives, or (ii) they may be added as an additional stand-alone fifth perspective (Alewine and Stone, 2013; Hansen and Schaltegger, 2016; Journeault, 2016: Kalender and Vayvay, 2016). The way sustainability parameters have been integrated or added to the four BSC perspectives are referred to as SBSC architecture (Hansen and Schaltegger, 2016). In this context, the extant literature indicates that there are mixed findings in scholarly research on whether there are any significant differences between the SBSC architecture when it comes to deploying them to decide on investment-related outcomes.

The extant literature indicates that the SBSC architecture is divided into two dominant schools of thought (i.e., SBSC-4 with sustainability embedded into four perspectives, and SBSC-5 with sustainability as stand-alone fifth perspective). Furthermore, the issue of whether architecture of SBSC-4 and SBSC-5 are significantly different from each other when they are used by decision-makers to evaluate investment options related to sustainability goals of an organization are still unresolved (Hansen and Schaltegger, 2016). Therefore, the conflicting findings warrant a detailed study to determine whether the dominant SBSC architecture are significantly different from each other when they are used to make environmental investment decision-making.

Although a majority of the studies appear to suggest that the extended SBSC configuration with sustainability parameters as a stand-alone 5th perspective is the more effective tool for environmental investment decisions, not all studies agree to this assertion. This add-on performance metric has triggered debates between scholars about the usefulness of such extensions in the architecture of SBSC (e.g., Hahn and Figge, 2018; Hansen and Schaltegger, 2016; Hansen and Schaltegger, 2018). Additionally, the relationship between SBSC architecture and environmental investment decision-making may be accounted for by other variables. For example, there is a possibility that organizational knowledge of concepts and applications about SBSC configurations (i.e., SBSC knowledge) may have a mediating role between SBSC architecture and environmental investment decision-making. The investigation of whether SBSC knowledge mediates the relationship between SBSC architecture and environmental investment decision-making appears to have been overlooked in prior empirical studies.

Furthermore, the role of strategic risks (financial and non-financial) to organizations may need to be considered in order to make more informed decisions, which are expected to improve sustainable business practices in an ever more complex business environment (Cheng et al., 2018; Sarker and Monroe, 2012; Olson and Wu, 2017; Wisutteewong and Rompho, 2015). However, the effect of considering risks when associating SBSC architecture with environmentally conscious investment is inconclusive, and the few empirical studies in this area is due to the fact that the influence of risk indicators along with SBSC perspectives on environmental investment decision-making has not been sufficiently studied. Hence, the situation warrants further investigation into whether considering risk indicators along with SBSC architecture has a significant role in the manner in which environmental investment outcomes are influenced when SBSC-4 and SBSC-5 are used by decision-makers to evaluate such investments.

Based on the preceding discourse, there is a perceived need for more in-depth empirical research that provides a clear and predictable linkage between incorporating risk through SBSC frameworks (Faris et al., 2013; Olson and Wu, 2017), and to understand how they impact decision-making when other pertinent variables are brought into the study model.

The current study proposes to address these gaps that are likely to have implications for both managers and academic researchers. The research endeavor considers an integrated framework that takes SBSC architecture into account, and investigates how environmental investment decision-making is affected by different SBSC architecture when 'SBSC knowledge' is considered as a mediator and 'risk indicators' as moderator. In order to build the theoretical framework of this research, the study deploys the Adaptive Decision-Maker Framework as the primary theoretical lens to propose the conceptual link between variables in the research model, where the aforesaid theory suggests that people's decisions are impacted by how information is presented to them (Payne et al., 1993). Furthermore, the study also draws on the support of the loss-aversion component of the Prospect Theory (Kahneman and Tversky, 1979) to predict the behavior of decision-makers when risk indicators are incorporated into the framework. The foundations of the above two theoretical lenses are explained in detail in Chapter-2, and the application of these theories in building the research model in the current study are explained in Chapter-3.

In terms of methodology, this study employs an experimental method by building on the work done by Alewine and Stone (2013) and Cheng et al. (2018) and deploying the experimental study method being a between-subjects (2×2) factor experimental design. Details of the experimental method and justification for its' use in this study are explained in Chapter 4. The next section presents the practical and theoretical problems that necessitate the undertaking of this research endeavor.

1.2 Problem Statement

A survey on success of sustainability initiatives by over 300 global companies undertaken by the consulting firm; Bain and Company in 2016, indicates that CEO's today feel the pressure from stakeholders to vigorously pursue environmental stewardship and social development along with traditional performance benchmarks (Davis-Peccoud et al., 2016). The typical approach followed by most companies is to appoint a chief sustainability officer and allocate millions of dollars to such an initiative. After a lot of publicity and fanfare, eventually the momentum fades and the outcome of such strategic initiatives shows very poor results. The following quote is extracted from their report.

> *"It's a frustrating setback—and a common one. Bain research on corporate transformation programs shows only 12% achieve or exceed their aims. For sustainability, that figure is just 2%. Why? Sustainability transformations add another dimension of challenge. Often, enthusiastic leadership teams overlook the difficulties frontline employees confront when implementing new approaches. If employees feel forced to choose between sustainability targets and business targets, for example, most choose business targets. As a result, corner-office passion remains stuck at the top*."
>
> (Davis-Peccoud et al., 2016*, pg.1*).

The preceding paragraph depicts a mere 2% success rate of implementing sustainability initiatives even in global organizations, and this is a cause for concern. In the backdrop of the aforesaid dilemma, stakeholders nowadays are demanding more proactive engagement from CEOs of global companies in terms of sustainable business practices (Lamach, 2017). Among the primary reasons for failure of sustainability programs can be traced to the fact that initiatives are taken up without building adequate capacity among the employees to cope with the complexity of dealing with environmental and social sustainability parameters. Such a situation often leads to internal resistance from the organizations' employees, mainly because they are not equipped to cope with sustainability targets on top of existing targets that are driven by

financial bottom-line considerations (Burchman, 2018).

The primary drivers of the negative attitude of organizational employees towards complex initiatives such as sustainability programs come from two basic sources:

(i) There is often ambiguity in the measurement of sustainability outcomes, such as environmental performance measurements. In other words, the decision-makers entrusted with the responsibility of ensuring success of such initiatives are not clear on what a successful environmental or social project looks like (Gomes and Rao, 2017).

(ii) There is substantial lack of organizational knowledge on how to connect the organization's existing strategy maps to their sustainability objectives. Even with the existence of effective decision-making tools, such as SBSC, managers are often unable to deploy them effectively to achieve sustainability targets (Chakravorti, 2017).

While decision makers are familiar with the use of the BSC based on four (4) measurable perspectives that are frequently used in operational functions of business organizations (i.e., financial, customer, internal business process, and learning and growth), the utilization of SBSC architecture are not easily understood (Gomes and Ramao, 2017). The difficulty of using SBSC is mainly because of its' complex architecture, where the four balanced scorecard perspectives are mostly based on quantitative measures, while sustainability parameters are typically based on qualitative measures (Hansen and Schaltegger, 2016). Without further clarity on how different SBSC architecture fit with sustainability investment goals such as desired environmental outcomes, managers will continue to struggle to effectively execute top-down edicts on sustainability targets.

The discourse presented in the preceding paragraphs paints a picture of the challenges faced by industry practitioners regarding successfully implementing

sustainability goals. The problem appears to be strongly tied with the existing, conflicting scenario with regards to the findings of academic literature on SBSC architecture and how they associate with investment decision-making connected to environmental outcomes.

There are a few studies, especially studies using experimental research, that were conducted to examine the impact of environmental information on investment decision-making aimed at achieving organizational sustainability objectives (e.g., Alewine and Stone, 2013; Jassem et al., 2018; Sarker and Burritt, 2008; Sarker and Monroe, 2012; Schaltenbrand et al., 2018; Tsai et al., 2009). The aforesaid studies conclude that environmental information strategy has significant influence on how managers make their environmental investment decisions. In particular, they found that managers are more willing to undertake environmental investments in a situation where the firm has a voluntary environmental information strategy. This strategy provides direction to the managers to operate in a sustainable way, as opposed to a situation in which the firm has a conventional environmental information strategy. Decision-makers are expected to make a proper balance between both the environmental impact and financial return when they make an investment decision. Despite the broad agreement among researchers on the usefulness of SBSC itself, several studies suggest that SBSC scholars are locked in an intense debate on the impact of SBSC architecture on organizational performance outcomes (e.g., Hahn and Figge, 2018; Hansen and Schaltegger, 2018).

From the preceding discourse, it is obvious that more clarity needs to be brought into the understanding of SBSC architecture and how it impacts investment decisions that are aimed at achieving the organizational goals of environmental stewardship. Thus, this doctoral study is based on the premise that SBSC architecture will likely influence decision-makers, whereby they will make different decisions about investment

options based on the type of SBSC architecture presented to them. The ongoing debate among SBSC scholars is not only limited to the relevance of SBSC architecture. It is also extended to include the differences within the SBSC architecture.

The literature reveals that there are contradictory findings regarding whether the differences between SBSC architectures are significant (Jassem et al, 2018). While some studies suggest that there is a significant difference between both SBSC architectures in terms of their impact on environmental investment decision-making (Jiangtao and Pin, 2010), others found no significant difference between the SBSC architectures (Alewine and Stone, 2013). Hence, the significance of the SBSC architecture in terms of its influence on environmental investment decision-making calls for a closer examination

On a further note, there appears to be variation in the behavior of decision-makers between the four-perspective and five-perspective SBSC, depending on the conditions presented to the decision makers. For instance, Pin and Jiangtao (2010) argue that presenting environmental perspective as a stand-alone fifth-perspective makes environmental data more salient compared to the four-perspective SBSC architecture where environmental parameters are embedded into each of the four perspectives of the traditional BSC. This finding is in contrast to Kaplan and Wisner's (2009) findings.

Therefore, as the first research gap, this study seeks to determine a more nuanced understanding of how the two most popular configurations of SBSC (i.e., four and five perspective SBSC architecture) impact investment decisions in organizations. Furthermore, the study brings into the picture an important challenge faced by decision-makers; to connect risk indicators with SBSC architecture and environmental investment decision-making (Faris et al., 2013). As strategy execution inevitably involves risks, analyzing sustainability and risks allow managers to get a better understanding of the performance and viability of their strategies. Consequently,

decision-makers are focusing their attention on simultaneously improving their performance measurement and reporting their risks and strategic performance (Kaplan, 2009). Therefore, the above discourse poses a pertinent research question that needs to be investigated to arrive at a finer-grained understanding of the relationship between SBSC architectures and environmental investment decision-making without any additional information such as risk. At the same time, the above linkage needs to be examined when risk information is presented along with the SBSC configurations (for both SBSC-4 and SBSC-5). Hence, the preceding arguments lead to the following research question.

RQ1a: Is there a significant difference between the two SBSC architecture (SBSC-4 and SBSC-5) when decision-makers utilize them to make environmental investment decisions?

RQ1b: Is the difference between SBSC-4 and SBSC-5 significant when risk indicators are presented along with SBSC architecture for making environmental investment decision-making?

The second issue that warrants attention and appears not to have been adequately covered by SBSC research is the role of '*SBSC Knowledge'* in the relationship between the types of SBSC architecture and environmental investment decision-making. Industry practitioners and academic scholars appear to have overlooked the validity of the causal links between drivers and the outcomes of the SBSC, and often ignore the underlying strategically linked casual business model which could lead to the failure of the firm in evaluating and considering strategy effectiveness in performance evaluation (Banker et al., 2011).

The evidence from previous studies indicates that even if the information about strategy effectiveness is available in the SBSC instrument, it is not used as much as would have been expected because of cognitive limitations posed by the complexity of

SBSC configurations (Alewine and Miller, 2016). The extant literature on SBSC finds that the knowledge deficiency of managers regarding the common and unique SBSC measures will impact their decision-making (Alewine and Stone, 2016; Banker et al., 2004; Kaplan and Wisner, 2009). Accordingly, it is likely that an insufficient range of SBSC measures may provide inadequate information to managers, which could seriously limit their view of business performance. For example, this occurs when supervisors evaluate the performance of managers using SBSC, based only on common measures across different units, and not on the measures that were unique to particular business unit (Banker et al., 2004; Lipe and Salterio, 2002). The studies indicate that participants had cognitive biases on which SBSC measures to use and how to weigh them (Alewine and Miller, 2016). Although the understanding of SBSC architecture, is essential to better alignment of managerial actions with strategy (Machado, 2013), examining a proper understanding of each measure in order to achieve a firm's targets appears to have been overlooked by the traditional SBSC proponents.

Hence, there exists an additional gap in the literature in terms of examining the mediating role of SBSC knowledge on the direct relationship between SBSC architecture and environmental investment decision-making. Therefore, the second research question (stated below) that arises from the above gap in the body of knowledge is to propose SBSC knowledge as a mediator between SBSC architecture and environmental investment decision-making.

RQ2a: Does SBSC knowledge mediate the relationship between the two SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making?

RQ2b: Is the mediation effect of SBSC knowledge significant when risk indicators are presented along with SBSC-4 and SBSC-5, when they are used for environmental investment decision-making?

Although, SBSC has great flexibility in addition to the performance perspectives based on the business circumstances, relevant literature indicates that incorporation of

risk indicators into SBSC architecture to determine whether environmental investment decision-making changes when risk is integrated into the SBSC architecture has not been sufficiently researched. Extant literature suggests that considering risk with financial and non-financial information influences managers in their decision-making processes and thus warrants further investigation into the context of SBSC architecture and environmental investment decision-making (Cheng et al., 2018; Kotze et al., 2015).

So far, there appears to be a dearth of empirical studies to determine whether SBSC architectures that integrate risk indicators will lead to significant conclusions that account for the difference in investment choices among decision-makers. Hence, this is an additional gap in the extant literature to be addressed by this study. Thus, the study attempts to determine whether incorporating risk indicators into the framework leads to significant changes in how decision-makers select investment options that impact environmental outcomes. Thus, this study poses the following research question (shown below) to investigate whether risk indicators are the reason for the conflicting findings manifested in previous studies on whether a significant difference exists between SBSC architectures.

RQ3: Does 'risk indicators' moderate the relationship between SBSC architecture and environmental investment decision-making?

As previously discussed, decision-makers are expected to know how to choose the most suitable SBSC architecture and understand the potential roles and the main differences in SBSC architectures in order to identify the true goals of organizations behind adopting the SBSC in their analysis of investment alternatives (Hansen and Schaltegger, 2016). In this context, decision-makers who lack SBSC knowledge will be less likely to interpret the SBSC comprehensively, especially when making investment decisions linked to environmental objectives. Prior literature indicates that an integrated perspective that considers the impact of SBSC architecture on environmental investment

decision outcomes along with SBSC knowledge as a mediator and risk indicators as a moderator has not been considered. Therefore, the fourth gap being addressed by this doctoral research proposes an integrated research framework that considers the above variables working together, leading to the following research question.

RQ4: Is there a significant mediating effect of SBSC knowledge in the presence of moderating effect of risk indicators (i.e., a moderated mediation effect) between SBSC architecture and environmental investment decision-making?

An additional gap identified in the literature is methodological in nature. The extant literature indicates that majority of the experimental studies related to SBSC architecture have been conducted with students as surrogates for real-world managers. Therefore, the current study proposes to contribute to the body of knowledge by conducting the current experimental study with managerial decision-makers working with large multinational companies where BSC are used, and sustainability and enterprise risk management are crucial components of their strategic planning.

1.3 Research Objectives

Business enterprises with environmentally conscious strategic goals seek high quality investment decisions that simultaneously address conventional business success factors such as financial performance while, at the same time improve environmental quality and human living standards (Bento et al., 2017). Such companies are expected to be aware of the appropriate selection of SBSC architecture that includes environmental metrics and risk consideration as part of its evaluation process (Hansen and Schaltegger, 2016). Examination of prior literature indicates a dearth of studies that examine environmental investment decision changes based on the types of SBSC architecture when risk indicators are presented. In light of the discourse presented in the preceding

sections, the research questions generated earlier (based on gaps in the extant literature) along with corresponding research objectives are summarized in Table 1.1.

Table 1.1: Research Objectives and Questions

No.	Research Objectives	Research Questions
1a	To examine whether there is significant difference between the two SBSC architecture (SBSC-4 and SBSC-5) when, decision-makers utilize them to make environmental investment decisions.	Is there a significant difference between the two SBSC architecture (SBSC-4 and SBSC-5) when, decision-makers utilize them to make environmental investment decisions?
1b	To determine if the difference between SBSC-4 and SBSC-5 are significant when risk indicators is presented along with the two SBSC architecture for making environmental investment decision-making.	Is the difference between SBSC-4 and SBSC-5 significant when risk indicators are presented along with SBSC architecture for making environmental investment decision-making?
2a	To determine if SBSC knowledge mediates the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making.	Does SBSC knowledge mediate the relationship between SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making?
2b	To determine if SBSC knowledge mediates the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making, when risk indicators are presented along with the SBSC architecture.	Is the mediation effect of SBSC knowledge significant when risk indicators are presented along with SBSC-4 and SBSC-5, when they are used for environmental investment decision-making?
3	To examine if risk indicators moderate the relationship between SBSC architectures (SBSC-4 and SBSC-5) and environmental investment decision-making.	Do risk indicators moderate the relationship between SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making?
4	To test if there is a significant moderated-mediation effect between SBSC architecture and environmental investment decision-making, where SBSC knowledge is a mediator and risk indicator is a moderator.	Is there a significant mediating effect of SBSC knowledge and moderating effect of risk indicators (moderated-mediation effect) between SBSC architecture and environmental investment decision-making?

1.4 Research Motivations and Contribution

As social values change, growing numbers of investors are beginning to identify the potential role of investments in assisting moves towards ecologically sustainable development. Meanwhile, most investors have sought sustainability perspectives from their investments. The idea of reaping environmental benefits from investment is widely accepted, because ecology and economy have long been considered positively correlated between environmental and financial performance. The concept of sustainable development and sustainable business practice suggests a radically new vision for integrating financial and environmental goals. These three goals, economic, environmental, and ethical sustainability, are often referred to as the three pillars of sustainability.

Assessing business activity along these three lines is often referred to as the "triple bottom line" approach. The original proponent of the triple bottom line concept, Herman Daly, states that sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Daly et al., 1994). Adding to Daly's ideas on sustainability, the SBSC now takes into account the measures of environmental sustainability and evaluates investment decisions that achieve environmental objectives. Thus, SBSC architecture plays an extremely important role in environmental investment decision-making (Falle et al., 2016; Jassem et al., 2018).

One of the main motivations of this study is an ongoing debate within the SBSC literature on determination of which type of SBSC architecture is more effective on environmental investment decision-making. Industry practitioners use a variety of SBSC architectures to make investment decisions that achieve an environmental objective, out of which the most prevalent are the SBSC-4 and SBSC-5 (Journeault, 2016). SBSC provides management with a powerful instrument that includes

sustainability information to help managers to make effective investment decisions, allowing them to cope with the sustainability standards that global companies are being held to by their stakeholders (Bento et al., 2017).

The majority of empirical studies on firm performance outcomes based on SBSC applications are focused on direct business performance, such as profitability (Bento et al., 2017). Studies on the difference between SBSC architecture and their impact on environmental investment decisions are very few in number, and almost nonexistent in the context of manufacturing organizations (Nurcahyo et al., 2018). For this to be determined, the obvious option is to conduct experimental research, which this study undertakes.

1.4.1 Theoretical Contribution

This study attempts to offer various significant theoretical contributions to the relevant body of knowledge on SBSC literature and environmental investment decision-making.

First, the current study attempts to address the conflicting findings (e.g., Alewine and Stone, 2013; Hahn and Figge, 2018; Hansen and Schaltegger, 2016; 2018) in the literature regarding whether a significant difference exists between SBSC-4 and SBSC-5 on the pattern of their impact on decision making related to environmental investments. Furthermore, whether such differences between SBSC architectures are more evident when risk indicators are presented to decision-makers.

A nuanced understanding of this finding is expected to add to the SBSC literature by attempting to bring more clarity to the theoretical linkage presented in previous studies such as Alewine and Stone (2013), Jiangtao and Pin (2010), and Alewine and Miller (2016).

Furthermore, this study may pave the way for re-designing the existing SBSC architecture, either by integrating risk indicators into the SBSC-4 and SBSC-5

configurations or by not presenting risks at all. The possibility looms large, that some of the variations reported in different studies on SBSC are due to the exclusion of organizational risk factors in the previous research frameworks. The current study will attempt to discern this issue by including and excluding risk indicators through the experimental procedure.

The consideration of risk factors in the relationship between SBSC architectures and environmental decision-making has not been sufficiently studied. The literature indicates that researchers have examined the impact of integrating risk with the traditional BSC (but not SBSC) on organizational performance (e.g., Cheng et al., 2018; Kotze et al., 2015). However, so far there is only one study done by Soror (2014) where integrating risk with SBSC to investigate their impact on organizational performance has been attempted but it is not related to environmental investment decision-making. Therefore, the current study appears to be the first to examine whether risk acts as a moderator in the relationship between SBSC architecture and environmental investment decision-making. For theory development, constructs are expected to provide consistent and predictable relationships (Dean and Bowen, 1994), and the outcome of this study may prove to be an important finding in terms of a consistently predictable link between SBSC architectures and investment decision outcomes.

Accordingly, there has been limited empirical research on how such integration can be achieved, and the potential effect of such an approach. This component of the current study is likely to contribute further to theory building by demonstrating the role of considering risk in the decision-making process connected to achieving environmental investment goals through the use of SBSC architecture as a tool.

Several studies have addressed the issue of conflicting findings in the literature and have suggested that the link between SBSC architecture and investment outcomes may be better explained by intervening variables that were not considered in previous

studies (e.g., Banker et al., 2011; Jassem et al., 2018). Therefore, by considering the mediating role of SBSC knowledge on the relationship between SBSC architecture and environmental investment decisions, the study proposes to make a pertinent contribution to theory building by examining whether SBSC knowledge among decision-makers accounts for the relationship between the two dominant SBSC architecture; SBSC-4 and SBSC-5, and environmental investment decision-making.

An important methodological gap existing in the SBSC literature is that most experimental studies that investigate SBSC architecture and outcomes such as environmental investment decision-making have utilized students as surrogates for real-world managers as experimental participants. The current study proposes to conduct the experiment on managers working with multinational manufacturing companies in two regions of Asia (China and GCC countries in the Middle East). The use of managers with practical experience in managing sustainability objectives of organizations may be considered as an important contribution to the body of knowledge.

Finally, to extend theory about our understanding of SBSC architecture and environmental investment decision-making, this study proposes a moderated-mediation model (Hayes, 2013), which may explain the mediating role of SBSC knowledge on the relationship between SBSC architecture and environmental investment decision-making when risk indicator is integrated as a moderator. In summation, this study is expected to reveal how decision-makers manifest different investment behaviors according to their level of knowledge of processing SBSC architecture and based on the different levels of risk they perceive.

1.4.2 Practical Contribution

In addition to theoretical contributions, this study offers practical contributions for the benefit of industry practitioners. SBSC architecture, as a performance evaluation mechanism, is a holistic guide for managers when choosing between alternatives.

Managers in charge of making environmental investment decisions are likely to benefit from this study by knowing that the two SBSC architectures (SBSC-4 and SBSC-5) have different patterns of impact on environmental investment decisions. Thus, they can standardize use of SBSC as a performance evaluation tool in real-time based on the needs of their respective organizations. Since, academic research has not yet delivered a consensus on significant difference on SBSC architecture, it is important to undertake the necessary study to reach such a conclusion. The role of SBSC knowledge as a mediator in the relationship between SBSC and investment decision-making will be an important finding. Business organizations that deploy SBSC in their decision-making will realize the necessity of customizing their managerial training modules in order to enhance the depth of the appreciation and understanding of SBSC and to ensure that the use of such tools leads to more effective decisions in their organization.

Studies in the past have possibly overlooked the need to provide empirical evidence as to whether integrating risks into the SBSC architecture can significantly influence decision-makers in making environmental investment decisions in comparison to SBSC architecture without risk integration. The results of this study will enable managers to comprehend whether integrating risks in the SBSC architecture will lead to more effective environmental investment decision-making.

1.5 Chapters Summary

This thesis is organized into six chapters, and a brief synopsis of each chapter is given below.

Chapter 1: Introduction

This chapter starts with a background scenario and the context of this study. The next section delves into the problem statement that explains the rationale and importance of undertaking such an exhaustive study on SBSC and environmental investment decision-

making. Thereafter, the chapter summarizes the research gaps and the subsequent research objectives and questions that form the foundation of this study. The next section explains the contributions that this study expects to make to theory and practice. Finally, the chapter ends with a summary of the organization of the thesis.

Chapter 2: Literature Review

The chapter commences with an introduction to the literature and proceeds to discuss environmental investment decision-making, which is the dependent variable in the research model of this study. The following section elaborates on SBSC and its various configurations. The subsequent section presents a discourse on enterprise risk and how it converges with SBSC in environmental investment decision-making. Thereafter, the chapter explains the role of SBSC knowledge in the framework. Next, the chapter provides a detailed explanation of the theoretical lenses deployed in the current study that led to the proposition of the research model. Finally, the chapter presents elaboration on the research gaps in the literature.

Chapter 3: Research Framework and Hypotheses Development

This chapter presents the build-up to the theoretical framework by presenting a detailed discourse on the Adaptive Decision Maker Framework and the Prospect Theory, and how they come together to build the research model. The subsequent discussions draw on the empirical studies in the literature to propose hypotheses for each of the links in the model. The next section delves into how SBSC knowledge fits into the model as a potential mediator between SBSC architecture and environmental investment decision-making. The subsequent section covers hypotheses for the moderating effect of enterprise risk indicators.

Chapter 4: Research Design and Methodology

This chapter starts with a discussion on research paradigms and the selection of the appropriate paradigm for this study. Thereafter, the chapter explains the design of this experimental study, followed by how the constructs in the model are measured. The

subsequent section deals with development process of the experimental study including the instrument pre-test and pilot study. Thereafter, the chapter discusses the selection of study participants. Finally, the chapter elaborates on the proposed method of data analysis and the justification for using such a procedure.

Chapter 5: Data Analysis and Results

This chapter discusses how the data was analyzed and the results were obtained. The first part discusses response rate and how the data was prepared for analysis. Next part describes the characteristics of the data, such as normality of distribution and the common method bias is presented. The subsequent section presents demographic information and descriptive statistics. Next, the discussion moves on to testing the hypotheses by demonstrating results on the relationships and statistical significance between the associations presented in the model. Finally, the chapter ends with a summary of the hypotheses tested.

Chapter 6: Discussions, Implications and Conclusion

This chapter discusses the results found in Chapter 5 and relates it to the original research objectives stipulated in Chapter 1. Thereafter, the chapter focuses on the significance of the findings in terms of theory and practice. The next part presents the limitations of this study followed by a section on future research directions. Finally, the chapter ends with a conclusion.

CHAPTER 2: LITERATURE RIVEW

This chapter presents the existing discourse in the literature on environmental investment decision-making and looks at how this phenomenon is impacted by the application of various architectures of SBSC, which is a more contemporary version of the original BSC developed by Kaplan and Norton (1992). With the aim of discovering what is known in order to address the research objectives mentioned in the previous chapter, this chapter presents the existing discourse in the body of knowledge. The chapter attempts to present the discourse related to the various configurations of SBSC architectures and how they relate to investment decision-making that are aimed at achieving objectives of environmentally conscious business organizations. The aforementioned are elaborately discussed along with a summary of the current debates in the empirical literature on the constructs in the research framework.

The chapter further explains Enterprise Risk Management (ERM) and how it links with SBSC and environmental investment decision-making. Thereafter, the chapter elaborates on the role of '*SBSC Knowledge*' among the decision-makers, and how knowledge of SBSC fits into the relationship between SBSC and environmental investment decision-making. The penultimate section of this chapter highlights the theoretical lenses deployed in developing the research model of this study. Finally, the chapter ends with the identification of the research gaps that form the foundation of this doctoral study.

2.1 Environmental Investment Decision-Making

In today's global sustainability challenges there is a continual need for managers to invest substantial resources to cope with stakeholders' expectations (Lamach, 2017). This issue is further supported by studies such as Deegan and Blomquist (2006) and Loh et al., (2015) that present theoretical links between stakeholder influence and

behavior of managers such as corporate reporting practices in terms of environmental and social goals by looking at stakeholder theory and legitimacy theory. The combination of the two theoretical perspectives suggests that managers are influenced by stakeholder expectations and therefore seek legitimacy by complying with such actions. Thus, managers have to be equipped with reliable information systems and sound decision-making processes (Khan et al., 2016). Contemporary best practices in organizational decision-making, takes into account wider concerns regarding social justice, economic development and environmental protection, as well as conventional financial considerations. If corporate decision-makers consider not only economic factors but also environmental and social aspects when making investment decisions, their analysis will be much closer to stakeholder expectations (Cubas-Díaz and Martínez, 2018). This assertion is further substantiated by Loh et al.'s (2015) study that presents theoretical linkage between stakeholder influences and behavior of managers. The reason behind this is that a complex environment requires the use of a framework that incorporates the multiple-objective nature of investments, and also considers the behavioral aspects of decision-making (Hafenstein and Bassen, 2016). Therefore, business strategies have to consider the concept of sustainable development and adapt accordingly, in order to satisfy the increasing environmental and social demands from external stakeholders (Welford, 2016), and make companies more sustainable on the longer-term horizon (Jansson et al., 2017).

For investors and organizations to be able to consider the above stated factors and take proper investment decisions, they need reliable and useful data and measures. A broad consensus among sustainability scholars indicates that investment decision-making requires informed decisions that greatly depend on the availability of relevant financial and non-financial information related to sustainability aspects (Matiin et al., 2018). Furthermore, studies assert that environmental accounting information has a

more significant influence on the willingness of managers to incorporate environmental considerations into investment decisions and to avoid future environmental risks (Barbier and Burgess, 2018; Sarker and Burritt, 2008).

Environmental accounting information's unique and non-traditional metrics present challenges because they are typically qualitative in nature, thus making it difficult to integrate them with traditional financial metrics that are usually quantitative measures (Alewine, 2010; Hansen and Schaltegger, 2016). Accordingly, businesses need to search for optimum management techniques to evaluate investment alternatives whereby they can achieve quality investments that simultaneously improve environmental quality and human living standards. (Alewine and Stone, 2013; Gallego-Alvarez et al., 2018).

Scholarly endeavors documented in the literature tried to provide techniques that can be understood by investors and managers, regardless of their comprehension of the full spectrum of the concept of sustainability (Cubas-Diaz and Martinez, 2018). Based on equations developed by Figge and Hahn (2011), the availability of such statistical tools that facilitate data analysis to strengthen the investment decision-making process would be an advantage to decision-makers helping them to invest in organizations with high sustainability performance and low commitment failure. While, these tools could be useful for a particular set of investors who have sufficient analytical capacity, there may still be shortcomings because they lack consideration for significant external factors such as risks.

Organizational initiatives such as Social Responsibility Investment (SRI) influence the practicality of expanding the scorecards that involve both external (e.g., market-based) and internal (e.g., resource-based) factors, and then they use these analyses to evaluate choices and to develop strategic foresight by analyzing hypothetical scenarios (Tsai et al., 2009). Although, the aforementioned study did not take into

account environmental data, nevertheless a cluster of related studies (e.g., Alewine and Stone, 2013; Gallego-Alvarez et al., 2018; Jiangtao and Pin, 2010) have incorporated the usage of environmental data for future environmental investment decisions.

In addition to selecting better environmental investment alternatives, it is crucial to use environmental information when making environmental decisions with the added dimension of risk parameters. Aligned with this thought, researchers assert that new information about changes in financial markets are inadequate when it comes to making environmental investment decisions that are isolated from considering risk levels (Barbier and Burgess, 2018; Disatnik and Steinhart, 2015). Hence, there appears to be a need for new mechanisms to enhance environmental investment decision-making processes that include risk-related factors. An environmental investment decision-making process is difficult to formulate under the current uncertainty and unpredictability surrounding the business environment (Jano, 2017).

In a seminal piece of work, Judge and Douglas (1998) surveyed U.S. environmental executives and found that integrating environmental concerns with strategic planning allows companies to exploit opportunities and to address threats that lead to better investment decision-making. The discourse in the aforementioned study is further expanded by the suggestion that long-term sustainability of business organizations is addressed by integrating social, environmental and economic dimensions into strategic planning (Schaltegger and Wagner, 2017). This type of an inclusive and integrated framework would guide managers towards environmental options with more impact (e.g., economically efficient processes) and with risk considerations in the background. In this regard, Jano (2017) asserted that such a framework would aid decision makers in selecting economically efficient and socially acceptable energy portfolios with low carbon footprints, given their risk-taking thresholds.

In light of the preceding arguments, there is a perceived need for a more rigorous and academically sound empirical study of the relative impacts of different SBSC architectures on investment alternatives that are aimed at achieving environmental objectives. Furthermore, considering sustainability information with risks being addressed is expected to have a major impact on achieving environmental investment decision-making. Effective investment decision-making is the primary responsibility of management (Mardani et al., 2017).

According to Vecchiato, (2012), managers do many things in addition to making investment decisions. Managers are usually trying to fulfil multiple objectives in their decisions, and therefore, they have to make trade-offs between expected returns and risks. It is often simplistically assumed that investment decisions (such as those faced by multinational companies that operate globally) are a simple matter of selecting the alternatives that will maximize financial returns (Kelly and Philippatos, 1982). The objective nature of an investment decision-making process has expanded beyond financial aspects to vital nonfinancial aspects, such as including the effects of climate change, environmental regulation, social acceptance of technologies, and security and privacy issues (Jano and Crawford, 2017). Therefore, a growing body of studies suggest that holistically designed performance evaluation tools, such as the SBSC adopted by business organizations in evaluating their performances, are helpful in structuring successful environmental investment decisions (Alewine and Stone, 2013; Junior et al., 2018; Pin and Jiangtao, 2010; Tsai et al., 2009).

2.2 Sustainability Balanced Scorecard

The SBSC has been widely recognized as a valuable approach in the management of sustainability (Schaltegger, 2011). SBSC is another derivative of the BSC that aims at integrating social and environmental considerations within corporate management in a

structured way (Figge et al., 2002). Scholars have developed extended scorecard architectures under the names of SBSC (Hansen and Schaltegger, 2012). There are two (2) reasons for this evolution:

(i) To allow management to address goals in all three dimensions of sustainability by integrating economic, environmental and social aspects keeping abreast of the triple bottom line (TPL) concept.

(ii) The SBSC integrates these three dimensions in a single integrated management system instead of parallel systems.

Based on these considerations, SBSC differs from the original BSC explicitly by recognizing sustainability related objectives along with traditional performance measures, and has been deemed as an appropriate tool for integrating strategically relevant environmental, social and ethical goals (Jiang, 2017; Schaltegger and Wagner, 2018).

2.2.1 BSC to SBSC: Phases of Development

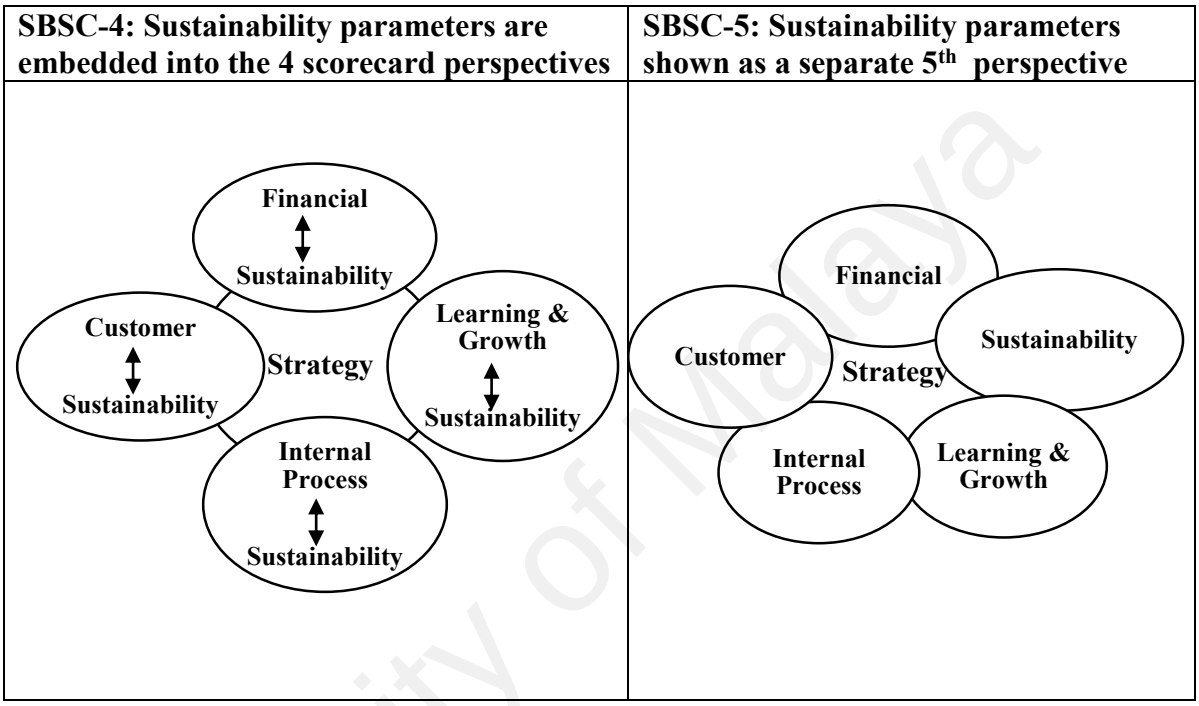
The founders of the balanced scorecard (BSC); Norton and Kaplan, introduced BSC in 1992 as a strategic performance measurement system that displays four key organizational performance measures in the form of a dashboard. These measures are related to financial targets, customer-based goals, improvements in internal processes and objectives related to human resources of an organization. Subsequently, with collaborative efforts between academic scholars and industry practitioners, the BSC evolved into the sustainability balanced scorecard (SBSC), which later evolved into two dominant schools of thoughts in terms of SBSC. The evolution from BSC to SBSC took place through multiple phases summarized below in Table 2.1:

Table 2.1: Evolutionary Phases of Development of BSC to SBSC-4 and SBSC-5

Phase	Summary of Phase	Source
1	**BSC:** The balanced scorecard was introduced as a performance measurement system where the authors conducted a longitudinal research on 12 companies, at the leading edge of performance measurement. The study designed a dashboard (i.e., the BSC) that gives top management a fast and comprehensive view of their business. The BSC includes financial measures that tell the results of actions already taken by complementing financial measures with operational measures on customer satisfaction, internal processes and people within the organization.	Kaplan and Norton (1992)
2	**SBSC-4 (Phase-1):** Four components embedded into regulatory and social processes (i.e., environment, safety and health performance, employment practices, and community investment) embedded into the four BSC perspectives. This scorecard was designed for companies to comply with national and local regulations on the environment, employee health and safety, hiring and employment practices to avoid shutdowns or litigations, etc. Furthermore, companies would be expected to enhance their reputation in the community such as customers, investors, suppliers, present and potential employees and society as whole.	Kaplan and Norton (2004a)
3	**Parallel development of SBSC-5 and emergence of the Two Schools of Thought:** Stephan Schaltegger along with two of his Ph.D students published a seminal paper that introduces the SBSC framework where the sustainability parameters are proposed as a separate 5th perspective. Their initial intent was to introduce non-market perspectives such as "child labor". In several follow up papers, Schaltegger and his team introduced other components of sustainability related to the physical environment from environmental management accounting (EMA). The introduction of the 5th perspective, thus gave birth to two separate schools of thought on SBSC; one where sustainability parameters are embedded into BSC perspectives (SBSC-4) and the 5th perspective type configuration with sustainability as a separate perspective (SBSC-5).	Figge, Hahn, Schaltegger, and Wagner (2002)

2.2.2 Perspectives of the Sustainability Balanced Scorecard

As explained in the preceding sections, the two dominant schools of thought on the configuration or architecture of SBSC are SBSC-4 and SBSC-5 as shown in Figure 2.1.



Source: Author's own work

Figure 2.1: Two Dominant Architecture of SBSC-4 and SBSC-5

Figure 2.1 shows SBSC-4 with sustainability measures embedded along with each of the four BSC perspectives, while SBSC-5 presents sustainability measures separately as a stand-alone perspective (Alewine and Stone, 2013; Hansen and Schaltegger, 2016).

Henceforth, the reference to SBSC architecture types will be SBSC-4 for SBSC with four perspectives where sustainability parameters are embedded into each perspective, and SBSC-5 with sustainability parameters as a stand-alone fifth perspective. The next sections describe each perspective mentioned in the above architecture.

2.2.2.1 Financial Perspective

The main goal of using the SBSC is to consider non-financial measures such as environmental and social metrics alongside financial measures to achieve the financial targets of business organizations (Niven, 2006). Financial measures indicate whether the implementation of the companies' strategies and their execution are contributing to the achievement of desired bottom-line results (Kaplan and Norton, 1992; Niven, 2006; Sands et al., 2016). Focusing resources, energy and capabilities on customer satisfaction, quality, knowledge and sustainability in the other perspectives without incorporating indicators showing the financial returns of an organization may produce little added value to investors (Niven, 2006). This perspective evaluates the profitability generated by the execution of the current business strategies and whether such measures contribute adequately to the creation of shareholder value.

Therefore, financial perspective in the SBSC focuses on measuring anticipated financial outcomes that have the goal of enhancing shareholder value. The most commonly used measures are derived from the objectives of revenue growth and productivity, such as return on equity, return on investment, sales growth, and cash flow (Horngren, 2015). Some scholars contend that the financial perspective can measure the effectiveness of all the other perspectives (Sands et al., 2016). Johansson and Larson (2015) strengthen the above discourse by stating that the financial perspective indicates whether the previous strategies have been used to lead to economic success and seek to define the financial performance of strategies to achieve revenue growth and cost reduction.

2.2.2.2 Customer Perspective

In the customer perspective, the aim is to identify whether customer-centric measures such as growth in market share, market penetration, repeat sales, and higher

customer satisfaction scores are being satisfactorily addressed. Thus, it consists of measures relating to the most desired customer groups in which the organization will compete, and, accordingly, the measures to track related performances (Kaplan and Norton, 1996). The customer perspective should ask how an organization appears to customers ranging from broad objectives such as mission and vision of the organization to more operational targets such as customer perceptions of the products and services of the company.

> "*The most common operational measures for the customer perspective include market share, customer satisfaction, loyalty and acquisition*" (Kalender and Vayvay, 2016: pg. 83).

Customer values and profitability can be considered as key measures that enable an organization to create a clear vision of its customers and who it should target in terms of their needs and expectations from the company. This reflects the factors that are really important to customers (Kaplan and Norton, 1992). These factors have been recognized as time, quality, performance, service and cost (Kalender and Vayvay, 2016). In other terms, this dimension makes it possible to get the internal processes, services and products into line with the necessities of current and future markets.

2.2.2.3 Internal Business Processes Perspective

Great customer-centric performance is the result of processes, decisions, and actions taken by management in order to satisfy customer needs (Kaplan and Norton, 1992). According to Kaplan and Norton (2000), the internal business process perspective in an organization determines how it will achieve the value proposition for its customers and the productivity improvements to reach its financial and customer objectives in order to satisfy its shareholders. This perspective generally identifies more effective processes for the organization to achieve high efficiency in all aspects of its' business processes. These can include both short-term and long-term objectives as well

as incorporating innovative process development in order to stimulate an environment of continuous process improvement. Companies are required to identify and structure efficiently the internal value driving processes that are vital to the goals of customers and shareholders (Kaplan and Norton, 1996).

This perspective measures the internal business processes that have the greatest impact on customer satisfaction (Kalender and Vayvay, 2016), such as measuring and fine-tuning factors that contribute to cost reductions, quality control, lean operations, product improvements, and shortened lead times. In this perspective, companies should identify and measure their core competencies and the technologies that are critical to ensuring market leadership (Kaplan and Norton, 1992). The measures that represent this perspective are inventory turnover, delivery, productivity, cycle time and research and development expenses (Niven, 2006).

2.2.2.4 Learning and Growth Perspective

This perspective identifies the human resources, information communication and the processing capabilities necessary for an organization to learn, improve and grow (Kalender and Vayvay, 2016). These capabilities help to achieve superior internal processes that, in turn, create value for customers and shareholders. By measuring the organization's ability to innovate, improve and learn, the learning and growth perspective identifies the needed infrastructure to support the other perspectives (Epstein and Wisner, 2001; Kaplan and Norton, 1996).

Niven (2006) argues that measures of the learning and growth perspective are the enablers of the other perspectives and represent the foundation of the balanced scorecard concept. According to Kaplan and Norton (1992), continual improvements and the ability of an organization to learn and understand new information and to introduce new products and services are the precondition for an organization's expansion in the global marketplace and an increase in the company's value.

Knowledge, employee skills, satisfaction, training and administration of routine processes, availability of information and adequate tools are frequently the source of growth and therefore the most common measures of this perspective (Niven, 2006; Tsai et al., 2009).

2.2.2.5 Sustainability (Society and Physical Environment) Perspective

This perspective refers to the impact of a firm`s operational activities on society as well as the physical environment, also referred to as 'people and planet' (AlHaddi, 2015; Bocker and Meelen, 2017), and on measuring the sustainability of a firm`s performance in economic, ecological and social terms. Environmental perspective shows the company's ability to produce goods and services by using processes and systems that are non-polluting, conserving of energy and natural resources (especially those that are non-renewable), economically efficient, and safe and healthy for workers, communities and consumers. Environmental measures consider benchmarks such as the emissions of greenhouse gas annually, the number of community complaints about company pollutant emissions, effluent treatment, reducing carbon footprints, water recycling, and the use of renewable energy (Horngren et al., 2015).

As stated earlier in the discussions on Figure 2.1, sustainability measures that encompass environmental and social factors measures are generally presented in one of two ways (Alewine and Stone, 2013; Hansen and Schaltegger, 2016; Kaplan and Wisner, 2009):

a) They may be embedded with the four (4) perspectives of the BSC or,

b) They may be added as a stand-alone additional fifth perspective.

2.2.3 Sustainability Balanced Scorecard Architecture

The core components of SBSC are known as SBSC architecture. Hansen and Schaltegger (2016) distinguish three types of architectures, namely *strictly hierarchical*,

semi-hierarchical and *non-hierarchical* SBSC structures. The selection between the three options of SBSC architecture depends on the company's priorities that are contingent on the value system that the organization chooses to operate in, such as profit-driven, care-driven or system-driven.

The first type of SBSC architecture proposed by Hansen and Schaltegger (2016) as the '*Strictly Hierarchical*' is one in which environmental data are either embedded, added on as fifth perspective or both (extended). This type of SBSC architecture emphasizes the original BSC perspectives with accurate linkage of strategic core issues and performance drivers, all of which ultimately contribute to the financial objectives. It also supports decision-makers who make trade-offs between alternatives and is a balance between prioritizing the firm's financial and environmental objectives.

The second type of SBSC architecture is known as "*Semi-hierarchical*", which is partly similar to the first type of SBSC architecture. However, it gives more weight to the sustainability objectives. In this type of architecture, the financial perspective is usually replaced with an eco-efficiency/environmental criterion/triple bottom line perspective. The cause and effect chain of performance perspectives in this type of SBSC architecture direction is not fixed, but rather, is in an unfixed direction. The SBSC-4 and SBSC-5 are both based on the above two architecture of SBSC-*hierarchical* and semi- *hierarchical* (Hansen and Schaltegger, 2016).

The third type, "*Non-hierarchical*" SBSC architecture is more concerned with the cause and effect chains between performance perspectives. This type is quite tricky to use due to its' complexity. Usually people and organizations with high commitment levels are able to apply it effectively. Hansen and Schaltegger (2016) advocate that it is essential for companies to know which type of SBSC architecture is more appropriate for their respective organizations to achieve sustainability goals and to help decision-makers to make a proper investment decision.

In addition to understanding the components of SBSC discussed above, it is also important to present the prevailing disagreements between SBSC scholars on the importance of SBSC architecture. In a detailed analysis of SBSC architecture and its' role in organizational performance evaluation, Hansen and Schaltegger (2016) presented an article that provides thorough insights into the structure and applications of SBSCs. As a critique of the preceding article, Hahn and Figge (2018), point out that the architecture of the SBSC was irrelevant and would not make much difference to achievement of organizational strategies. In their article, Hahn and Figge (2018) further state that the arguments made by Hansen and Schaltegger (2016) are flawed, and that the architecture of SBSC does not matter since, irrespective of their architecture, SBSCs are ill-suited to achieving substantive corporate contributions to sustainability.

Thereafter, in a rebuttal to Hahn and Figge's (2018) conclusions about the irrelevance of SBSC architectures, Hansen and Schaltegger (2018) elaborately explain the misunderstandings in the Hahn and Figge (2018) article, and state that in their 2016 article, they never alluded to the use of SBSC as the last stop for improvement of organizational performance. In fact, their article argues that SBSC architecture does matter when it comes to decision making in organizations. Therefore, the detail-to-general orientation that is adopted in most SBSC design methods presents a clear discrepancy in this area of research and can seriously undermine the environmental decision-making process based on the most relevant SBSC architecture (Chaker et al., 2017).

To emphasize the importance of determining whether environmental parameters should be integrated within traditional BSC architecture (i.e., SBSC 4) or added on as a fifth perspective (i.e., SBSC 5), empirical research appears to suggest that SBSC architectures have a significant impact on decision-making when it comes to environmental investment alternatives. However, there is a lack of consensus on

whether SBSC-4 or SBSC-5 is more effective when it comes to environmental investment decision-making (Hasnen and Schaltegger, 2018; Jassem et al., 2018).

Prior studies (e.g., Alewine and Miller, 2016; Jiangtao and Pin, 2010; Kaplan and Wisner, 2009), have explored the relationship between the organization of data in scorecards and decision outcomes when analyzing environmental data. The authors have examined the influence of SBSC-4 and SBSC-5, and have then investigated managements' decision outcomes from this manipulation.

Kaplan and Wisner (2009) conducted experimental research to investigate how judgments differ with high or low levels of management communication on the importance of non-traditional strategic objectives (e.g., environmental goals) when SBSC-4 and SBSC-5 are used. They found that decision-makers gave less differential weightage to SBSC-5 compared to SBSC-4 when management communication of environmental goals was at a low level. However, with higher levels of management communication, the differential attention of decision-makers to SBSC-5 was higher than SBSC-4. In the case of SBSC-4 under both low and high level of management communication there was no significant difference.

Similarly, Jiangtao and Pin (2010) carried out an experimental study to examine whether environmental data integrated into a BSC changes investment decisions, and the presentation of the environmental data affects investment decisions. Results indicated that participants chose a more environmentally friendly investment option when the environmental data is added as a fifth perspective (SBSC-5), rather than when the data was embedded into the traditional four perspectives (SBSC-4).

Alewine and Stone (2013) investigated and found that environmental data positively affects investment decisions. They found that within the SBSC architecture, no major difference between SBSC-4 and SBSC-5, but they acknowledge that when participants were asked to use SBSC-5, they applied greater cognitive effort and spent a

longer time to analyze the environmental data, in comparison to the participants that used SBSC-4.

In an experimental study by Alewine and Miller (2016), the researchers delved into the environmental features of 'dual-natured environmental measures. Dual-natured environmental measures are those that reflect more than one feature. For example, 'lowering power consumption' has both financial impact (a traditional feature) and environmental impact (an environmental feature). The findings of Alewine and Miller's (2016) are presented below:

(a) With regard to the environmental feature of dual-natured measures, the authors found that environmental features of dual-natured measures are more salient (i.e., differential attention given by participants to provided information) when environmental measures are embedded within traditional perspectives (i.e., SBSC-4) compared to when they are grouped together (i.e., SBSC-5).

(b) The authors also state that the differential attention (i.e., the saliency of environmental features) is not observable when there is an overall scorecard evaluation. To observe the differential attention of decision-makers, one has to evaluate each scorecard perspective (i.e., financial, customer, etc.) individually.

(c) Lastly, an entity's environmental reputation based on past performances would result in loss aversion concerns (i.e., individuals react to losses differently from gains based on one of the premises of the Prospect Theory). Therefore, if the reputation is positive, then such reputational concerns would be more salient regarding the environmental features of dual-natured measures when a scorecard with environmental information grouped together is used (i.e., SBSC-5) compared to when it is embedded (i.e., SBSC-4).

As a conclusion to the discourse stated above, there appears to be a broad consensus in the literature that SBSC architecture has a significant impact on decision-makers when it comes to selecting optimum environmentally beneficial investment options. However, there are variations in the findings between the findings of many of these studies on which of the two SBSC architectures (SBSC-4 or SBSC-5) influences the behavior of decision-makers more towards effective environmental investment outcomes. While the conflicting positions on the type of SBSC architecture that is most suitable for superior environmental investment decision-making is yet to be dealt with, scholars agree that SBSC is flexible enough to incorporate modifications of perspectives and indicators, and hence different kinds of information may be accommodated by it (Hansen and Schaltegger, 2016). Therefore, this study paves the way for further development of SBSC architecture by integrating risk indicators in order to investigate the changes in the choices made by decision-makers when making environmental investment decisions.

2.3 Role of Knowledge in the Value- Chain from Data to Decision-Making

Due to rapid changes in the business environment today, businesses need to constantly fine-tune their strategies to ensure that all of the relevant information that is available to the people who need them to make effective and more informed decisions (Fong et al., 2003). Although availability of data is the first step towards informed decision-making, data alone does not yield effective decision-making, as it has no inherent association with the possible consequences of an action beyond its existing form (Gandhi et al., 2018).

Information is defined as data that is processed into a form that has meaning to the user and is of real or perceived value in current or prospective actions or decisions (Davis and Olson, 1984). Therefore, the organizational decision-making value chain needs to ensure that data are rapidly translated to intelligent and useful information that

enables managers to leverage on the information and take effective decisions (Ghandi et al., 2018). Furthermore, the linkage between information received by managers and decisions taken by them is influenced by the *knowledge* possessed by such managers (Obeidat, et al., 2016). Information without adequate knowledge to synthesize the information into actionable plans will unlikely to translate into efficient and effective decision-making (Kettinger and Li, 2010).

Aligned with the preceding arguments, modern day tools and techniques used in managerial decision-making processes need to be well understood by managers in order to achieve their intended goals (Jassem et al., 2018). In fact, knowledge based on expertise in the domain problem significantly impacts how information is processed for better decision-making (Payne et al., 1993). Therefore, successful organizations invest a sizeable amount of their resources on the training and capacity building of their managers and employees in order to enable them to become firmly grounded in the understanding of the core issues involved in the decision chain. However, organizational processes that need improvements remain in the status state even though the areas of improvement have been identified. This is mostly because of a lack of awareness and the importance of explicit knowledge of how to utilize knowledge into actionable plans (Beljic et al., 2013).

The lack of adequate knowledge in implementing sustainability strategies can affect the outcomes of investments made in organizational environmental programs (Kaplan et al., 2011). Therefore, this study assumes that for decision-makers, it is imperative to possess sufficient '*SBSC Knowledge'* for implementing sustainability strategies. Furthermore, it is also assumed that the level of SBSC knowledge of decision-makers is likely to account for the relationship (i.e., mediate the relationship) between SBSC architecture (i.e., SBSC-4 and/or SBSC-5) and superior environmental investment decision-making. The next part of the chapter highlights the influence of

SBSC knowledge and how it is likely to mediate the relationship between SBSC architecture and environmental investment decision-making.

2.3.1 The Mediating Role of SBSC Knowledge between SBSC Architecture and Environmental Decision-Making

An essential aspect of SBSC is that it offers management with a holistic framework that translates a firm`s strategy into a coherent set of performance measures while linking these performance measures with the organizations' strategic objectives (Kaplan and Norton, 2000). SBSC translates strategic objectives into actionable measures to help organizations improve their performance. Thus, employees' understanding of SBSC measurements is critical to an organization's success. The better employees understand firm strategy, the better they will be able to use strategically linked performance measures to guide their decisions and actions (Kaplan and Norton, 2000). Hybrid types of SBSC architectures have a variety of common and unique measures. Common measures often tend to be lagging, such as financial indicators of performance, whereas unique measures are often more leading and are mostly non-financial indicators (Dilla and Steinbart, 2005). Researchers have emphasized the reason behind common measure bias (Grevinga, 2013, Kang and Fredin, 2012) in the BSC, seeing it as the decision-makers unwillingness to incorporate the unique information because this information requires greater cognitive effort to process. This limited knowledge of unique measures can have serious implications for business unit performance evaluation by managers (Jassem et al., 2018).

The literature also indicates that one method to reduce common measures bias as stated by Kang and Fredin (2012) is by providing extra information regarding SBSC measurement. They found that by evaluating the performance of two sets of managers (one set under feedback conditions and other under non-feedback conditions), the evaluators tended to use more unique measures compared to managers that were not

given any supplementary information. Providing managers with a better insight into the situation through feedback led to better decision-making. Thereby, this study asserts that sufficient knowledge of SBSC measurements has a robust effect on performance evaluation. Several studies (Banker et al., 2011; Dilla and Steinbart, 2005; Jassem et al., 2018; Kang and Fredin, 2012; Wu and Haasis, 2011) have observed how aspects of SBSC knowledge can improve organizational performance.

Knowledge is an enabler for the appropriate application of any tool, as is the case of the application of SBSC as a performance evaluation tool. In line with this thought, Wu and Haasis (2011) conclude that knowledge of SBSC perspectives is essential to making seamless utilization of SBSC, and to ensure its effectiveness. This is due to the fact that a different way of presenting information can lead to differences in decision-making to such a degree that knowledge of SBSC measures has a critical impact in facilitating successful decision-making (Banker et al., 2011). Findings in the SBSC literature further suggest that providing supplementary information when presenting information can influence decision-makers differently when they are choosing between alternatives. Jassem et al. (2018) discovered that offering additional environmental information with SBSC-4 and SBSC-5 requires knowledge of SBSC measures for better interpretation of the environmental data. In this regard, it may be said that, in order to make effective environmental investment decisions by using SBSC, decision-makers should be adequately knowledgeable about the SBSC parameters for choosing the better investment alternative (Schaltenbrand et al., 2018; William et al., 2005).

Understanding the impact of SBSC-4 and SBSC-5 on environmental investment decision-making mandates that decision-makers possess specific knowledge regarding environmental information. This is due to the fact that this knowledge helps to standardize the influence of embedded and stand-alone environmental data on

investment decision-making. Additionally, SBSC knowledge helps to process environmental accounting information for more effective outcomes in environmental investment decisions (Jassem et al., 2018).

SBSC knowledge helps to provide insights into how and when parts of scorecard data should effectively be integrated in decision-making, including environmental investment decisions. Therefore, managers who do not possess sufficient SBSC knowledge may make poor investment decisions due to lack of a proper grasp of the core concepts behind it. SBSC knowledge may increase awareness of the SBSC measures that will lead to better environmental investment decision-making (Jassem et al., 2018). Moreover, SBSC knowledge can reduce confusion between SBSC architectures. This because increasing the quantity of information into the SBSC architecture may increase the possibility of information overload (Alewine and Stone, 2013).

2.4 Enterprise Risk Management

Organizations around the world are engaged in anticipating risks and developing proactive risk management strategies, and are thereby increasing the likelihood of withstanding the negative impacts of potential risks in a volatile market place (Patterson et al., 1999; Florio and Leoni, 2017). The analysis of enterprise risk is not new in academic research and, in fact, risk management strategies have been studied for decades (Florio and Leoni, 2017). However, the nomenclature of risk management has been changing over time. For example, risk management systems that focus on aligning corporate strategies along with risks across the organization are referred to as Enterprise Risk Management (ERM), and are formally defined based by the COSO-ERM Framework.

The '*Committee of Sponsoring Organizations of the Treadway Commission*' (known as the COSO Framework) was established in 1985 by a commission of five

U.S. based private organizations to prevent and combat the fallout of corporate fraud (such as ENRON and TYCO). The guidelines of the framework evolved over time and tried to standardize definitions of common themes such as enterprise risk management across the globe. For instance, ERM is defined as:

"a process effected by an entity's board of directors, management and other personnel, applied in strategy settings and across the enterprise, designed to identify potential events that may affect the entity, and to manage risk to be within its risk appetite, and to provide reasonable assurance regarding the achievement of entity objectives" (Committee of Sponsoring Organizations of the Treadway Commission, 2004, p.16).

This definition highlights essential characteristics of ERM; that it is a holistic framework to manage risks that a business faces in order to align the whole organization with a specific risk management strategy. ERM measures guide managers to improve the quality of decision making, such as customer boycott, poor analyst ratings, and negative impact on share prices. (Faris et al., 2013).

According to the definition of ERM mentioned above, it could be stated that ERM is a plan-based business strategy that aims to identify, assess and prepare for any dangers, hazards or other potentials for disaster that may interfere with an organization's operations and objectives. Therefore, an organization's goal cannot be fully achieved due to the existence of risks that have not yet been anticipated and managed. However, incorporating risk and performance information into the same report is not always the most feasible solution to achieving the intended goals of the decision makers (Palermo, 2011). The desire to take risks and the ability to understand them are among the fundamental drivers behind the global economy. Without this consideration, no one would make investments or take the initiatives required to be successful (Faris et al., 2013).

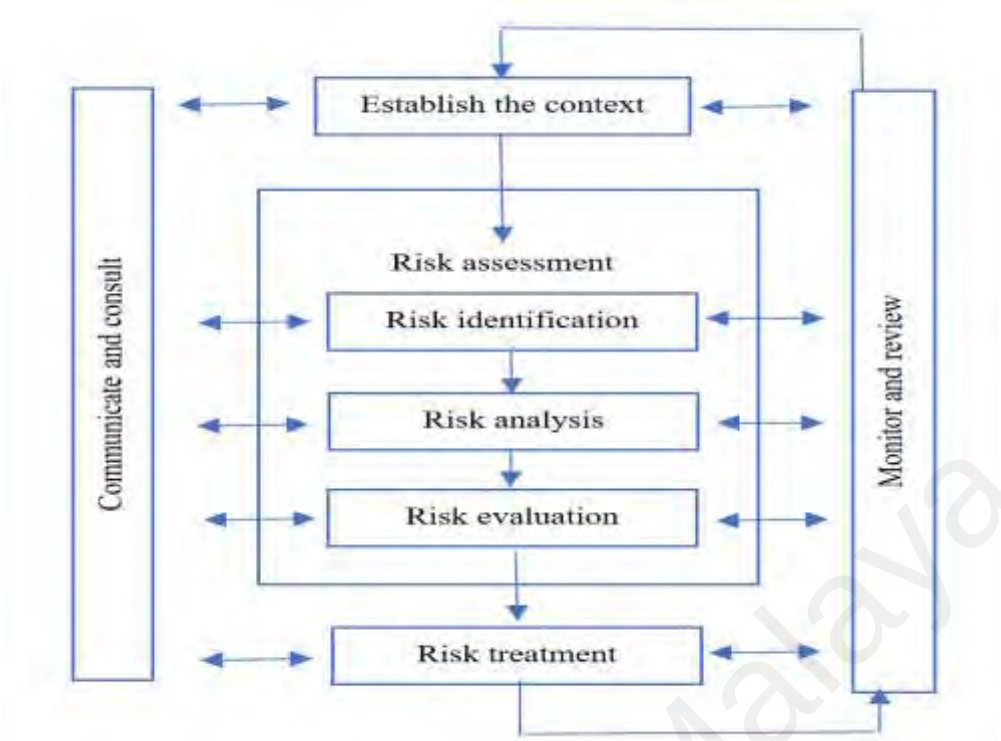
Enterprises face many different types of risks. Kaplan (2009) classified risks into three categories based on their level of their predictability, their management and most importantly, on the magnitude of the consequences of the risks to the enterprise. These risks can be identified into a hierarchy with three distinct levels based on their likelihood of occurrence and the potential impact if they do occur:

(i) *Routine Operational and Compliance Risks*, which are known and their impact is typically negligible (considered as level-3 risks),

(ii) *Strategy Risks*, which are inherent in the firm's strategy (considered as level-2 risks),

(iii) *Global Enterprise Risks*, which are the hardest to predict and have the most detrimental effect if they occur (considered as level-1 risks).

Forecasting and controlling risks through financial and non-financial indicators allow an organization to manage anticipated risks by making a decision to mitigate, avoid or absorb the consequences (Lam, 2014). This also allows the early detection of weak signals from the environment and provides a more timely and long-term oriented view of the business, as well as helping the decision makers to improve their decision-making (Arena et al., 2011; Kaplan and Norton, 2001; Oliveira et al., 2019). The 'ISO 31000' guidelines of the International Organization for Standardization provides principles and generic guidelines on risk management. These guidelines provide a systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, identifying, analyzing, evaluating, treating, monitoring and reviewing the risks (Figure 2.2).



Source: (Purdy, 2010, p.883).

Figure 2.2 : Risk Management Architecture.

In order to identify the risk events that would threaten strategic objectives, organizations are encouraged to establish risk criteria and then evaluate the risks against those criteria to determine which risks need treatment (ISO, 2009). The 5 × 5 risk map shown in Figure 2.3 below, provides an illustration of how organizations can map probability ranges to common qualitative characterizations of risk event likelihood, and then provides a ranking scheme for potential impacts. The development of an effective risk map has several critical elements: a common understanding of the risk appetite of the company, the level of impact that would be material to the company, a common language for assigning probabilities and the potential impacts. The impact of risk can be also be ranked based on the material in financial terms, or in relation to the achievement of strategic objectives. In this example, risks are prioritized using a simple multiplication formula (impact if the risk occurs × likelihood of occurrence) (Source:

ISO 31000, 2009). The risk score from each identified risk is populated on the risk map (Figure 2.3). The risks in the top right quartile of the risk map are of the highest priority based on their scores.

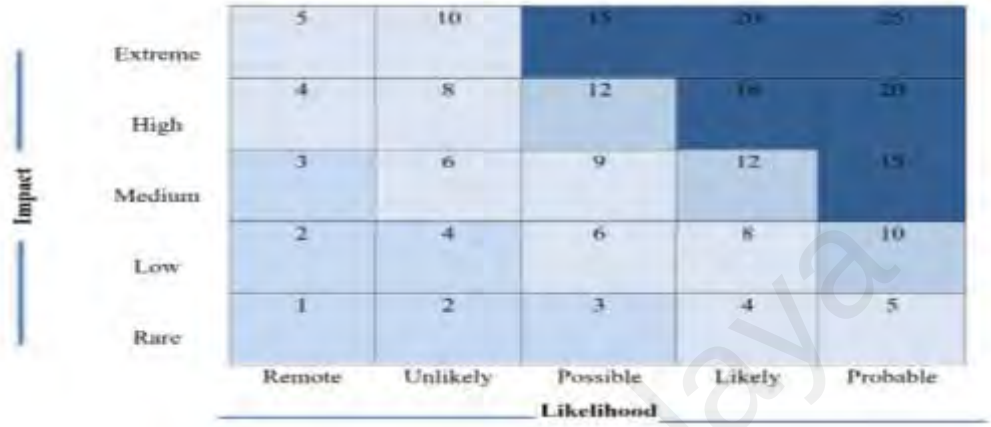


Figure 2.3 : Risk Map (Adopted from ISO 31000, 2009)

2.4.1 Enterprise Risk Management Elements

ERM literature indicates that risk may be managed by considering elements of ERM that are both financial and non-financial in nature.

Financial Risks

Financial risk deals with the array of risks that the company encounters from sources such as credit, market, operational, liquidity risk and management of its economic capital. Effective financial management must address risk as well as returns since financial performance provides a link to the risk management cost/benefit analysis of the responses. Objectives relating to growth, profitability, and cash flow emphasize improving returns from investment, but business should balance expected returns with management and control of the risk (Kaplan, 2009).

Customer Risks

Customer risk relates to managing risks related to strategy, market and reputation that may affect or be affected by company's customers. Based on this element, the impact of possible threats to the company from interaction with customers

can be reduced. For example, brand indicators can be used to assess uncertain events threatening corporate reputation in the customer perspective, adverse publicity on customer experience or change in customer preferences, whereas the financial performance uses ERM cost/benefit analysis to link with this perspective (Beasley et. al., 2006).

Operational Risks

While risks can arise from external forces, they can also arise from internal business processes. Therefore, there is a need to identify, assess, respond to and monitor risks throughout all business processes. The goals of this perspective are related to risk tolerance and risk performance metrics and to business processes such as employees misreading specifications, or critical equipment breakdowns (Beasley et. al., 2006; Kaplan, 2009).

Learning and Growth (Human Resource) Risks

Learning and growth risks bring consistency and clearly define the approach to risk management for all company employees. It is designed to increase recognition of risks to the employees. For example, when testing employee's skills, information, and organization capital for implementing risk control, the measures could include unstable IT hardware or software, or the loss of key personnel (Cheng et al., 2018).

Environmental Risks

This element of ERM encompasses forecasting, planning, measuring and monitoring sustainability-related risk that the organization faces and the materiality of those risks in maintaining firm performance in achieving its sustainability objectives. Using key environmental and social risk indicators, organizations can control their sustainability risk management at each level of the organization (Faris et al., 2013).

Based on suggestions from scholars (e.g., Olson and Wu, 2017), when presenting risk indicators as an additional perspective in to the SBSC, it would be more

prudent for the research objectives of this study, to integrate risk indicators into the SBSC architecture in order to investigate how investment decision making changes according to this integration.

2.4.2 Convergence of SBSC and ERM

Considering risk in any company, whether big or small, is crucial, as is evidenced by the literature. Organizational success is dependent on whether or not management has considered risk indicators in their strategy formulation and implementations processes (Kaplan and Mikes, 2012; Oliveira, 2014). The aforementioned authors advocated that adding risk to the BSC will enable companies to clearly focus on risk being directly related to achieving their business objective. In this regard, the literature suggests that strategy risk indicators can be straightforward and easily quantifiable. Beasley et al., (2006) argue that BSC provides a powerful framework for identifying strategic and key operational risks, which can also be monitored with a separate risk scorecard.

Incorporating enterprise risks into organizational performance measurement frameworks such as SBSC has become vital in today's challenging and dynamic global business environment (Olson and Wu, 2017). BSC architectures that integrate both sustainability as well as enterprise risks enable a more robust and holistic framework, compared to traditional enterprise risk management techniques (Soomro and Lai, 2017). In order to provide decision-makers with the ability to identify, assess, manage and monitor organizational opportunities and risks, SBSC architectures that include enterprise risks generate a more effective framework for managers (Maia and Chaves, 2016).

Studies suggest that the integration of risk indicators and performance information into a single management tool, such as the SBSC, could be the best solution to increasing the risk awareness of senior managers (e.g., Beasley et al., 2006). Extant

literature has criticized BSC frameworks due to the absence of risk parameters that may lead to misconceived strategies or strategies devoid of key risk factors (Oliveira, 2014; Olson and Wu, 2017). The implementation of SBSC without appropriate risk management strategies exposes the enterprise to unforeseen hazards. For example, stretched financial and customer targets stipulated in the lead/lag measures of the SBSC might create risk-taking behavior among managers, leading to long-term value loss for the organization (Wisutteewong and Rompho, 2015). Additionally, any risk management framework that does not clearly focus on corporate strategic objectives could be unproductive, because the key risks affecting an entity do not receive proper attention from the risk owners and consequently, adequate contingency measures are not taken. Therefore, SBSC and appropriate risk considerations must be integrated to ensure that shareholder value is protected. The integrated approach takes the relationship between sustainability strategy and risk management into consideration (Wisutteewong and Rompho, 2015).

Beasley et al., (2006) highlighted the similarities between ERM and BSC, which is important in establishing a link between them. For instance, BSC rely on key performance indicators, while risk management can rely on key risk indicators. Similarly, SBSC focuses on business processes, which can be compared to risk mapping where key risk indicators are mapped to processes (Scandizzo, 2005). Risk measures can also be classified as being either leading (common measures) or lagging (unique measures) (Beasley et al., 2006). This is similar to the performance measure in the SBSC classifications.

Several studies (e.g., Cheng et al., 2018; Kotze, et al., 2015; Olson and Wu, 2017; Wisutteewong and Rompho, 2015; Wu and Olson, 2009), have examined the usage of the BSC for managing risks, by balancing short- and long-term goals and considering the risk aspects. Wu and Olson (2009) demonstrated that BSC analysis

provides a means to measure multiple strategic perspectives. Business risk scorecards offer an understanding of what might go wrong and opportunities to prepare reaction plans in order to satisfy a variety of stakeholders. This is done, by selecting four diverse areas of strategic focus and identifying concrete measures that managers can use to measure organizational performance on multiple scales. Researchers suggest that scorecards may be applied to evaluate the risk management posture of a particular organization, such as a large bank that uses various ERM performance measures to evaluate loans to small businesses through BSC metrics (Zeghal and El Aoun, 2016). Results indicate that the SBSC is flexible and hence, any type of measurement metrics to plan the production of any organization may be included.

To investigate whether stand-alone or integrated strategic risk information in the scorecard architecture offers better guidelines to managers for effective understanding of the performance and viability of their strategies, Cheng et al. (2018) experimentally determined that integrating strategic risk indicators in a BSC along with the risk profile of a strategy affects managerial strategy evaluation and recommendation decisions. This is due to the fact that participants who were managers are more concerned with strategic risks associated with performance drivers rather than strategic risk association with performance outcomes.

The relationship between BSC and ERM in publicly listed companies in Thailand was investigated by Wisutteewong and Rompho (2015). These researchers found that a significant positive relationship exists between utilization of effective BSC and ERM. Therefore, they concluded that the combined approach of these management tools should be taken into consideration in order to achieve maximum benefit.

Kotze et al., (2015) explored how organizations were adding risk factors to their scorecards to determine what methods they apply to add risk to the BSC. They highlighted that most studies embed ERM measures into the BSC perspectives as

proposed by Beasley et al. (2006). As far as this researcher has been able to determine, so far only two studies have suggested separating scorecard risks. It is also noted from the conclusions of prior studies that embedding risk indicators into the BSC measurements might lead to a problem of over-complexity, compared to treating risk as a stand-alone criterion in the BSC framework.

Most of the scholarly work on linkages between ERM and BSC has focused on the original BSC, rather than the SBSC, possibly due to the fact that SBSC is a more recent concept. Based on suggestions from the authors of several studies, there are two ways to incorporate the risk indicators into SBSC: either embed ERM into the BSC, or add it as an additional stand-alone perspective to the scorecard architecture (Beasley et al., 2006; Kotze et al., 2015; Oslon and Wu, 2017; Wisutteewong and Rompho, 2015).

The majority of the studies in the extant literature have examined the impact of integrating ERM into the BSC and they assert that it would be worthwhile to include risk measures into the BSC. This would help managers to be aware of the multiple sources and types of risks and be able to manage and monitor risks related to the objectives in each BSC perspective (Downey, 2007). Although focus on considering risk indicators along with BSC has been in vogue for quite some time now, the focus on environmental and social issues along with the balanced scorecard has gained significant strategic relevance for business organizations.

The above discourse justifies the need to undertake studies that consider SBSC along with risk indicators. Aligned with the preceding argument, according to Faris et al., (2013) investors increasingly believe that an organization's social and environmental policies correlate strongly with its risk management strategies and ultimately its' financial performance in giving risk managers the information they need to make better, more informed decisions on an array of risks, including environmental, social, economic, operational and strategic issues.

Compared to the traditional stand-alone ERM framework, the SBSC combined with risk indicators provides a more robust and inclusive mechanism for managers to evaluate their project-selection decisions. SBSC allows decision-makers to consider potential risks and at the same time visualize the trade-offs that risk mitigation measures would lead to considering the other vital decision parameters, such as financial issues, when selecting investment options.

Therefore, integrating risk indicators within the SBSC architecture allows managers to ensure a comprehensive view of necessary variables that will impact investment decisions that are aimed at achieving environmental objectives (Faris et al., 2013; Wong, 2014).

By integrating risk strategy with SBSC (which are inherently dissimilar functions), companies will be able to discern tough trade-offs decisions more effectively. Managing risks through SBSC perspectives will generate valuable information so that managers can create value at the acceptable level of risk over time (Rasid et al., 2017). To date, only a few studies have integrated risk with SBSC and investigated its impact on decision-making (e.g., Soror, 2014).

The study by Soror (2014) examined the impact of total quality costs on strategic performance evaluation. The author considered the SBSC perspective for performance evaluation, where risk measurement was considered as an additional perspective in the SBSC architecture. The study revealed that there appears to be a positive correlation between total quality costs and strategic performance evaluation using the SBSC. Moreover, the researcher concludes that by adding risk measurements as an additional perspective to the SBSC architecture, managers have more comprehensive information, leading to improved investment decisions.

Based on the discourse in the literature, it appears that adding sustainability and risk measures to the balanced scorecard configuration has been suggested in three (3) different ways as follows:

(i) Both risk and sustainability data are embedded in the four perspectives of the SBSC architecture;

(ii) Sustainability data is embedded into the architecture (i.e., SBSC-4) while risk indicators are treated as stand-alone 5th perspective.

(iii) Sustainability stands alone as a 5th perspective (i.e., SBSC-5) while risks stands alone as a 6th perspective.

2.5 Theories Used in Sustainability Balanced Scorecard Research

In order to understand the theoretical lenses deployed to support the model proposed in this study, it is necessary to gain insights into the predominant theories that have been used by researchers in the field of SBSC research. Arora (2020) presents an insightful look at the various theories applied by academic scholars to unravel the intricacies of scholarly investigation of applying BSC for measuring sustainability performance of business organizations. Although a vast majority of the studies have been a theoretical, the following theories have been applied in context of BSC and sustainability goals: stakeholder theory, legitimacy theory, the institutional theory, signaling theory, the equity theory and the prospect theory.

The application of the Stakeholder theory (Freeman, 2010) is based on the premise that decisions regarding pursuit of sustainability goals by senior management are driven by the need to meet stakeholder expectations. Among the earlier studies that apply the stakeholder theory in the context of the BSC are by Figge et al. (2001) where they examine how they are used as a value-based management tool to pursue sustainability goals. In a later study Horisch et al. (2014), the authors consider conceptual links

between stakeholder theory and sustainability management, while Kang et al. (2015) apply stakeholder perspectives to study link between CSR activities and SBSC.

Huang et al. (2011) consider the Legitimacy theory, which is based on the assumption that organizations seek to ensure that they operate within bounds and norms of their respective societies. The study investigates the influence of SBSC dashboards on assessing organizational legitimacy in terms of their sustainability goals.

The Institutional theory posits that management practices are the product of social rather than economic pressures (Meyer and Rowan, 1977). Hoque and Adams (2011) deploy this theory to study how BSC are used to study performance of Australian government departments.

The signaling theory was applied by Hristov et al. (2019) to propose a new strategic framework to provide a way to manage critical issues connected to the SBSC. While Na et al. (2020) use the theory to examine how CEO messaging in sustainability reports, are applied through use of SBSC.

The Equity theory was deployed by Zhou et al. (2020) to study how application of SBSC drives green innovations and sustainable supply chains through fairness perceptions, embeddedness and knowledge sharing.

The use of the Prospect theory on the other hand is more prevalent in the literature especially in the study of the original BSC. For instance, Liedtka et al. (2008) utilize the Prospect theory to suggest that ambiguity within a BSC category causing evaluators discomfort may depend on whether the relevant BSC category reports positive or negative information. Hence, “ambiguity-intolerant” evaluators may react differently to ambiguity depending upon the situation. The authors hypothesized that increased variability within a BSC category in which mean performance is relatively weak will

not impact overall performance judgments made by ambiguity-intolerant evaluators. This hypothesis is developed based on the premise of Prospect Theory, that when an outcome appears negative, ambiguity should not present a threat to any evaluators because there are no perceived gains that could to be illusory.

Furthermore, Schau et al. (2014) utilize the Prospect theory to hypothesize that a decision-maker's preference for deliberation will decrease the probability of demonstrating fixated judgments in a BSC setting. The study presents a deeper understanding of the cognitive processes (using a process tracing method) and the personality factors that determine functional fixation in a management accounting context.

In addition to the preceding discourse, a close examination of the extant literature reveals that none of the studies in the extant literature so far have used the Adaptive Decision Maker Framework in the context of research on SBSC. Furthermore, an in-depth review article by Hansen and Schalteger (2016) classifies theoretical perspectives used in SBSC research. The next sub-section summarizes the classifications made by the aforesaid study.

2.5.1 Classification of Theories Used in SBSC Research

In a systematic literature review by Hansen and Schaltegger (2016), the authors classified the theories used in SBSC research into three primary clusters. The clusters are: (i) Instrumental Theories, (ii) Socio-political Theories, and (iii) Normative Theories.

Instrumental Theories:

Instrumental theories are based on the premise that a corporation is an instrument of wealth creation and only considers economic aspects of interaction between business

and society (Friedman, 2007; Kramer and Porter, 2011). Researchers that have used instrumental theories have demonstrated the practical performance-based contribution of SBSC as a tool in the strategic management of organizations. The vast array of theories used in this stream of publications, which are mostly used in strategic management research, focus on direct performance outcomes such as profitability, market share, competitive advantage, productivity, brand value and direct environmental impacts. Therefore, the usefulness of the SBSC as a performance evaluation tool would be viewed through the lens of maximizing organizational performance metrics that are connected to maximizing shareholder wealth.

Socio-political Theories:

Socio-political Theories are based on how the organization is perceived by societal stakeholders. Such theories emphasize the social power of organizations and their responsibilities in the social and political domain. For instance, business corporations accept certain social duties and rights as part of their corporate citizenship (Freeman,2004). This cluster of theories is based on societal and political perspectives. In other words, the emphasis is on how external stakeholders, society, media, customers, regulators and policy makers view the organization from the outside. In this approach, the management is less focused on the internal performance of the organization, as compared to how their overall performance is being viewed by outsiders. The Stakeholder Theory (Freeman, 2004) has been the primary driver of this cluster of studies undertaken by SBSC researchers.

Normative Theories:

Normative Theories are based on the premise that ethical relationships between business and society are embedded in ethical values. In other words, organizations are obligated to determine whether their prioritized responsibilities are being met. Hence,

firms are expected to assume their ethical obligations above all considerations (Cassel, 2001, Shrivastava, 1995). The management's performance objectives should not just be driven by instrumental needs, such as profits or demands of societal stakeholders, but the intent should be based on the utilitarian ethics of seeking benefits for maximum stakeholder groups. Similarities may be drawn to Immanuel Kant's ethical theory of doing the right thing. In the case of SBSC, it would mean that the environmental and social benefits being measured should include the wellbeing of all stakeholders, whether they have power to influence the organization or not.

2.5.2 The Adaptive Decision-maker Framework (ADMF)

The concept of adaptive decision-making is the mental process of effectively reacting to inputs based on the situation, experiences of the decision-maker and the value of the outcomes that will emerge from such decisions. From the typology of theories discussed in the previous section, the 'Adaptive Decision-Maker Framework' (ADMF) (Payne et al., 1993), falls under the category of instrumental theories, as it is related to the study of how information is processed and decisions are framed by decision makers with the intent of achieving certain desired outcomes related to organizational goals. The theory is best applied when multiple attributes and multiple alternatives are presented to decision-makers (Beresford and Sloper, 2008).

In their seminal work, Payne et al., (1993) outline several strategies that decision makers employ to evaluate situations where several outcomes are to be matched with multiple attributes to reach a decision that maximizes the perceived value of the outcome. The most prominent strategies outlined under the ADMF are: (a) WADD (Weighted Additive Strategy), (b) LEX (Lexicographic Strategy), (c) SAT (Satisfying Strategy) and (d) EBA (Elimination by Aspects).

a) In the WADD strategy, the decision-maker uses a matrix approach and assigns weight to each attribute. He then multiplies the weight to the score of each attribute to derive a weighted score. The outcome with the highest weighted score is selected. This strategy may require complex mathematical calculations.
b) Under the LEX strategy, the decision-maker assigns maximum weight to a single attribute and selects the outcome based on the highest score of the particular attribute. This strategy is fairly easy to use.
c) In the SAT strategy, the decision-maker assigns cut-off values to each attribute and then compares the scores of the outcomes to the cut-off point. If none of the outcomes satisfy all of the cut-off points, then the benchmark value is relaxed.
d) The EBA is somewhat similar to SAT. However, the difference is in the assigning of preferential scores to the cut-off points of each attribute.

The proponents of the ADMF further explain how decision-makers select from the different strategic alternatives mentioned above. The selection is based on four criteria: perceived decision accuracy, ease of justification, perceived amount of cognitive effort and probable negative emotions from the outcome (Payne et al., 1993). The theory further stipulates that preferential decision problems are framed using three essential components:

(i) The alternatives available to the decision-maker in terms of the number of attributes and the number of possible outcomes,
(ii) Past experiences of the decision-maker based on events that relate actions to probable outcomes,
(iii) The perceived value of those outcomes to the decision-maker.

Beresford and Sloper (2008) extended the above discussions on ADMF made by Payne et al. (1993) and suggest that decision-makers, by default, select alternatives that are less complex and require less cognitive effort. Therefore, if an individual perceives a certain decision-making tool to be more complex, by default they will be inclined to alternatives that require less cognitive effort to understand and use. Therefore, in the case of selecting between SBSC architectures to evaluate environmental investment decisions, the default script is expected to be the selected configuration that appears to be less cumbersome to use. However, effects of such complexity may be mitigated by the knowledge and experience of the decision-maker.

In light of the preceding discussions, the ADMF serves as a feasible theoretical lens for research in managerial decision psychology, especially in cases where decision-makers are presented with more than one alternative and are required to select the most preferred outcome. Therefore, this theory provides a suitable platform to predict linkages between the different SBSC architecture and investment outcomes that maximize expected returns to the organizations regarding environmental objectives.

2.5.3 Prospect Theory (Decision-Making Involving Risk)

The second theory leveraged in this study is the Prospect Theory (Kahneman and Tversky, 1979), which explains how individuals prioritize loss-avoidance over potential gains. Therefore, when potential risks associated with an investment decision are added to the decision scenario, the decision-makers are likely to assign greater weight to outcomes that pose the minimum level of risks to the organization. For instance, if the decision involves investments that are likely to enhance financial gains, but at the same time expose the firm to significant regulatory scrutiny or negative media coverage due to environmental hazards, the focus of the decision-maker will be to avoid the potential risk instead of concentrating on the potential gains.

Prospect Theory is a theory in cognitive psychology that describes the way people choose between probabilistic alternatives that involve risk, where the probabilities of the outcomes are known. The theory stipulates that people make decisions based on the potential value of losses and gains rather than on the final outcome, and that people evaluate these losses and gains using certain heuristics. The model is descriptive and it tries to model real-life choices, rather than optimal decisions, as normative models do (Kahneman and Tversky, 1979). The theory primarily deals with decision-making under risk.

Prospect Theory assumes that losses and gains are valued differently by people and that individuals give more focus to perceived losses than to perceived gains. The concept is also known as 'loss-aversion theory', and the general concept is that when two choices are put before individuals, both equal, the decision-maker will frame decisions based on loss avoidance rather than ignoring risks and discount the potential for gains. Support of this theory is necessary for this study due to the fact that the research framework presents risks as contingency variables, and therefore, the decision-makers are likely to draw from the underpinnings of this theory when they evaluate multiple investment outcomes based on multiple attributes. The manner in which the prospect theory has been deployed to propose links between constructs is elaborated upon in Section 3.1.3 of the next chapter.

2.6 Gaps in the Literature

The extant literature on SBSC shows that there is more than one type of SBSC architecture (e.g., integrated or add-on) (Hansen and Schaltegger, 2016), which has been described and referred to earlier in this chapter as SBSC-4 and SBSC-5. There appear to be several gaps in the literature that have been overlooked by empirical studies in the past. While SBSC researchers are yet to reach a consensus on whether SBSC-4 or

SBSC-5 presents a superior option as a strategic performance evaluation framework, there is still ambiguity on whether both these architectures are significantly different from each other when decision-makers use them to achieve environmental investment decisions (Jassem et al., 2018). Additionally, the literature seems to have overlooked the necessity of also incorporating risk criteria while attempting to arrive at an agreed-upon conclusion on whether SBSC-4 and SBSC-5 have significantly different patterns of impact on environmental investment decision-making. Therefore, the ***first research gap*** that this study proposes to address is to experimentally examine whether significant differences exist between SBSC-4 and SBSC-5 when considering their impact on environmental investment decisions, under both circumstances with and without risk indicators presented along with SBSC.

SBSC scholars argue that a great amount of information flows into organizations, especially in the age of 'big data', due to the cascading effect of information flow enabled by the Internet. Thus, organizations are having to process and make sense of a massive amount of information overload (Benselin and Ragsdell, 2016). This has made the use of tools such as SBSC quite challenging for decision-makers to use, especially in those companies that have complex business strategies (Banker et al., 2011). Moreover, it has been acknowledged by several empirical studies on SBSC, that limitation in measures exists, due to the lack of adequate knowledge about SBSC among managers (Jassem et al., 2018). The aforementioned study indicates that participants had cognitive biases regarding which SBSC measures to use and how to assign weight to them.

In line with the arguments in the preceding paragraph, adequate knowledge of SBSC among managerial decision-makers is essential for better alignment of managerial actions with strategies. Nevertheless, relatively few empirical studies have been published so far, that attempt to explain how SBSC knowledge links SBSC with

investment decisions. In fact, to the best of the knowledge of this researcher, there appears to be no study that tries to determine if SBSC knowledge accounts for the above link. Therefore, the ***second research gap*** is to investigate the role of '*SBSC Knowledge'* as a possible mediator between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making.

The extant literature provides some insight into the strengths, reasons and benefits of integrating risk within BSC (e.g., Cheng et al., 2018), and these studies suggest that risk measures should be added to the BSC in different ways; either through aggregate or disaggregate risks measures. As mentioned earlier, there are conflicting findings in the literature as to whether significant differences exist in SBSC architecture when it comes to its impact on managerial decisions. The conflicting findings may be due to the absence of pertinent moderators. Hence, there are possibilities that the strength of relationships between SBSC architecture (SBSC-4 or SBSC-5) and managerial decisions, such as environmental investment decisions, are contingent upon other variables, such as risk indicators. There appears to be a dearth of empirical studies in the existing literature that have considered 'risk indicators' as a moderating variable between SBSC architecture and environmental investment decision-making. Hence, the ***third research gap*** that this study proposes to address is that risk information is possibly a moderator in the relationship between SBSC architecture (i.e., SBSC-4 and SBSC-5) and environmental investment decision-making.

The relationships stated in the preceding paragraphs have been proposed in isolation. However, there is a possibility that an integrated framework connecting all the constructs (i.e., SBSC Architecture, SBSC Knowledge, Risk Indicators and Environmental Investment Decision-Making) emerges. A careful examination of the literature reveals that, as far as this study has been able to determine, there is no study so far that proposes an integrated model. Hence, the ***fourth research gap*** that this study

proposes to address is that the relationship between SBSC architecture and environmental investment decision-making is mediated by SBSC knowledge, while the direct and indirect relationships are also moderated by risk information. Therefore, the fourth research gap proposed is to test a moderated-mediation model integrating all the constructs together.

The ***final research gap*** is a methodological gap, where majority of the experimental studies conducted in the extant literature on SBSC and investment outcomes used students as surrogates for managers as participants in the experiments. The current study proposes to conduct the experiment on real-world managers who utilize sustainability parameters and risk management in their strategic planning and operations. The results from such a study are expected to be more robust and dependable.

Table 2.1 (in next page) presents a summary of all the four gaps identified in the body of knowledge on SBSC architecture and environmental investment decision-making.

Table 2.1: Summary of the Research Gaps

No.	Research Gap
1	There is an absence of a finer-grained understanding on whether the two SBSC architectures are significantly different from each other and have significantly different impacts on environmental investment decision-making is yet to be determined. Furthermore, whether the difference between SBSC-4 and SBSC-5 will be significant when risk indicators are integrated with the SBSC architecture has not been addressed.
2	Whether SBSC Knowledge mediates the link between SBSC architecture and environmental investment decision-making appears to have been overlooked

3	Past empirical studies are yet to determine if presenting risk information has a contingency effect on the relationship between SBSC architectures and environmental investment decision-making.
4	The extant literature appears to have overlooked the possibility that an integrated model exists that links SBSC architecture and environmental investment decision-making, through SBSC knowledge as a mediator, and risk information as a moderator. Hence, a moderated-mediation model may be having significance that has not yet been investigated so far.
5	Literature indicates that majority of experimental studies using SBSC-4 and SBSC-4 utilized students as surrogates for managers as participants. Hence, using real-world managers instead of surrogates may be a methodological contribution to the body of knowledge.

2.7 Chapter Summary

This chapter has presented the existing discourse in the literature on the linkages between SBSC architecture and their impact on environmental investment decision-making. Furthermore, the necessity of adequate knowledge of SBSC among decision makers has been discussed and proposed as a mediator between the SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making. The chapter also introduces an elaborate discussion on ERM and its important role while considering any research model that examines organizational performance tools designed for strategic decisions such as the SBSC.

The Adaptive Decision-Making Framework has been explained as the primary theoretical lens as the basis for proposing a research model that establishes the link between SBSC architecture and environmental investment decisions. Additionally, the 'loss-aversion component' of the Prospect Theory is also briefly explained, as it forms the supporting theory for incorporating risk management into the research model.

Finally, five (5) distinct research gaps have been identified that will be the foundation of this doctoral research endeavor. The next chapter will introduce the

theoretical framework and explain how the above-stated theories are deployed to propose the research framework of this study. Thereafter, the arguments for the hypotheses developed for this study are explained along with empirical support.

CHAPTER 3: RESEARCH FRAMEWORK AND HYPOTHESIS DEVELOPMENT

This chapter explains how the theory and past empirical studies come together to form the research framework of this study and lead to the development of a set of the hypotheses that are to be subsequently tested in this experimental study. The chapter starts by discussing the application of the main theory that is deployed to propose the research model; Adaptive Decision Maker Framework (ADMF) (Payne et al., 1993), and the Prospect Theory (Kahneman and Tversky, 1979), which is leveraged as a supporting theory that enables the incorporation of risk into the theoretical framework.

After discussions on the theories are deployed, discussions follow on the SBSC architecture and its potential impact on environmental investment decision-making. The next set of discussions is arguments made to suggest that '*SBSC knowledge*' acts as a mediator between SBSC architecture and environmental investment decision-making. The subsequent section discusses the importance of considering risk indicators are a potential moderator in the relationship between SBSC architecture and environmental investment decision-making.

Finally, the chapter explores the possibility that an integrated moderated-mediation model emerges, involving the SBSC architecture as an independent variable (IV), environmental investment decision-making as the dependent variable (DV), SBSC knowledge as the mediator and risk indicators as the moderator. Therefore, it is posited that the relationships on the direct path (IV to DV) and the indirect path (IV to DV through the Mediator) are both moderated by risk. Thus, a moderated-mediation model is proposed which resembles Model-8 from Hayes (2013).

3.1 Theories of Judgment, Decision-Making and Choice

This study draws on the theory of the Adaptive Decision Maker Framework (ADMF) (Payne et al., 1993) and previous studies in the literature (e.g., Cheng and Humphreys, 2012; Dilla and Steinbart, 2005; Humphreys and Trotman, 2011; Kaplan and Wisner, 2009) to investigate if SBSC architecture (SBSC-4 and SBS-5) significantly differ from each other when it comes to managerial decisions for effective environmental investment decisions. Additionally, the study leverages the theoretical lens provided by the 'Prospect Theory' (Kahneman and Tversky, 1979) along with relevant empirical studies (e.g., Beasley et. al., 2006; Cheng et al., 2018; Kaplan, 2009; Kotze et al., 2015) to argue that managerial decision makers are driven by loss-aversion inclinations when organizational risks are associated with environmental investment decision making. The two theories allow for convergence of the arguments to propose a research model that enables this study to examine whether SBSC knowledge plays a mediating role between SBSC architecture and environmental investment decision-making while being moderated by risk indicators.

3.1.1. The Information Processing Approach to Decision Research: The Adaptive Decision Maker Framework

The Information Processing Approach to decision research can be traced back to Simon (1959) and the notion of bounded rationality. That is, humans are 'bounded' by constraints in their environment (for example, information costs), and in their minds (for example, limited memory) and these constraints shape their behavior. For the purpose of this study, The Adaptive Decision Maker Framework (ADMF) is considered as the appropriate theoretical lens for constructing the relationships between the variables in this study. The theory falls under the instrumental theory cluster described earlier in Chapter 2, taken from Hansen and Schaltegger's (2016) review article. The ADMF is an

example of the information processing approach to decision-making. The approach is based on the following assumptions (Payne et al., 1993):

(i) People are highly selective about what information they attend to and how it is used. Hence, processing information is dependent upon the information architecture (i.e., how information is presented to them);

(ii) Acquiring and processing information has cognitive and/or emotional cost, so information presentation influences decision processes, attention, and choice through its influence on decision-makers' attempts to minimize cognitive effort while achieving a desired level of decision accuracy;

(iii) People use simplification mechanisms (heuristics) to select and process information and a lot of different heuristics have been identified. Heuristics are chosen on the basis of the nature of the task problem;

(iv) Beliefs and preferences are often constructed or generated through the process of decision-making, as opposed to individuals having known, well-defined preferences, which they bring to a decision-making situation.

The above assumptions of ADMF enable the proposition of the research framework of the current study. The framework emerges from the following discourse.

First, the literature on cognitive aspects concludes that using different SBSC architecture (i.e., SBSC-4 or SBSC-5) has led to contrasting interpretations made by decision-makers. This is simply due to the different ways the information has been presented, leading to a variation in the cognitive effects on decision-makers (Payne et al., 1993). For instance, having a stand-alone perspective (SBSC-5) reflects the importance of environmental issues to an entity's strategic objectives, and forces decision-makers to look at the metrics separately, compared to a situation when they are embedded with other metrics in different perspectives (i.e., SBSC-4).

The debate over use of SBSC-4 or SBSC-5 is complicated by recent evidence that suggests little benefit from isolating similar information in a separate scorecard (e.g., Alewine and Stone, 2013), which is in contrast to other studies (e.g., Alewine and Miller, 2016; Kaplan and Wisner, 2009). Jiangtao and Pin (2010) found that decision-makers gave more weight to SBSC-5 relative to SBSC-4. However, Alewine and Stone (2013) found that there was not a significant difference between SBSC-4 and SBSC-5 when decision-makers utilized them to evaluate investment alternatives. Furthermore, Alewine and Miller (2016) found that when decision-makers are presented with dual-natured measures (i.e., measures that feature both traditional perspectives such as financial and also non-traditional such as environmental), the environmental features receive less differential attention of decision-makers in case of SBSC-5 as compared to SBSC-4. However, this situation reverses when there is positive environmental reputation of the firm due to the decision-makers priority towards avoidance of loss of reputation. Therefore, the discourse presented from the aforesaid studies suggest that the past empirical works present mixed findings with regards to whether significant differences exist between SBSC-4 and SBSC-5 when they are used to decide between environmental investment options.

The foundations of the adaptive decision maker framework, provides an ideal lens to discern the difference between how presentation of different configurations of the SBSC are likely to influence behavior of decision-makers. In this study the two architectures; SBSC-4 where sustainability parameters are embedded into the four perspectives and SBSC-5 where sustainability is presented as a separate perspective, is expected to influence how decision-makers use them to make different environmental investment allocations. The assumption based on ADMF theory is that the manner in which information is presented will create a significant difference in how experimental

participants respond to the inputs. The build up to the hypotheses to be presented in section 3.2 of this chapter will take this matter into cognizance.

Second, much of the experimental research on SBSC has been grounded in cognitive psychology, where individuals are portrayed as having a limited information processing capacity (Beresford and Sloper, 2008). For example, individuals are able to process only approximately seven to nine measurements cues simultaneously (Miller, 1956). A broad range of research supports this view (e.g., Alewine and Stone, 2013), and have applied this view to the SBSC context, concluding that evaluating managerial performance is represented as a complex task, when a large number of performance measures are used, especially in the absence of substantial knowledge of SBSC among decision-makers.

Lipe and Salterio (2002) stated that separately processing, weighing, and combining a large number of performance measures into an overall evaluation "is, cognitively, a very difficult thing to do." The positive relationship between a number of cues or attributes and task complexity has a negative impact on decision-making that requires substantive knowledge (Bonner and Sprinkle, 2002; Schaltenbrand et al., 2018). Adding extra measurements to the BSC such as environmental measurements causes cognitive overload that requires knowledge to help to overcome the difficulty in interpreting the information (Beresford and Sloper, 2008; Payne, et al., 1993). This conclusion is consistent with this current study that argues that, with a limited range of SBSC knowledge, individuals will find it difficult to process the amount of SBSC information effectively, especially when the environmental data is embedded.

Third, simpler decision processes (i.e., heuristics) save on cognitive effort by only processing some of the decision-relevant information (Shanteau, 1988). In experimental conditions it has been significantly proven that the greater the number of different attributes presented to the decision-maker, the poorer the accuracy of the

resultant outcome. Researchers have identified and named different types of heuristics for making more efficient use of short-term memory by grouping information, known as "information chunking strategy" (Miller, 1956; Wertheimer, 1944). In this regard, processing SBSC-4 vs SBSC-5 architecture is expected to have different levels of intensity of impact on cognitive effort. Grouping environmental data into a stand-alone perspective (SBSC-5) increases the saliency of the sustainability component to the decision-maker and thus needs less cognitive effort to increase in its decision weight (Boeree, 2000). Furthermore, information chunking (Miller, 1956) and its use in strategies, such as the "divide and conquer" cognitive heuristic (Shanteau, 1988), may lead to less decision weight for environmental data embedded in a scorecard (SBSC-4) (Alewine and Miller, 2016; Kaplan and Wisner, 2009; Lipe and Salterio, 2002).

Finally, it is crucial to determine how decision-makers and investors choose between alternatives (or options) to make environmental investment decisions. Such decisions are known as preferential choice problems. The ADMF (Payne et al., 1993) argues that preferential choice problems are generally solved through a process of information acquisition and evaluation about the alternatives and their attributes. Hence, decision-makers may evaluate and choose better alternatives for processing SBSC architecture.

The following sub-sections provide a finer-grained explanation of how the theoretical lenses converge with the constructs of this study and lead to clues that enable linking the constructs that lead to formation of the theoretical framework.

1. Decision-Maker Desirability

Decision-maker desirability as an outcome depends on the psychological inclination of the individual choosing between alternatives that have trade-off situations in which a clear advantageous scenario does not exist, because the options presented have pros and cons embedded in each option. Therefore, in such a situation, the decision

maker is likely to justify a certain option over another simply because the probable outcome of the choice favors their internal preferences. For example, a manager trained to think in terms of financial results as a priority will subconsciously lean towards the choice with higher return on monetary investment even if other factors point in the negative direction. On the other hand, a manager from a marketing and customer satisfaction background may prioritize market-share and customer-centric outcomes even if financial returns appear less attractive.

2. The Uncertainty of Actually Receiving the Attribute Value

The other factor that influences decision-makers is the perceived uncertainty of actually receiving the stated attribute in the projected outcomes of the options presented. When decision options are presented, the decision-makers base their considerations on their experience and learning from previous decision scenarios, which may lead them to evaluate the realistic possibilities of achieving the stated outcomes. For example, an investment option with lower risk on environmental goals that predicts a long-term benefit for the organization but with higher short-term risk on financial sacrifices may not be considered realistic and achievable by some managers. People are skeptical about the long-term outcomes due to the fact that the long-term horizon holds many unforeseen issues not accounted for in the current scenario of options.

3. The willingness of the decision-maker to accept a loss on one attribute in exchange for possible gain on another attribute:

The willingness of the decision-makers to accept a loss on one attribute for gain on another attribute is a pertinent issue that comes into play in the decision calculus. The decision-maker weighs the value of the gain against the value of the loss and tries to determine the net outcome. This issue is also based on acquired knowledge and experience, and the perceptions of the decision-maker about the values of the loss and gain.

Therefore, the above stated arguments imply that considering other cognitive factors which have been so far been unexplored in the literature, there is a possibility that such factors may interact with SBSC architecture to influence judgments involving environmental performance measures. Under the integrated approach examined in this study, the risk indicators are linked to the SBSC as an additional column along with the other SBSC perspectives to investigate whether there is an existing difference within SBSC architecture (SBSC-4 and SBSC-5) when it comes to the decision-making behavior of managers. Prior research in both financial accounting and management accounting has shown that when related information is placed near each other in meaningful way, individuals will recognize their relationships and will make decisions accordingly (Alewine and Stone, 2013; Cheng et al., 2018; Lipe and Salterio, 2002; Schaltenbrand et al., 2018). Hence, this leads to the possibility that placing risk indicators into the SBSC architecture will alter choices made by the decision-makers.

This study recognizes that the ADMF did not elaborate on how decision-makers are likely to respond when risk information is presented to them. Therefore, this study posits that including risk factors along with SBSC architecture will alter the information processing by decision-makers. In order to support this prediction, this research draws on pertinent components of the Prospect Theory (Kahneman and Tversky, 1979) in addition to the ADMF to support parts of the research framework that incorporate risk indicators.

3.1.1 Role of SBSC Knowledge in the Research Model

Knowledge is a problem domain representing a key factor that can significantly affect how information is processed (Chi, 2006). Findings from the literature indicate that knowledge of SBSC and environmental accounting metrics reduces the common measurement bias, allowing decision-makers to allocate their limited organizational resources in a more objective and effective manner (Dias et al., 2002). Quality

decision-making emerges when the decision-makers are endowed with a thorough understanding of the framework or tool that they are utilizing (Epstein, 2014).

In a detailed case study of several transnational companies (e.g., G.E., Wal-Mart, and Body Shop), Epstein (2014) looks at how performance measures are translated to managerial decisions that impact economic, social and environmental outcomes when the respective firms invest in adequate training and capacity-building of their managers. The author finds that in such organizations, enhancing knowledge of evaluation tools plays a significant role in the association between measures and effective managerial actions. Borrowing from premise of Epstein (2014) as a related study, the current study argues that specialized knowledge of SBSC is essential for decision-makers and accounts for a strong association between SBSC architecture and environmental decision-making.

3.1.2 The Role of Risk Indicators in the Framework: Drawing from the Prospect Theory

In their seminal piece of work in 1979, Kahneman and Tversky proposed a decision-making approach involving risks, known as the '*Prospect Theory'*. The theory is acknowledged to be the best descriptive model of risky decision-making. Since then, the theory has been developed and modified, from which two parallel streams have emerged:

(i) Economists that have been striving to refine the mathematics of the proposed model, and

(ii) Psychologists that have been more interested in exploring the underlying psychological processes (for example, cognitive processes, personality and motivational factors).

The former stream of work (primarily the econometric modeling aspects) has resulted in an evolved form of the model known as the Cumulative Prospect Theory

(Tversky and Kahneman, 1992). An important aspect of its' development has been to incorporate decision-making involving uncertainty. A key finding from (or aspect of) the Prospect theory approach is that, when faced with a decision problem, people form a mental representation of that problem. The mental model (or framing) of a problem includes both information about the decision problem and the context of the decision problem (for example, time constraints, or emotional aspects). Individual differences in the way information is perceived, organized and interpreted, and differences in context, mean that the decision or choice made about the same decision problem will vary between individuals and across different contexts (Kahneman and Tversky, 1979)

The implication of a personal and situation-specific mental model is that two individuals who might be presented with the same problem stimulus might actually be solving different 'mental' problems (Soman, 2004). Prospect theory stipulates that, in some circumstances, people are risk-averse, whereas in other circumstances people are risk-seeking. According to this theory, two main assumptions can be derived:

(a) Individuals identify a reference point representing their current state,

(b) Individuals are more sensitive to potential losses than to potential gains; referred to as '*loss aversion*'.

According to the first assumption, managers choose alternatives that achieve their organization's strategic objectives. If the main aim of their company is to conduct business in a manner that demonstrates major responsibility towards the environment, they will choose the alternative that achieves environmental objectives. However, they will select less risky alternatives if the main aim of the company is to mitigate potential risk (Tversky and Kahneman, 1992).

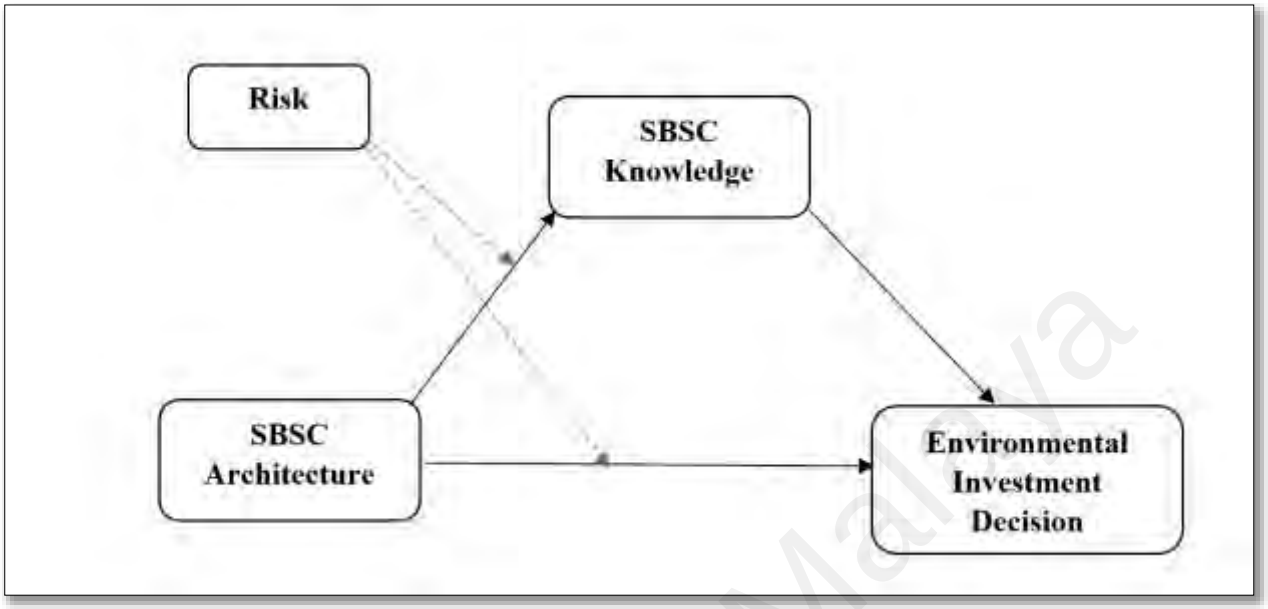
With regards to the second assumption (i.e., loss aversion), most of the investors are risk-averse (e.g., they will rather not lose $100, than try to gain $500), especially when the probability of risk is high. In other words, managers would be inclined to

sacrifice some of the firm's objectives (such as environmental targets) in order to achieve the firm's overarching objectives, such as financial success (Beresford and Sloper, 2008).

In order to succeed in providing shareholders, employees and society with value through sustained economic performance, an entity must be able to recognize and respond to risks. The desire to consider sustainability and risk are fundamental drivers behind the core concept of global sustainability. Without these, it would be a struggle to make environmental investments or to take the initiatives required to be successful. Therefore, in terms of achieving sustainability objectives, this study investigates the type of risks that decision-makers are likely to be averse to, whether they are financial or environmental risk, in order to achieve environmental objectives.

In summation of the discussions on theory, the current study proposes a theoretical framework that links SBSC architecture with environmental investment decision-making and proposes several hypothesized relationships based on the theories and supported by prior empirical works. First, by using the ADMF, the current study proposes that the two SBSC architecture (SBSC-4 and SBSC-5) may have significantly different patterns of impact on environmental investment decision-making because the way the information is presented to individuals impacts their decision-making behavior. Second, the ADMF enables the proposition of SBSC knowledge as an intervening variable that will account for the relationship between SBSC architecture and environmental investment decision-making. Third, with the support of the Prospect Theory, it is suggested that risk indicators will act as a moderating variable in the relationship between SBSC architecture and environmental investment decisions. Fourth, this study conceptualizes the *'Conditional Indirect Process Model'* (Hayes, et al., 2017), which defines the nature of the mechanism or mechanisms by which one or

more variables transmit its effect on another variable or a set of variables. Therefore, an integrated moderated-mediation model emerges (Figure 3.1).



Source: Author's own work

Figure 0.1: Research Model

3.2 Differences between SBSC Architectures when using them for Environmental Investment Decision-Making

As success or failure of environmental investment outcomes rests upon how effectively decisions are evaluated, it is important to understand that the investment decision-making process requires appropriate tools to make it easier to achieve goals that can lead to sustainable investment pathways (Sarker and Burrit, 2008). Hence, there is a potential benefit for devising a managerial accounting evaluation system that addresses such issues. SBSC may be one mechanism that captures this opportunity. In fact, SBSC has emerged as a popular management technique to help organizations to achieve various new objectives, including broader sustainability objectives, people development, social impact, and objectives related to an organization's constituents (Kaplan and Norton, 2006). SBSC metrics link together several domains and elements of a firm's strategy in the SBSC architecture (SBSC-4 or SBSC-5). These linkages

visualize the hypotheses regarding cause-and-effect relationships which are based on the principle of cause and effect and on the paradigm of instrumental rationality in particular (Kaplan and Norton, 1996b).

Generally, SBSC metrics have a significant influence on the willingness of managers to incorporate environmental considerations into investment decision-making (Alewine and Stone, 2013). The extant literature alludes to the assertion that SBSC has significant impact on environmental investment decision-making. However, scholars differ on whether there are significant differences between SBSC architecture for SBSC-4 and SBSC-5 when it comes to environmental investment decision-making (Alewine and Miller, 2016; Jiangtao and Pin, 2010).

Several studies advocated adding SBSC environmental measures as a stand-alone fifth perspective (Hansen and Schaltegger, 2016). The proponents of the SBSC-5 architecture contend that treating environmental criteria as a separate fifth perspective would provide more visibility, hence adding a new perspective that can be considered as a less complex way for firms to measure performance along with sustainability criteria (Kalender and Vayvay, 2016).

Moreover, some of the prior studies point out that embedding environmental measures into each of the traditional performance perspective of firms may be very challenging or even, at times, impossible, and they argue that market-based prices for goods and services may not fully reflect environmental activities (Figge et al., 2002). In this regard, there is more incentive to better achieve environmental investment decisions with the SBSC-5 architecture compared to the SBSC-4 architecture, due to the greater attention being placed on the scorecard's segregated environmental data.

However, other studies disagree with the preceding assertions and argue that isolating environmental measures in a separate perspective might weaken environmental initiatives by not providing clear ties to the other perspectives (Butler et al., 2011). In

this setting, environmental data receives less decision weight than when they are embedded across multiple perspectives (Kaplan and Wisner, 2009; Lipe and Salterio, 2002). When environmental data is embedded, the data are not recognized as related to each other. They are regarded as multiple indicators of performance, thus garnering more collective decision weight (Kalender and Vayvay, 2016). This cognitive process pertains to the divide-and-conquer decision heuristic (Shanteau, 1988). Moreover, SBSC-5 architecture requires more cognitive effort in comprehending the environmental data than in the SBSC-4 architecture (Alewine and Stone, 2013).

The different findings from empirical works may arise from the dual-natured feature for SBSC measurements (Alewine and Miller, 2016). For example, environmental measures (e.g., energy cost savings) often contain "dual-natured" features, and they can be classified within either traditional (e.g., financial) or non-traditional (e.g., environmental) scorecard perspectives. This classification choice (e.g., placing the measure in an environmental perspective) may result in saliency differences for the features in the measures, such that the feature that is more aligned with the chosen perspective (e.g., environmental perspective) becomes more salient than the nonaligned feature (e.g., financial perspective) (Alewine and Miller, 2016).

Another important issue indicated by the extant literature on SBSC is related to unintended decision consequences on the importance of environmental objectives, especially when low management communication levels exist (Kaplan and Wisner, 2009). In such a situation, the environmental feature of the dual-natured environmental measures is less salient when the measures are grouped (i.e., SBSC-5) in the environmental perspective (rather than embedded among the four traditional perspectives), and the traditional features of the dual-natured environmental measures are more salient when the measures are embedded (i.e., SBSC-4) within the traditional perspectives, instead of being grouped as a fifth perspective (Alewine and Miller, 2016).

From this viewpoint, the potential changes in saliency to influence analysis of environmental performance measures requires cognitive factors to be explored and interacted with SBSC architecture to influence the judgments involving environmental performance measures and to examine its impact on environmental investment decision-making. As a result, different decision-makers will process SBSC architecture differently. This is due to the fact that the information display format influences their decisions (Payne, et al., 1993; Sloper and Beresford, 2008). To summarize the above discourse in the literature regarding the difference between SBSC-4 and SBSC-5, the core comparison emanates from two sources; 'cognitive effort' required by decision-makers to decipher and deploy the SBSC frameworks and the 'decision weights' assigned by the decision-makers.

This study investigates whether a significant difference exists between SBSC-4 and SBSC-5 architecture when they are deployed for evaluating environmental investment alternatives, and whether the differences between the architectures will remain significant when risk information is presented to decision-makers. The assumption is that the stand-alone architecture (SBSC-5) will be more prominent compared to the embedded architecture (SBSC-4), and this is because SBSC-5 will be appear to be less complex, thus reducing the cognitive effort associated with processing this information. This is consistent with the theoretical argument made by ADMF (Beresford and Sloper, 2008). Thus, the current study predicts that SBSC architecture have a significantly different pattern of impact on environmental investment decision-making, whether risk indicators present or absent. Therefore, the following hypotheses is stated in two parts.

> **H-1a**: When managers utilize SBSC architecture for decision-making, both SBSC-4 and SBSC-5 will have significantly different effects on environmental investment decision-making.

H-1b: When managers utilize SBSC architecture for environmental investment decision-making, the difference between SBSC-4 and SBSC-5 will be significant when risk indicators are presented along with the SBSC architecture.

3.3 The Mediating Effect of SBSC Knowledge

SBSC's architectures (SBSC-4 or SBSC-5) suggest a way for decision-makers to mentally organize the large number of performance measures that may mitigate these cognitive difficulties. ADMF theory suggests that information processing, and subsequent judgments are impacted by the way information is organized (Payne et al., 1993) and by the hierarchies or relations among information items contained in a decision-task (Hansen and Schaltegger, 2016). Decision-makers objectively compare the effects between alternatives to evaluate organizational performance based on SBSC configurations, which requires sufficient knowledge of SBSC measures to help develop scenario analysis (Banker et al., 2004; Jassem et al., 2018).

An important aspect of SBSC knowledge is an understanding of common and unique measures (i.e., lag and lead measures) to compare different investment alternatives. Managers with limited grasp and experience in using BSC based their performance evaluations on common measures across units and ignored any unique strategy measures of each unit (Banker et al., 2004). Moreover, knowledge on the quality of performance evaluation is essential to enhance investment decision-making for achieving organizational environmental objectives. A lack of knowledge about the core concepts of SBSC and its' efficient use can negatively affect the outcomes of environmental investment decisions (Jassem et al., 2018). SBSC knowledge is defined as knowledge about SBSC measures and how to apply them in evaluating decision alternatives (Kang and Fredin, 2012). Since, the SBSC framework is designed to facilitate performance evaluation that reflects all performance measures linked to an organization's strategy (both common and unique), it is imperative for decision-makers

who utilize them to be well grounded in their concepts and applications (Banker et al., 2011).

Epstein (2014) conducted case studies on transnational companies, and the author explains how knowledge and thorough comprehension of sustainability measures among managers made a difference in the decision quality when managers attempted to translate measures into sustainability management actions. The findings of the aforesaid study allude to the possibility that knowledge accounts for the link between measures and actions. Therefore, as a related study, the current research endeavor leverages the findings of Epstein (2014) to suggest that SBSC knowledge accounts for the relationship between SBSC architecture and environmental investment decision-making as a mediator.

Based on the above arguments, it may be inferred that a thorough understanding and knowledge of SBSC architecture as a performance evaluation technique is essential for decision-makers in order to optimize their investment decisions. The level of knowledge and understanding of the SBSC metrics is likely to influence how evaluators use SBSC architecture (common and unique measures) to evaluate and choose between alternatives. Therefore, the second hypothesis is formally stated in two parts.

> **H-2a:** SBSC knowledge mediates the relationship between SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making.
>
> **H-2b:** SBSC knowledge mediates the relationship between SBSC architecture (SBSC 4- and SBSC-5) and environmental investment decision-making when risk indicators are presented along with the SBSC architecture.

3.4 Risk Indicators, SBSC Architectures and Environmental Investment Decision-Making

The following sub-section elaborates on the role of risk indicators as a moderator in the direct relationship between SBSC architecture and environmental investment decision-making.

3.4.1 Moderating Role of Risk Indicators on the Association between SBSC Architecture and Environmental Investment Decision-Making

As stated in preceding sections, significant difference is posited between SBSC architectures when their impact on environmental investment decision-making is considered. Furthermore, it has been stated that previous experimental studies on the above linkage suggests conflicting findings (Jassem et al., 2018). Therefore, the possibility looms large that the conflicting findings indicate that pertinent moderating variables may have been overlooked in prior empirical studies. Determining a clear and consistently predictable relationship between the SBSC architecture and environmental investment decision-making is crucial to guide managers for better investment decision outcomes. Therefore, one of the objectives of this study is to investigate whether risk indicators moderate the relationship between SBSC architecture and environmental investment decision-making.

Increasing awareness about the limitations of measuring organizational success merely with environmental and risk metrics has spurred interest in multidimensional performance measurement and organizational performance systems such as the SBSC (Faris et al., 2013). It has been suggested in previous studies that strategic decisions need to be made in the context of strategic risk assessments (Cheng et al., 2018). It is now becoming clearer that sustainable organizations need to have an effective risk management strategy in place.

Consultants and risk management practitioners have advocated that companies consider both sustainability management and risk management together so that they are in a better position to take the necessary actions to manage these risks before they result in decisions that pose hazards to the organization (e.g., Ernst and Young, 2012; Faris et al., 2013; Wong, 2014). Thus, including risk indicators into the SBSC could be an effective strategy for investigating whether it would cause differences in investment

decisions based on the different types of SBSC architecture. Therefore, incorporating strategic risk indicators into the SBSC perspectives aids decision-makers in improving strategic performance evaluation (Soror, 2014).

The introduction of risk indicators into the research framework leverages components of the prospect theory (Kahneman and Tversky, 1979), which states that individuals react disproportionately more to issues framed as losses than as gains. In the context of the current study, integrating risk indicators into the SBSC architecture allows managers to evaluate the performance of the existing strategies in light of their effect on the organization's overall risk exposure, as well as to appraise investments that achieve environmental targets (Kaplan, 2009). Therefore, this study predicts that when risk indicators are considered as a moderator between SBSC architecture and environmental investment decision-making, it will influence the strength of the relationship.

Additionally, the ADMF theory suggests that in complex settings, a trade-off between the desire to maximize decision quality and the limited processing capacity of human decision-makers will lead to decisions that seek to minimize the cognitive effort required to make such a decision (Beresford and Sloper, 2008). In simpler terms, this means that decision-makers will select the option that is easier to comprehend and use compared to the more complex framework. This idea is consistent with the theoretical underpinning stated in Section 3.1.1 of this chapter, which states that judgments requiring the weight and combination of multiple internal performance cues by managers affect whether the SBSC framework can influence the way managers interpret external information and evaluate the appropriateness of their strategy (Payne et al., 1993).

In this context, this study suggests that integrating new factors such as risk indicators can aid in investigating whether there is a difference between SBSC-4 and

SBSC-5 architecture, as such a holistic approach appears to have been previously overlooked. Therefore, this study hypothesizes that evaluations of investment alternatives that achieve environmental objectives by using SBSC architecture including risk indicators will differ from evaluations based on the same measures without risk indicators. Hence, risk indicators are likely to be a moderator in the relationship between SBSC architecture and environmental investment decisions. Thus, formally stated:

> **H-3:** Risk indicators moderate the relationship between SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making.

3.5 Integrated Moderated-Mediation Model

Due to the fact that the literature continues to debate which SBSC architecture to use when including sustainability performance measures, it is likely that it will benefit managers by giving them a better understanding of how risk indicators and SBSC architecture interact to influence environmental investment decision making. The set of hypotheses presented in the preceding sections all consider direct relationships, indirect relationships and moderated relationships in isolation. However, there is a possibility that the stated variables also interact together to provide a more inclusive and holistic framework that links the manipulated variables (SBSC architecture) and the dependent variable (environmental investment decision-making) under a conditional direct and indirect effect.

The literature indicates that prior studies have investigated the concept of SBSC architecture and environmental investment decisions in isolation (e.g., Alewine and Stone, 2013), and also SBSC knowledge and SBSC architecture (Jassem et al., 2018), as well as risk and BSC architecture (Cheng et al., 2018). However, it appears that, so far, none of the studies have looked at all four variables combined in a single integrated model where the risk indicators act as moderator on both the direct and indirect path,

and SBSC knowledge acts as a mediator, while considering the impact of SBSC architecture on environmental investment decision-making.

Based on the arguments made above, a moderated-mediation model is proposed, where SBSC knowledge acts as a mediator and risk as a moderator in the relationship between the SBSC architecture and the environmental investment decision, leading to the proposition of the following hypothesis:

Hypothesis-4 (H-4):

Risk indictors moderate the indirect effect of SBSC architecture (SBSC-4 and SBSC-5) on environmental investment decision-making through SBSC knowledge as a mediator. Therefore, a significant moderated-mediation effect exists.

3.6 Chapter Summary

This chapter presented the theoretical framework and a set of hypotheses for this experimental research. The first section presented discussions of the ADMF Theory, followed by the Prospect Theory, to suggest links between the constructs in the research framework. Thereafter, several sections were devoted to explain how the constructs relate to each other with the support from theory and prior empirical studies that lead to proposition of the four (4) primary hypotheses (H-1, H-2, H-3 and H-4) out of which H-1 and H-2 contain sub-hypotheses (H-1a, H-1b, H-2a and H-2b). The next chapter deals with the research methodology deployed in conducting this experimental study.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

This chapter focuses on the research design and methodology to be applied to test the hypotheses proposed. The discussion starts with the research paradigm to be adopted for this study. Thereafter, a detailed discussion ensues on experimental research and the justification for deploying this method for this study. The next part of the chapter deals with the selection of participants for the study and their features that are necessary to create a good fit between the research objectives of this study and the respondents.

The subsequent theme focuses on the need for validation of the instrument prior to collecting data. For determining the face validity and suitability of the instrument, a panel of experts was selected who examined the instrument and provided feedback on the issues that need to be incorporated into the content of the instrument. Following this section, the discussion moves on to the details of how the experiment is to be conducted. The experimental process is explained in detail, including how the variables will be manipulated in the experiment. Finally, the 'Conditional Process Model' is explained in detail, along with justification for deploying the moderated-mediation model for the SPSS PROCESS Macro.

4.1 Research Paradigms

The concept of the research paradigm is traced back to Kuhn (1962), where he suggested that the word paradigm refers to a philosophy of thinking for any researcher who seeks answers to his or her research questions. This idea has also been termed a 'worldview' by Mackenzie and Knipe (2006). This worldview is the perspective, or thinking, or school of thought, or a set of shared beliefs that inform the meaning or interpretation of research data. Lather (1986) expands on this and states that research paradigm depicts the researcher's inherent beliefs about the world he or she lives in. There are numerous paradigms used to guide research, and authors incorporate different

paradigmatic schemas to conceptualize and classify their research (Denzin and Lincoln, 2000b). The most widely used paradigms in academic research are positivism, post positivism, constructivism-interpretivism, and critical theory (Ponterotto, 2005). Each of these world-views are explained in the following sub-sections:

4.1.1 Positivism

Positivism may be viewed as a form of philosophical realism adhering closely to the hypothetical-deductive method (Cacioppo et al., 2004; McGrath and Johnson, 2003). This scientific method involves systematic observation and description of phenomenon contextualized within a model or theory, the presentation of hypotheses, and interpretation of statistical results in light of the original theory (Cacioppo et al., 2004). Therefore, relying on a deductive approach, positivism focuses on efforts to verify a prior hypothesis that are mostly stated in quantitative propositions that can also be converted to mathematical formulas expressing functional relationships (Lincoln and Guba, 2000). The primary goal of positivist inquiry is an explanation that ultimately leads to prediction and control of phenomenon (McGrath and Johnson, 2003).

4.1.2 Post Positivism

Post positivism arose out of dissatisfaction with some aspects of the positivist stance. Whereas, positivists accept an objective, apprehend reality, post positivists acknowledge an objective reality that is only imperfectly apprehended (Lincloln and Guba, 2000). This position holds that human intellectual mechanisms are flawed and that life's phenomenon are basically intractable, and therefore, one can never fully capture a "true" reality (Ponterotto, 2005). A key distinction between the positivist and postpositivist views is that the former stresses "theory verification" and the latter "theory falsification" (Lincloln and Guba, 2000). The idea is illustrated by Ponterotto (2005): "Whereas a million white swans can never establish, with complete confidence,

the proposition that all swans are white, as one black swan can completely falsify the theory" (p. 47). However, the goal of both paradigms is to predict and control phenomenon. Both paradigms emphasize cause-effect relationships that can be studied, identified, and generalized, and both stress on detaching the observer's role (Lincoln and Guba, 2000). Therefore, both positivism and post positivism are the primary foundational anchors for quantitative research.

4.1.3 Constructivism-Interpretivism

The constructivist (or interpret) paradigm can be perceived as an alternative to the positivist paradigm (Ponterotto, 2005). In marked contrast to positivism's concept of realism (i.e., a single objective external reality), constructivism adheres to a relativist position that assumes multiple, apprehended, and equally valid realities (Schwandt, 2000). Essentially, constructivists hold that reality is constructed in the mind of the individual, rather that it being an external singular reality (Hansen, 2004). The constructivist position maintains that meaning is hidden and must be brought to the surface through deep reflection (Schwandt, 2000). This reality can be stimulated by interactive researcher-participant dialogue. Therefore, a distinguishing characteristic of constructivism is the centrality of the interaction between the investigator and the object of investigation (Ponterotto, 2005). Only through such interactions can deeper meanings be uncovered. Thus, the researcher and the participants co-create the findings from their interactive dialogues and interpretations. The constructivism-interpretivism paradigm provides the foundation for qualitative research.

4.1.4 Critical Theory

Critical theory paradigm is aimed at emancipation and transformation, in which the researcher's proactive values (ideologies and beliefs) are central to the task, purpose, and methods of research (Ponterotto, 2005). The origins of critical theory are traced to

Institute of Social Research at University of Frankfurt in the 1920s (Creswell, 2014). The basic premise of this paradigm is the belief in a constructed lived experience that is mediated by power relations within social and historical contexts (Kemmis and McTaggart, 2000). Central to the critical theory is the emphasis on dialectical interaction leading to emancipation from oppression and a more egalitarian and democratic social order (Ponterotto, 2005). Some of the core issues in this paradigm are; first, a critic is a researcher who uses her or his work as a form of cultural or social criticism. Secondly, critical researchers assume that all thought is fundamentally mediated by power relations and are thus socially and historically constituted (Kemmis and McTaggart, 2000). This means that facts can never be isolated from the domain of values or removed from some form of ideological inscription.

Similar to constructivists, critics advocate a reality that is constructed within a social-historical context. However, critics conceptualize reality within power relations and they use their research to find ways to emancipate oppressed groups (Tolman and Brydon-Miller, 2001). In contrast to the constructivist approach, readers of studies done by critics can easily fathom the influence of the researcher's personal ideology and beliefs in their writings, and ideal example are studies done by feminist groups (Denzin and Lincoln, 2000a).

4.2 Experimental Method

An experimental method is used as it is deemed to be the most suitable way to determine the cause, effect and causal relationship between variables and control the irrelevant variables at the same time (Shadish, et al., 2002). Accordingly, in the experimental method, one variable would be manipulated to determine if changes in one variable causes change in another variable. According to the statement made by Moore and McCabe (1993): "The best method — indeed the only fully compelling method of

establishing causation is to conduct a carefully designed experiment in which the effects of possible lurking variables are controlled. To experiment means to actively change x and to observe the response in y" (p. 202).

Th experimental method relies on controlled methods, random assignment and the manipulation of variables to test the hypothesis (Field and Hole, 2002). Furthermore, Gay (1992) states that: "The experimental method is the only method of research that can truly test hypotheses concerning cause-and-effect relationships. It represents the most valid approach to the solution of problems, both practical and theoretical". (p. 298).

The main advantage of an experimental method is the capacity to control the factors of interests in order to clearly quantify the potential effects. Moreover, it is beneficial for examining the main and interaction effects, as well as for controlling confounding variables by building a single design (Field and Hole, 2002). Unlike surveys that capture attitudes, decision experiments measure behavior. The advantage with decision experiments is that when they do measure changes in behavior, they do so under controlled and hypothetical conditions, which provides greater internal validity.

In short, the level of confidence that can be placed on the experimental results depends to some extent on how robust the experimental conditions model is and how the actual decision setting is being imitated, comparing it to other types of research methods which best match the objectives of the study (Milne and Patten 2002). Therefore, this research is experimental in nature, with an intention to determine the impact of types of SBSC architecture on environmental investment decision-making, and it requires a study platform where SBSC is regularly utilized as a performance evaluation tool by relevant decision-makers. The primary aim of the study is to pinpoint whether there is an existing difference between SBSC architecture on environmental

decision-making and whether this difference could be due to external factors such as risk indicators, and this can be addressed best by designing an experimental framework.

4.3 Selecting Participants for Experimental Studies

The vast majority of experiments in social science use students as surrogates for real-world decision makers. They argue that the difference between the decisions made by students and industry decision-makers is minor (e.g., Alewine and Miller, 2016; Alewine and Stone, 2013; Banker et al., 2004; Jiangtao and Pin 2010; Kaplan et al., 2011; Lipe and Salterio 2000). Although, students were considered adequate surrogates for practitioners in the task of identifying the "dimensions of the cognitive structure", they were not adequate surrogates for the "more precise task of the measurement of meaning in accounting" (Houghton and Hronsky, 1993, p. 143). Even from a logical standpoint, students typically lack the real-world exposure of industry practitioners (managerial decision-makers), who make real-time decisions with the potential for significant impact on their organizations' growth and survivability.

Research results from attitudinal studies suggest that students' attitudes are not the same as those for whom they are being considered as surrogates. In fact, Hughes and Gibson (1991) found that students were not adequate surrogates for industry managers in the decision-making process. This finding is quite logical, as students cannot be expected to mirror the experience and cognitive abilities of industry managers who are using SBSC as tools in their routine functions and are exposed to real-time operational issues. This notion is further reinforced by Sarker and Burrit (2008) who stated that depending on student's participation by acting as managers in the study would produce inadequate results because their experience is lacking, compared to that of managers.

Christensen-Szalanski, et al., (1983) suggested that experts and non-experts may use similar thought processes but make decisions differently, by making biased risk

judgments because of their differing exposure to the real-world scenarios. In several studies in the past (e.g., O'Donovan, 2002; Sarker and Burritt, 2008; Schaltenbrand et al., 2018), the authors examined the role of managers in achieving and interpreting environmental information as the basis for decisions and action, including the effect of experience on decision-making. The studies reveal that managers are concerned about social values, reputation, investment strategies and the nature and type of environmental regulations when considering investment decisions. In the case of students, their exposure to such accountability would only be hypothetical, and thus it would not be realistic to compare them to real-world decision-makers.

Sharma (2000) found that in the manufacturing industry, environmental strategies are associated with management interpretations of environmental issues as either threats or opportunities. The extent to which some companies incorporate environmental concerns into decision-making is heavily dependent on the perception that managers have of these issues as opportunities or threats. Furthermore, Ness and Mirza (1991) identified that managers propose contrasting considerations to environmental issues according to their field of profession. It is recognized that different managers could have different roles and perceptions. Similarly, several other studies (e.g, Sarker and Burritt, 2008; Cheng et al., 2018; Schaltenbrand et al., 2018) found that top management is often key managers involved in large investment decisions. Therefore, the above discourse indicates that prior perception based on experience has a bearing on decision-making.

Therefore, for the purpose of the current study, it was decided to conduct the experimental study on a group of individuals that are involved in managerial decision-making regarding investments, and use SBSC frameworks as performance evaluation tools in their respective organizations. In this regard, a broad range of industry managers from across the production and supply chain in manufacturing industry

organizations were included in this study in order to allow for possible variance in their willingness to take environmental considerations and risk mitigation into account when deploying investment decision making. It would be pertinent to consider decision-makers at different levels in the manufacturing sector, since they have a substantial role in making environmental investment decisions that would affect the companies' future success (Hafenstein and Bassen, 2016; Sarker and Burritt, 2008; Schaltenbrand et al., 2018). Hart (1997), asserted that: "like it or not, the responsibility for ensuring a sustainable world falls largely on the shoulders of the world's enterprises, the economic engine of the future". (p.76)

Hence, given the potential importance of enterprises and their management to the environmental impacts of business, the focus here is on enterprises operating in the manufacturing industry. Thus, this study considers environmental investment decision-making by different types of managerial decision-makers who are working at different levels in the manufacturing industry. Consequently, decision-makers engaged in manufacturing and supply chain are included in the decision experiment, thereby ensuring the reliability of the study.

4.3.1 Selection Criteria for Participants

For the purpose of this experimental study, selected participants come from a set of large multinational manufacturing companies involved in production and marketing of earthmoving equipment and power generators (the companies are: Caterpillar, Volvo, Hitachi, Komatsu, Terex , Mitsubishi and Liebherr), that have been chosen based on three criteria.

(i) The first is that managerial decision-makers in such organizations are routinely using sustainability parameters for organizational performance measurements, or in some cases, tools that mimic the SBSC framework but

are customized for the type of business operations the firms have. Therefore, for the purpose of this study, these companies are an ideal social laboratory to measure the knowledge of their decision-makers about SBSC and its' impact on their investment choices.

(ii) Second, the companies chosen have been in business for more than several decades and are making sustainable progress possible and driving positive change on every continent in which they operate. These companies are in touch with the changing expectations of their key stakeholders who want to see the reputation of their firms as responsible corporate citizens. In this context, they are keen on converting their old practices into more environmentally friendly ones or introducing new, clean and efficient technologies, which means that sustainability is one of their performance benchmarks. Accordingly, sustainability has become a core tenet of their corporate strategy, so much so that the companies release an annual sustainability report to inform stakeholders about their progress.

As a result of these changing dynamics, these companies have received many globally recognized certifications on quality as well as environmental compliance, such as the International Organization for Standardization (ISO) certificates (e.g., ISO 9001 (quality), ISO 14001 (environmental care) and OHSAS18001 (occupational health and safety)). This means that all of the companies' sites and functions are in alignment and are consistent with the requirements of international standards set by the Global Reporting Initiative (GRI). The companies selected for the study have been recognized for their enormous efforts in reducing energy consumption, resource reduction and elimination of greenhouse emissions through the manufacturing process, for which some of them were awarded Gold and Silver certificates from Leadership in Energy and Environmental Design (LEED).

(iii) Finally, it would be prudent to seek out companies that not only consider sustainability as a vital parameter, but also assign equal importance to Enterprise Risk Management (ERM). The multinational companies selected for this study have been honing their risk management capabilities continuously for decades. All senior level managers are familiar with and are experienced in risk management processes, to the extent that the operational processes have been optimized to its essential pieces. The key risk information identified during the assessment enables business unit leaders, to develop their risk mitigation plans and integrate them into their strategy. The business-level work is methodically rolled up to the level of the group presidents and debated during the enterprise risk assessment.

The threats identified are then shared with the board. After assembling the business unit survey input and preparing a preliminary assessment of risks, the business risk management teams bring the consolidated input to the business unit leadership team for discussion and evaluation. Through this dialogue, the leadership team determines the risks that matter most to their business unit, in order to determine the set of key risks for each division, where each company has its own way of discussing and evaluating individual risks. Nevertheless, they all employ more or less similar strategies. These companies manage risks across the following two dimensions of a matrix: significance (magnitude of impact) and likelihood (probability of occurrence). The greater the risk, the more attention is given to determine how to manage it.

Based on the sustainability reports for the companies selected, they set up their risk management with forecasted risks and contingency measures in order to face risks that could threaten the companies' sustained growth, particularly compliance issues, environmental issues, product quality concerns, accidents, and information security problems.

Therefore, because these companies integrate sustainability parameters and risk management in their strategy and operations, the sample proposed for this study is suitable to achieve the research objectives successfully. Sustainability and risk management programs at manufacturing companies like those selected for this study gain more maturity and experience. Therefore, the firms will increasingly be able to take the guesswork out of enterprise risk factors. To do so, they believe that strategy development and risk management must be two sides of the same coin.

4.4 Instrument Development

The experimental instrument for this study is mostly adapted from the study by Alewine and Stone (2013) and further customized by borrowing some of the procedures applied in the study by Cheng et al. (2018), and suggested by Kaplan (2009) including risk information into SBSC to suit the context of this experimental research. Alewine and Stone's (2013) study determines how BSC frameworks are used by decision-makers by answering two research questions:

a. How much attention and cognitive effort decision-makers require, to utilize the metrics provided in the experimental framework based on BSC and both SBSC-4 and SBSC-5?
b. Which investment outcomes do they mostly favor given a trade-off scenario between financial returns and environmental stewardship?

Alewine and Stone's (2013) study was based on 168 business school students that were mostly undergraduate students in their advanced stages, and had theoretical exposure to BSC in their course work. The students were randomly selected for the study and split up in three (3) groups:

(i) The first group were the control group, where they were given the traditional BSC without any environmental data,

(ii) The second group were provided with SBSC-4, with environmental data embedded into the traditional four perspectives,

(iii) Finally, the third group were given SBSC-5 with environmental information as a separate stand-alone 5th perspective.

The students in each group had to select investment alternatives based on a case scenario, where they had to select either one of the two hypothetical outcomes that required achieving financial results as well as environmental stewardship targets. Between both outcomes, there was a trade-off between maximizing financial outcomes and environmental stewardship outcome. Hence, selecting one option negated gains in the other option.

In the final tally, Alewine and Stone (2013) had to discard a large portion of the instruments filled out by students that could not complete the assignment, and eventually ended up with a sample size of 95 respondents that provided useable information for analysis. The authors lamented that possibly due to the lack of real-world experience many of the students were unable to fill out the instrument satisfactorily. They go on to suggest that this experiment needs to be conducted on actual managers in business organizations that use BSC as tools in their functions. The current study addresses this gap, and conducts the experiment on real-world managerial decision-makers.

Regarding integrating risk information into the current experimental study, components of Cheng et al., (2018) experimental research was used with some adaptations. The aforesaid authors measured risk on a rating scale of 1 – 10, where risk indicators were integrated into each of the perspectives of the traditional BSC (performance driver risk and outcomes risk). For instance, integrated risk with financial and customer perspectives could be performance driver risks while internal business process and learning and growth could be performance outcome risks which was to be

rated by the participants based on the likelihood of occurrence and the impact on customer satisfaction if it did occur.

In order to manipulate risk indicators, the current study does not integrate risk in the same manner as Cheng et al. (2018), but rather utilised the model suggested by Kaplan (2009) where the author proposed a 3 x 3 matrix (known as a Heat Map) where one axis presents scores for likelihood of occurrence of a certain type of risk, and on the other axis there are scores for magnitude of impact if such risk does occur. The product (i.e., multiplication) of the score for likelihood of occurrence and magnitude of impact, gives a value that ranges from 1 to 25. Kaplan (2009) suggests that any score > 15 is considered a risk that has higher probability of occurrence with severe consequences if it does occur, hence it is a high priority risk, whereas any score < 15 would be the opposite (i.e., a low priority risk).

Details of the experimental procedure are discussed in this chapter in Section 4.7.1. Once the instrument was developed, the next step was to examine the face and content validity of the instrument by presenting it to a panel of experts for feedback. The following sections outline the expert panel and the processes followed.

4.5 Validation of the Instrument by the Expert Panel

In order to ensure face and content validity of the research instrument, six (6) experts were provided the instrument to obtain their comments and feedback. The panel of experts comprised of three (3) academic experts and three (3) industry experts. The experts from academia were professors in the field of accounting at three universities in three different countries (Malaysia, Iraq, and Oman). The academic experts have substantial research experience, and are engaged in consulting work in the fields of corporate sustainability and risk management. The industry practitioners are also well grounded in their respective fields, and all of them are qualified accounting professionals. Table 4.1 displays the background of the experts.

These professionals were provided with the details of the research instrument. They were briefed on the proposed experiment and encouraged to comment on the research instrument designed for this study. The experts all confirmed that linking risk with sustainability was crucial for managers when they were to take any investment decisions. Furthermore, they opined that their experience suggests that decision-makers who were tasked to achieve environmental objectives are likely to be influenced by sustainability and risk information when selecting new projects. Most of the experts felt that in order to achieve shareholder expectations in publicly listed manufacturing companies, greater weight is likely to be given to financial criteria, customer-based considerations, excellence in operational processes, improvement of their human resources and risk parameters, compared to environmental objectives. Normally, they would consider environmental objectives only as a reflection of their awareness of environmental impact and to avoid environmental penalties.

Table 4.1: Background of Members of Expert Panel

No.	Background of the Expert	Origin	Years of Experience
ACADEMIC RESEARCHERS			
1	Accounting Professor at University of Baghdad, Department of Accounting, Economics and Management Faculty. Specialist in Management Accounting Techniques.	Iraq	26 years
2	Assistant Professor at International Islamic University, Department of Accounting, Economics and Management Faculty. Specialist in Accountancy.	Malaysia	15 years
3	Assistant Professor at Sultan Qaboos University, Department of Accounting. Has published in reputable journals on corporate sustainability.	Oman	16 years
INDUSTRY PRACTITIONERS			
4	Senior Consultant in Corporate Sustainability at Deloitte Touche Tohmatsu (DTTL), in Oman. Education: FCA From U.K. Advises Clients on Sustainable Business Models.	Oman	26 years

5	General Manager of a U.S.-Based Multinational Company Involved in Manufacturing Earthmoving and Power Equipment. Education: MBA from USA.	Oman	22 years
6	Accounting and Finance Director of Largest Earthmoving Equipment Producer in China. Education: Master's in Accounting and Finance from Tsinghua University. Responsibilities include preparing GRI Compliance Reports on Sustainability.	China	33 years

4.5.1 Specific Feedback from Experts Regarding the Instrument

The first comment obtained from the expert panel was that the explanation of the hypothetical investment scenario should be explained in further detail in a more easy to understand manner. This is because from the initial reading of the passages, the writing style seemed more suited to an academic audience, which the industry practitioners may not be accustomed to. The expert suggested that the related passages be re-written in a simpler style and with shorter sentences. Among the reasons pointed out is that many of the respondents in the study are from different countries whose native tongue is not English, and even though they are fluent in English, the phrases used often take time to understand. The expert especially suggested that acronyms being used should be written in full. Based on this input, the instruction passages were re-written in a manner that would take less effort to understand.

The second feedback obtained suggested that the scenario of the SBSC consisted of two paragraphs that provided the participants with an introduction to the concept of SBSC, which have been reduced to one paragraph, following the expert suggestion. This is due to the fact that providing them with greater background would enable them to answer all the questions correctly. Making it quite difficult to distinguish between knowledgeable and non-knowledgeable participants and the validity of the results would be questionable.

Third, an expert suggested adding the phrase 'financial and non-financial performance measures' to the question regarding the usage of SBSC (i.e., Q: '*In your professional career have you ever used Sustainability Balanced Scorecard for performance measurement?*'). The reason behind this is simply because most sustainability professionals have used the sustainability-balanced scorecard several times but they may not necessarily know its' academic name and this point has been taken in consideration.

Fourth, after the participants were asked to allocate funds for both investments, a question was added for their choice of money allocation as suggested by an expert. This suggestion is to make sure that there is no presence of a third factor other than risk and environmental perspective to properly achieve the aim of this research.

4.6 Experimental Research Sample Size

Quantitative research is focused on detecting the occurrence of certain population phenomena by analysing data from a sample, and statistical power analysis techniques are used by researchers to evaluate hypotheses and make decisions to accept or reject such hypotheses (Creswell, 2014). Researchers should initially decide on an adequate sample-size needed for sufficient statistical power to ensure that valid and reliable results are obtained (Charan and Kantharia, 2013).

G*Power version 3.0 (Faul et al., 2007) is an excellent freeware program that allows the calculation of the optimum statistical power at the moment that the research is designed, with high-precision power and sample size analyses.

Ensuring that an experiment uses a large enough sample size to ensure reproducibility is a critical aspect of experimental design. Power, or the ability to reliably detect differences between experimental groups, is dependent upon several factors:

- Sample size (n) - the number of subjects in each experimental group
- Effect size - the magnitude of the difference between groups (including the variance of the data, as appropriate)
- α - the probability of a false positive finding (Type I error - incorrectly rejecting the null hypothesis), typically set at 0.05
- β - the probability of a false negative finding (Type II error - incorrectly supporting the null hypothesis), typically set at 0.2-0.1
- Power (1-β) - related to the probability of detecting a true positive (correctly rejecting the null hypothesis), typically set at 0.8-0.9.

In this research, the main statistical method was based on two-way analysis of variance (ANOVA). G*Power (Ver. 3.1.9.2) was used to calculate the minimum sample size based on power analysis, which was achieved through the preliminary study (effect size f= 0.39). The computed result suggested twenty-two per group, meaning that a total of 88 participants as the minimum sample in this study as it has been divided into four groups (Figure 4.1). Considering a 20% dropout rate, the overall targeted sample size for the current study was considered as twenty-seven in each group for a total of 108. Thus, sample size adequacy was met.

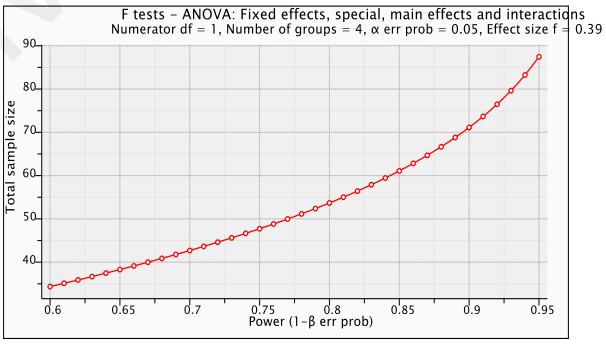


Figure 0.1: Results of G* Power Analysis

4.7 Participants and Design

In total, 108 participants were drawn from a pool of manufacturing companies that are among the largest in their industry. In this case they are: Caterpillar, Volvo, Hitachi, Komatsu, Terex, Mitsubishi and Liebherr. The reason for only selecting managers from such large organizations is because:

(i) Such organizations are publicly listed companies and are under pressure from stakeholders to pursue sustainable business practices and at the same time have in place elaborate risk management programs.

(ii) Such firms typically attract the best and the brightest in the industry. Having talented decision-makers in the pool of respondents will ensure that the participants comprehend the requirements of the experimental study procedures.

(iii) Large organizations usually have highly structured systems in place which mandate that the strategies adopted by management are constantly being evaluated. Hence the likelihood of SBSC being used in the organization is more probable.

(iv) Lastly, due to the sheer scale of operations of such companies, they usually achieve economies of scale that allows them the flexibility of introducing new performance evaluation tools into their process improvement programs.

Participants selected are all senior level managers (e.g., general manager) working in their respective firms where they frequently evaluate organizational performance and have exposure to using BSC as an analysis tool, either in its original form or a customized version of the same.

Research questions and hypotheses have been examined by using a 2×2 matrix format between-subjects experiment. The two independent variables are types of SBSC architecture (SBSC-4 and SBSC-5) and risk indicators (SBSC architecture without/ with

risk). All conditions included financial, customer, internal business, learning and growth and environmental perspectives. The measurements included financial and non-financial quantitative data (shown in Table 4.2). The purpose of these conditions was intended to achieve unambiguous results from evaluations by managers.

Table 0.2: **Measurement Metrics for Each Perspective of SBSC-4 & SBSC-5**

Perspective	Metrics
Financial	• Return on investment
	• Annual cash flow increase
	• Sales growth
	• Payback period
Customer	• Customer satisfaction rating
	• Percentage of sales to new customers
	• Customer referrals
	• New product offers to customers
Internal Business Processes	• Time to process customer order
	• Annual number of stock outs for an order
	• On-time deliveries as a percentage of all deliveries
	• Time to launch new products to market
Learning and Growth	• Employee turnover
	• Number of employee training certifications
	• Employee satisfaction
	• Annual production employee work-related accidents
Environmental	• Energy cost savings
	• Number of community complaints about the company's pollutant emissions
	• Annual tons of nitrogen dioxide emissions
	• Number of training hours per factory employee for environmental emergency responses

Note: In the SBSC-4 architecture, the four metrics in the environmental perspectives were distributed into the traditional four perspectives as follows: an energy cost savings metric was included in the financial perspective; the number of community complaints about company pollutant emissions metric was included in the customer perspective; the annual tons of nitrogen dioxide emissions metric was included in the internal business processes perspective; and the number of training hours per factory employee for environmental emergency responses metric was included in the learning and growth perspective. The environmental perspective was only included in the SBSC-5 architecture.

4.7.2 Case Scenario and Alternatives Presented

To examine the judgmental effects of SBSC architecture on environmental investment decision-making, a hypothetical case scenario approach was used following procedures deployed by Alewine and Stone (2013) and Cheng et al. (2018). Participants were required to assume the role of a manager for a hypothetical organization, Company ABC. As managers, they had to decide how to allocate $20 million between two proposed investment projects (Investments A and B). The amount of money invested in each project had to be aligned with the company's two strategic objectives: financial success and environmental stewardship.

In order to understand the justification for selecting an investment amount of US $ 20 Million to be allocated by the experimental participants, Professors Hank Alewine and Professor Dan Stone; authors of Alewine and Stone (2013), were asked through e-mail to explain why and how they selected the number $ 20 Million in their experiment. Both authors replied to the query and explained that the amount is an arbitrarily selected number, and could be any number for that matter. The amount was selected to be a large amount to impress upon the participants that the impact of their decision could have significant financial implications for the firm. However, the authors also clarified that any number could have been selected, and it would have no bearing on the outcome of the study, as the objectives of the study have nothing to do with this investment amount. Copies of e-mail exchanges with the authors are attached in Appendix-C.

The participants, as indicated earlier, were given the instrument, which contained either SBSC-4 or SBSC-5 architectures (depending on the randomized

condition presented to them). Each perspective contained four measurement metrics (shown in Table 4.1), which were derived from prior SBSC research (e.g., Banker et al., 2004; Libby et al., 2004; Kaplan and Wisner, 2009). The measurement metrics in the present study was based on existing literature that encouraged the usage of SBSC for effective environmental investment decisions (Alewine and Stone, 2013; Jiangtao and Pin, 2010; Jassem et al., 2018).

Investment options A and B were presented together to participants so that they could make relative comparisons. Participants were also given a benchmark for each measurement metric, and projected performance measures for investment options A and B. This information could help them to determine which alternative performed better with respect to each measurement. Only one alternative was projected to achieve each performance measure's targeted value. From these two ways of processing the information, participants could determine which alternative performed better with respect to each measurement.

For SBSC architecture, from the customer, internal business, and learning and growth perspectives, one alternative would meet the target in two of the four metrics, while the other alternative would achieve the target in the other two metrics. Unlike SBSC architecture, the risk indicators are not measured by each metrics, but were measured by rating on a scale of 1-25 for each perspective. Thus, the SBSC architecture and risk indicators with respect to these three perspectives (i.e., *customer*, *internal business process* and *learning and growth*), were projected to perform equally for investments A and B.

From the financial perspective of the SBSC architecture, investment B will achieve three out of the four metrics' targets, while investment A will achieve only one of the other financial metrics. For the risk indicators, investment B had less

financial risk compared to investment A. Thereby investment B is better than investment A in terms of a financial as well as a risk perspective.

From the perspective of the SBSC architecture environmental metrics, investment A achieves the target of three out of the four targets of the metrics, while investment B achieves only one other environmental metric. For the risk indicators, investment A had less environmental risk compared to investment B. Hence Investment A may be considered better than investment B in terms of environmental perspective.

To maintain consistency in the experimental design, the SBSC data values were not changed between conditions or participants (e.g., the three environmental measurements that favored one alternative remained the same for all conditions and participants).

This design was chosen to create a trade-off between the entity's two strategic objectives (i.e., financial success and environmental stewardship), where for both the alternatives to be equally successful, they could achieve only one objective, so participants could compare the two investment alternatives. Investment A was better in terms of environmental targets but with higher financial risk, and investment B had less financial risk but it was less effective in terms of environmental targets.

The reason behind the above choice of investment alternatives is to address the research objective of this study, which is to investigate whether managers give higher priority to the alternative that has a higher level of sustainability with higher levels of financial risk or to the alternative that has a higher level of financial achievement with lower risk. It would be quite misleading if a single investment

was considered better in terms of environmental stewardship, but less risky, simply because if we had to be more eco-efficient , for example, the organization may cut the number of operation hours or use recycled raw materials that may affect the quality of the goods produced. This means that investment A carried higher risk than B. Participants were also asked to clarify their reason behind their choice of money allocation to each investment alternative in order to eliminate any third factor that may have influenced their decision making.

Overall, this experimental design directs focus on the environmental parameters and risk information, and specifically, on how the risk information is influenced by differences in data presentation. The research method includes experimental design elements, including random assignment of participants to conditions and the ability to manipulate variables that provide unique strengths in identifying and isolating the causal variables that underlie an effect (Libby et al., 2002). While comparatively rare in environmental accounting research, the unique strengths of experimental designs can help explicate the behavioral and cognitive processes that underlie the effects of information displays on the successful and unsuccessful use of environmental accounting information (Alewine, 2010; Holm, and Rikhardsson, 2008).

4.7.3 Experimental Manipulations

4.7.3.1 Independent Variables

Two independent variables, in this case manipulated variables, were considered:

(a) SBSC architecture (SBSC-4 or SSC-5), and

(b) Presence or absence of risk indicators in the SBSC architecture.

To manipulate the input on risk indicators, they were presented to participants who received them as an additional column in the SBSC architecture The risk column

evaluates each SBSC perspective based on a scale of 1 to 25, whereby a score of below fifteen (<15) indicates lower priority of risk and a score of greater than fifteen (>15) indicates higher priority to risk based on two dimensions: likelihood of occurrence and impact if it does occur. Those groups that did not receive any risk information were not presented with an additional column with SBSC architecture.

For manipulating the SBSC architecture, participants received one of the two types of SBSC architecture (either SBSC-4 or SBSC-5). A summary of the four groups with SBSC architecture and risk is displayed in Table 4.3.

Table 0.3: Summary of Experimental Conditions

Conditions	Name	Including Risk	Perspectives No.	Appendix-A
1	SBSC-4 without risk	No	4	Group 1
2	SBSC-4 with risk	Yes	4	Group 2
3	SBSC-5 without risk	No	5	Group 3
4	SBSC-5 with risk	Yes	5	Group 4

4.7.3.2 Dependent Variable: Environmental Investment Decision-Making

This study consists of a single dependent variable; that is the investment outcome aimed at achieving the environmental goals of the organization.

The dependent variable was measured by looking at the money allocation (out of a total amount of $ 20 million) for the two investments A and B. The participants allocated an amount out of this $ 20 million to both A and B based on their judgments about the optimum results in terms of environmental stewardship and financial goals.

In the case of SBSC-4 (with risk indicators), environmental parameters are embedded within the four other perspectives of BSC where financial risk appeared to be prominent. In investment A, financial risk was greater (>15) in comparison to that of

investment B (<15). Hence, based on the premise of loss aversion (i.e., Prospect theory), decision-makers would be expected to allocate more money to investment B compared to investment A, if they prioritized avoidance of financial risk compared to environmental risk.

In the case of SBSC 5 (with risk indicators) investment A's financial risk was >15 and environmental risk <15, while investment B's financial risk was <15 and the environmental risk was >15 (i.e., the opposite). This study predicts that managers will give more weight to investment B compared to A because individuals might be willing to sacrifice some of their organization's environmental objectives in order to minimize to financial risks. This assumption is based on the loss aversion component of the Prospect Theory.

4.7.4 Mediating Variable: SBSC Knowledge

To measure the mediating role of SBSC knowledge between the SBSC architecture and the environmental investment decision outcome, a set of true or false questions have been adapted from Alewine and Stone (2013) as shown in Table 4.4.

Table 0.4: Binary Items for Measuring SBSC Knowledge

Item Number	Question	Binary Response (True or False)
1	SBSC can be used as a multi-criteria framework for evaluating investment opportunities.	
2	SBSC provides measurements, but these measurements do not have to help achieve business objectives.	
3	SBSC is a way that managers can evaluate investment opportunities.	
4	Companies can use SBSC to help managers make decisions in meeting the company's targets.	
5	SBSC might help managers in making environmental investment decisions.	
6	SBSC evaluates investment opportunities based on financial measures only.	

4.8 Procedure for Recruitment of Participants

Assistance was sought from a senior external consultant with a working network of multinational companies involved in manufacturing earthmoving equipment such as excavators and bulldozers. This consultant previously held very senior level positions at more than one of these firms. Through the help of this consultant, appointments were made with the intended participants who were promised confidentially and were given a USD $100 gift voucher for participating in this study.

After the finalization of experimental instrument for this study through feedback from the expert panel mentioned in section 4.4.1 of this chapter, 108 managers agreed to participate in the experiment from two separate corporate seminars. The participants were senior managers who work in the manufacturing sector and are accustomed to dealing with sustainability parameters in their respective organizations. Due to the fact that experience can lead to more informed and effective environmental investment decision-making, in this study their experience was taken into consideration during the selection. Based on Schaltenbrand et al., (2018), managers who have greater experience in sustainability perspectives compute better outcomes, compared to less experienced managers.

4.8.1 Experimental Procedures

In the first step, the participants were randomly assigned to one of the four conditions mentioned earlier in Table 4.2. All participants were asked to answer the demographic questions that were adapted from Alewine and Stone (2013) and Gagne et al.(2006) .The demographic data was comprised of the following information: number of years of work experience, age, gender, highest educational level, and their experience in using SBSC in their field. The participants were also required to provide their email address. Typically, in experimental research, the identity of the respondents is better kept confidential, and in fact, participants normally want to remain anonymous.

Nevertheless, in this case, all the participants were promised that they would be provided a copy of the outcome of the study, and as a result, it was necessary to retain the e-mail addresses of the participants.

Next, to measure the mediator (SBSC knowledge) for this study, the participants were given an introduction to the SBSC concept as one of the common ways to evaluate investments opportunities and test the participants' current knowledge of SBSC by answering objective questions.

Participants were then tested on SBSC concepts based on the scenario given. Related to this are three filter questions which would indicate whether the participant actually had a sound grasp about SBSC. Participants were then given a write-up on ABC Company's two strategic objectives, which emphasized the company's goals of financial success and environmental stewardship. In their role as a manager for this company, they were required to allocate investment funds based on the company's strategic objectives and the information presented in the SBSC architecture. During the experiment, participants had a total pool of $20 million to allocate to either of the two investment projects (A or B) based on their judgements on the alternatives provided. Once the experiment was completed, the time spent on the instrument by each participant ranged from 45 minutes to one hour and ten minutes. Finally, the participants were asked to give their opinion on how easy or difficult it was to understand and work with the instrument on a scale of 1-100.

4.9 Data Analysis Procedure

SPSS was used to generate descriptive statistics in the forms of mean-scores and standard deviation, and to describe the demographic characteristics. The non-parametric statistical methods were used when describing and analyzing data that were not normally distributed and were on a nominal or an ordinal level. A Chi-Square test was

used to identify the difference among groups for demographic characteristics. Prior to data analysis, all required statistical assumptions were tested.

To compare between the levels of the two factors and their interaction on dependent variables, a two-way ANOVA was applied followed by Bonferroni post hoc test using SPSS (v.22). While the mediation analysis and the moderated-mediation effect was analyzed by using PROCESS Macro in SPSS (Hayes, 2013). Therefore, hypotheses (H1a, H1b, and H3) will be tested using the two-way ANOVA, while hypotheses (H2a, H2b) will be tested using Model-4 of Hayes PROCESS Macro and hypotheses (H-4) is tested using Model-8 of Hayes Process Macro.

4.9.1 Hayes Process Macro (SPSS)

The SPSS Macro, popularly known as 'PROCESS', is a computational tool for path analysis-based moderation and mediation analysis as well as for their combination (conditional process model) (Hayes, 2013). It utilizes an ordinary least squares logistic regression-based analytical framework to estimate the direct and indirect effects in conditional process models (Hayes, 2012). PROCESS provides many of the capabilities of existing programs and tools while expanding the number and complexity of models that combine moderation and mediation (''mediated-moderation'' and ''moderated-mediation'') as well as dichotomous outcomes.

PROCESS offers many of the features of SOBEL (Preacher and Hayes, 2004), INDIRECT (Preacher and Hayes, 2008), MODPROBE (Hayes and Matthes, 2009), MODMED (Preacher et al., 2007), and MED3/C (Hayes, et al., 2011) while greatly expanding the number and complexity of the models that PROCESS can facilitate and estimates the indirect effect by using the SOBEL test and a bootstrap approach to obtain the confidence interval (CI) and to incorporate the stepwise procedure suggested by Baron and Kenny (1986).

Bootstrapping has been advocated as an alternative to normal-theory tests of mediation (Preacher and Hayes, 2004). Because a conditional indirect effect is merely the product of two causal path estimates conditioned on the value of one or more moderators, bootstrapping can be applied just as readily to the assessment of conditional indirect effects as it can to unconditional indirect effects.

Moreover, the Bootstrapping method is superior to Sobel's test because it is a non-parametric test that does not require a normality assumption and is applicable to small sample sizes. It also increases the power of the test (Hair et al., 2014; Hayes and Matthes 2009; Shrout and Bolger, 2002; Zhao et al., 2010). Normally, the sample size of an experimental method is small compared to other research methods, and thus, SPSS is suitable for this research (Preacher and Hayes, 2008).

This study will use the Model-4 to test for H2a and H2b from Hayes PROCESS Macro in SPSS (Hayes, 2013). To test for the mediation effect of SBSC knowledge, the Hayes PRCOESS Macro (Model-4) shown in figure 4.2 resembles a simple mediation model where the significance of the mediation effect will be determined through bootstrapping (Hayes, 2017).

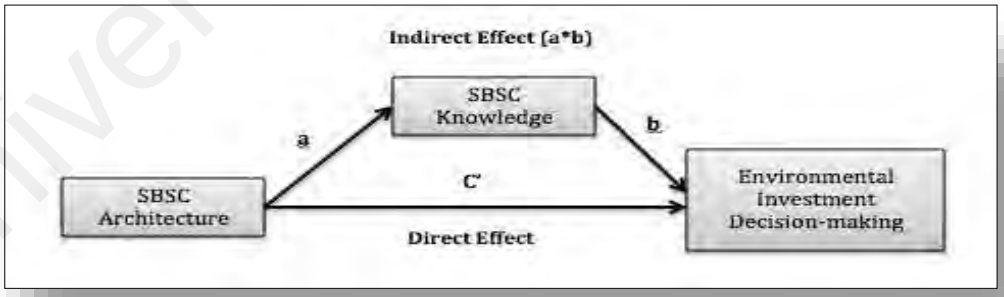


Figure 4.2: Hayes Model-4 (Simple Mediation Analysis)

4.9.1.1 Conditional Process Hayes Model-8 (Moderate-Mediation)

This model is based on the premise that when both a mediation component and a moderation component are incorporated together in one model, it is known as a

conditional process model (Hayes, 2017). This model revolves around the fact that the direct and/or indirect effect of independent variable X on dependent variable Y through a mediator M is moderated by one or more variables (Hayes, 2013). In other words, a conditional process model is used to explain the causal relationship between four variables (independent variable, moderator, mediator and dependent variable).

Therefore, when the treatment effect of an independent variable X on an outcome variable Y via a mediator variable M differs depending on levels of a moderator variable W, this means that mediation of the effect of X on Y is moderated, and this phenomenon called moderated-mediation. This is different from mediated-moderation, which refers to the phenomenon in which the product of X and a moderator of X's effect W on Y carries its effect on Y through M (Hayes, 2013).

According to (Baron and Kenny, 1986), a pre-existing condition of mediated-moderation is the occurrence of overall moderation between the independent and dependent variables. The effect of the independent variable on the dependent variable crucially depends on the moderator variable. There are at least three different types of mediated-moderation models: between the independent and mediator variables, between the mediator and dependent variables, or both (Muller et al., 2005). In contrast, according to Hayes (2013), moderated-mediation occurs when two predictor variables are being correlatively influenced by a mediator variable, which in turn influences an outcome variable. The main difference that could possibly distinguish moderated-mediation from mediated-moderation is just perspectives on the same interaction.

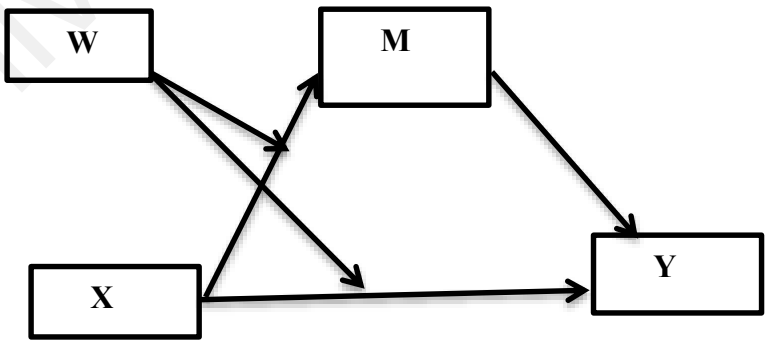
According to Hayes, (2013), the indirect effect of a product in mediated-moderation is quite absurd because the interaction between independent variable X and moderator W is not a measure of significance. However, in a conditional process model, the indirect effect of the product can be presented as an approximated difference between conditional indirect effects in a moderated-mediation process. Thus, Hayes

(2013; 2018) recommends that questions about mediated-moderation should be reworked in terms of a moderated-mediation process. This eliminates the spotlight on the pointless XW as the causal agent and redirects it towards X where it originally stands.

Andrew Hayes makes a good argument in favor of the moderated-mediation perspective as being the more useful approach to adopt. When Hayes (2013) conducted a comparison between moderated-mediation and mediated-moderation model, he suggested that, moderated-mediation model targets on the conditional nature of an indirect effect and how an indirect effect is moderated. The author further states:

> "Focus in mediated-moderation is these estimations of the indirect effect of the product of X and W. However, what degrades this model is that the mediated-moderation as a concept is that the product of X and W is meaningless. It is not a measure of anything". (Hayes, 2013; p.387)

Therefore, based on the above arguments, this study proposes to use the "Moderated-Mediation Model" which is Model 8 (Figure 4.3) in PROCESS Macro by Hayes (2013) to test H-4, as it seems to be the most suitable model to deploy in light of the explanations stated in the preceding paragraphs.



Source: Hayes (2013)

Figure 0.3: Conditional Process Moderated-Mediation Model-8

4.10 Chapter Summary

This chapter presented a brief discussion on the research design and methodology employed for testing the hypotheses drawn from the theoretical framework, where the model is proposed to determine the influence of SBSC architecture (SBSC-4 and SBSC-5) on the environmental investment decision. As the study is based on the experimental method, the entire experimental procedure is explained along with how the moderating effect of risk, as well as the mediating effect of SBSC knowledge, is tested in one integrated model using the moderated-mediation model developed by Hayes (2013).

An important discussion in the chapter was related to the justification for selecting the target participants of this study and how they were recruited. It was highlighted that this experiment actually used real-world managers who use SBSC in their work functions, instead of using students as surrogates for managers, which has been the case in the majority of the previous studies. Additionally, it was justified why the participants were only recruited from large manufacturing companies where BSC are routinely used.

The case scenario for the participants is explained and how the scenario is presented to the managers is discussed. The chapter also explains how the independent variables are used to manipulate the experiment, and the measurement of the other variables in the model. The following chapter presents analysis of the data.

CHAPTER 5: DATA ANALYSIS AND RESULTS

This chapter reports the results of the data analysis and evaluates them according to the research objectives and hypotheses drawn and presented in the preceding chapter. Quantitative analysis through experimental technique was used to derive the results and they are presented in two main sections. The first section presents how the data was cleaned and prepared for analysis, followed by the features of the data and quantitative results of the study including preliminary analysis and descriptive data. In the descriptive section, variables of the study are examined and statistical parameters such as frequency, percentage, mean, and standard deviation are determined. In the second section, inferential statistics were applied to evaluate the outcome of the research hypotheses posited in the theoretical framework, firstly by using a two-way analysis of variance (two-way ANOVA) using SPSS (v.22), and secondly, by applying a moderated-mediation analysis using PROCESS Macro (Hayes, 2013).

5.1 Initial Data Screening

The researcher established contact with 108 managers at multinational companies in two different regions of Asia (Oman and China) to conduct the experimental procedures stipulated for the current study. The first set of participants comprised of 43 individuals in Muscat, Oman, were senior managers from multinational manufacturing companies based in GCC (Gulf Cooperation Council) countries. The experimental study was facilitated by a consultant at a seminar organized for managers of large equipment manufacturing firms. After initial screening, it was determined that 39 of the participants are qualified for the experiment, and the remaining 4 were not included because they did not meet the inclusion criteria. The first group will be known as '*Experimental Group-1*'.

After a period of two months, the second phase of the experiment was conducted in China with managers who work in large multinational manufacturing companies that

produce earthmoving equipment and power generators, etc., such as Caterpillar, Volvo, Hitachi, Mitsubishi, etc., were attending another seminar. In the second seminar, 65 potential participants were approached, where the willing participants were managerial decision-makers in large manufacturing companies. Also, in this case, after the initial screening, responses from 10 individuals were excluded from the study, as they did not meet the inclusion criteria. Thus 55 remaining participants from the second group took part in the experiment in this part of the study. The participants from the second seminar will be known as '*Experimental Group-2*'. Therefore, the final tally of qualified participants in the experimental procedure was 94, combining both experimental groups 1 and 2.

A sample t-Test was conducted to determine if the mean scores of the two experimental groups were significantly different. The results of the t-Test (Table 5.1) indicated that there was statistically no significant difference between the mean values of the groups. The idea behind conducting the t-Test is to demonstrate homogeneity between the both experimental groups.

Table 0.1: **Comparison Between Experimental Group-1 and Group-2**

Variables	Place	N	Mean	SD	t-value	p-value
Investment B	**Group 1**	39	11.641	4.487	0.534	0.595
	Group 2	55	11.218	2.462		
Investment A	**Group 1**	39	8.359	4.487	-0.534	0.595
	Group 2	55	8.782	2.462		
Knowledge	**Group 1**	39	3.641	1.784	0.312	0.756
	Group 2	55	3.545	0.812		

Significance at $p < 0.05$. Mean & SD values shown in $ millions

5.2 Background of the Respondents

This section displays pertinent demographic variables that were generated by deriving descriptive statistics separately for each of the four (4) groups in this experimental study (*SBSC-4 without risk, SBSC-4 with risk, SBSC-5 without risk, and SBSC-5 with risk*). The four (4) groups were compared to determine if they were demographically homogeneous by using the Chi-Square test (Rana and Singhal, 2015). According to the results (Table 5.2), there was no significant difference between the four groups for all demographic variables. Therefore, it can be concluded that all four groups were homogenous in terms of their demographic features.

Table 0.2: Results for Homogeneity of Groups for Demographic Variables

Variable	Level	SBSC-4		SBSC-5		$\chi 2$	p value
		without risk	with risk	without risk	with risk		
Age	30-50	19(86.4)	16(69.6)	14(58.3)	21(84)	6.409	0.093
	51-71	3(13.6)	7(30.4)	10(41.7)	4(16)		
Gender	Male	21(95.5)	19(82.6)	23(95.8)	19(76)	6.204	0.102
	Female	1(4.5)	4(17.4)	1(4.2)	6(24)		
Profession	Accounting	4(18.2)	2(8.7)	2(8.3)	3(12)	22.208	0.102
	Finance	4(18.2)	4(17.4)	3(12.5)	4(16)		
	Operations	1(4.5)	3(13)	3(12.5)	6(24)		
	General Mngt.	9(40.9)	5(21.7)	15(62.5)	10(40)		
	Marketing	4(18.2)	7(30.4)	1(4.2)	2(8)		
	HRM	0(0)	2(8.7)	0(0)	0(0)		
Experience	Below 10	6(27.3)	6(26.1)	5(20.8)	1(4)	5.403	0.145
	10 and Above	16(72.7)	17(73.9)	19(79.2)	24(96)		
Degree	Undergraduate	9(40.9)	11(47.8)	9(37.5)	10(40)	14.270	0.113
	Postgraduate	13(59.1)	10(43.5)	11(45.8)	8(32)		

5.3 Results of the Descriptive Statistics

Table (5.3) shows the central tendency (mean) and dispersion from the mean (standard deviation) of the data on environmental investment decision-making. Based on this table, the mean of Investment-B appears to be higher than the mean of Investment-A for both without and with risk in the case of SBSC-4. The results also indicate that majority of the participants assigned to SBSC-4 (with and without risk) chose investment-B over investment-A, while participants assigned to SBSC-5 the group without risk prioritized investment-B over A. However, participants using SBSC-5 (with risk) selected investment-A over B. The implications of this finding will be discussed in chapter-6.

Table 0.3: Descriptive Statistics of Environmental Investment Decision-Making

SBSC Type	Risk	Investment A		Investment B	
		Mean	SD	Mean	SD
SBSC-4	Without risk	8.409 (42)	2.922	11.591 (58)	2.922
	With risk	5.521 (27.6)	1.647	14.478 (72.4)	1.647
SBSC-5	Without risk	12.833 (64.2)	1.786	7.167 (35.8)	1.786
	With risk	7.56 (37.8)	2.123	12.44 (62.2)	2.123

The next set of statistical distribution data is on the distribution of the correct answers to all six items related to the measurement of SBSC knowledge among four groups (*SBSC-4 without risk, SBSC-4 with risk, SBSC-5 without risk, and SBSC-5 with risk*). Table (5.4) shows the results, which indicate that the highest percentage of correct answers were recorded in the cases of items no. 4 and no. 3, with more than 90% observed in group 2, while the lowest was observed in item no. 6 for all groups.

Table 0.4 : Descriptive Statistics of Items Related to the SBSC Knowledge Scale

	SBSC-4		SBSC-5	
	Group-1	**Group-2**	**Group-3**	**Group-4**
	Without risk	With risk	Without risk	With risk
Item1	77.3	82.6	66.7	84
Item2	40.9	73.9	33.3	32
Item3	59.1	91.3	37.5	68
Item4	63.6	95.7	58.3	68
Item5	63.6	87	37.5	60
Item6	31.8	65.2	33.3	28

5.3.1 Relationship between the SBSC Perspectives, Risk, and Environmental Investment Decision-Making

Pearson correlations (also referred to as Pearson's 'r') was applied to study the presence of linear relationships and also to determine the statistical significance of relationships between the perspectives of SBSC architecture with environmental investment decision-making. The correlation helps to clarify how the variables are related in strength and magnitude (Gogtay and Thatte, 2017). The correlations coefficient (r-values) ranged from -1 to +1. As depicted in Table 5.5 below, this study found a significant and negative relationship between the 'internal business processes perspective' and environmental investment decision-making ($r = - 0.249$, $p = 0.015$). The results also revealed there is also a negative and significant relationship between 'sustainability perspective' and environmental investment decision-making ($r = - 0.335$, $p = 0.001$). Similarly, 'risk' also showed negative but statistically significant results ($r = - 0.339$, $p = 0.018$). The only positive (but non-significant) coefficient was observed in the case of 'financial perspective', which if analyzed as a one-tailed test may become significant. The possible explanation for the directions of the coefficients is that this

type of investment decision is more a part of corporate strategies rather than strategies at the business unit level.

Table 5.5 : Pearson Correlation Coefficient Between Perspectives of SBSC Architecture, Risk & Environmental Investment Decision-Making

SBSC Perspectives	R	p-value
Financial	0.182	0.079
Customer	-0.163	0.118
Internal Business Process	-.249*	0.015
Learning and Growth	-0.086	0.41
Environmental	-.335**	0.001
Risk	-.339*	0.018

* p < .05, ** p < .01

5.4 Normality Test

According to Stevens (2012), it is necessary to evaluate the normality test of all research variables before using statistical methods, especially for inferential statistics. Normality defines the normal distribution of the values of variables. In this experimental study, the common rule-of-thumb for statistical normality was considered, where the skewness and kurtosis are to be within the range of -2 and +2 (Mallery and George, 2003). The results showed that the skewness test was within the range of -0.975 to 0.975 and also the kurtosis test produced a range of -1.746 to 1.114 for all research variables (Table 5.6). This means all variables were distributed normally.

Table 5.6: Normality Test for IV, Mediator & DV

Groups	Variable	Skewness	SE	Kurtosis	SE
SBSC-4 without risk	Investment A	0.624	0.491	-0.073	0.953
	Investment B	-0.624	0.491	-0.073	0.953
	Knowledge	0.249	0.491	-0.682	0.953
SBSC-4 with risk	Investment A	-0.342	0.481	-0.387	0.935
	Investment B	0.342	0.481	-0.387	0.935
	Knowledge	0.089	0.481	-1.746	0.935
SBSC-5 without risk	Investment A	-0.427	0.472	-0.616	0.918
	Investment B	0.427	0.472	-0.616	0.918
	Knowledge	-0.545	0.472	0.061	0.918
SBSC-5 with risk	Investment A	-0.957	0.464	1.114	0.902
	Investment B	0.957	0.464	1.114	0.902
	Knowledge	0.335	0.464	-0.332	0.902

5.5 Test for Outliers

The process of gathering and entering the data is typically associated with the occurrence of errors, which might cause clearly varying values from the value of the other respondents. Such data are therefore considered as outliers (Hair et.al. 2007). The existence of outliers in a study can affect the validity of the study and therefore it is necessary to identify the outliers and take remedial measures accordingly (Bluman, 2013; Hair, et al., 2007; Kline, 2016; Pallant, 2016).

The univariate outliers were assessed based on the minimum and maximum of the Z-scores of the observed data, as suggested by Kline (2016). Univariate outliers were defined through univariate data (box-plots and standardized Z-scores). Absolute Z-values > 4.0 indicate extreme observations (Hair, 1998). The result (Table 5.7) shows

that the standardized Z-scores of the imputed variables ranged from –2.761 to 1.924, indicating that none of the variables exceeded the threshold.

Table 0.7: Results for Univariate Outliers

Standardized Z-Score	Minimum	Maximum
Investment-A	-1.924	1.862
Investment-B	-1.862	1.924
SBSC Knowledge	-2.761	1.860

One of the common methods used to identify the multivariate outliers' is Mahalanobis distance (Mahalanobis, 1936), which represents the distance from the case to the centroid of variables cases (Hair, et al., 2010; Kline, 2016). This method requires plotting the Mahalanobis distance value against Chi-square percentile points to determine which cases are outliers. Following the previous method, the SPSS (Version 22) program was used to investigate the values of the Mahalanobis distance, which resulted in values located between 0.119 and 7.966. These values were then compared with the critical value on Chi-square at 0.001. By doing so, the results indicated that all values are less than the critical value 13.81 (Brereton and Lloyd, 2016), which gives a clear indication that each case is not significantly separated from the rest of data, which, in turn, leads to the conclusion that there are no outliers' in the remaining dataset.

5.6 Homogeneity Test of Variance

The assumption of homogeneity of variance is that the variance within each of the populations is equal, which is an assumption of analysis of variance (ANOVA) (Kim and Cribbie, 2018). ANOVA works well, however its assumption can be violated, in the case where there are unequal numbers of subjects in the various groups (Gonzalez-Espada and Oliver, 2002). There needs to be homogeneity of variances for each combination of the groups (Kim and Cribbie, 2018). This assumption in SPSS statistics

can be tested using Levene's test for homogeneity of variances (Jayalath et al., 2017). Levene's Test of Equality of Error Variance (Table 5.8) shows that for research variables, the error variance was equal across the groups, meaning that the assumption of homogeneity of variances was met.

Table 0.8: Levene's Test of Equality of Error Variances

Variables	F	df1	df2	p-value
Investment-A	2.583	3	90	0.058
Investment-B	2.583	3	90	0.058
SBSC Knowledge	1.256	3	90	0.294

Significance at $p < 0.05$

5.7 Hypothesis Testing

The effect of SBSC architectures (both SBSC-4 and SBSC-5) along with two factors (without risk and with risk) on environmental investment decision-making were analyzed based on two-way ANOVA (also known as two-factor ANOVA). A two-way ANOVA compares the mean difference (MD) between groups that have been split on two independent variables (or factors) as in the case of this study (Kim and Cribbie, 2018). The main purpose of such a test is to understand if there is an interaction between the two independent variables on the dependent variable. Furthermore, the two-way ANOVA assumes normal distribution of data and also homogeneity of variance (Kim, 2014). Tests mentioned in previous sections of this chapter indicate that both conditions are met.

For analysis of the experimental data, Analysis of Variance (ANOVA) is considered one of the most efficient methods (Armstrong et al., 2002). Especially the Two-way (or Two-factor) ANOVA allows flexibility to examine the impact of two or more independent variables on a single dependent variable, with two levels of factors or conditions, as in the case of the current study. Furthermore, this method allows for comparison between pairs of groups through post-hoc tests (Pallant, 2016).

The design of the experiment is based on a factorial design approach (Cohen, 2013). A factorial design represents a study that includes an independent group for each possible combination of levels of the independent variable. The current study follows the approach used by Cohen, (2013). Thus, the two-factor (2×2) factorial design is shown in Figure (5.1), creates four conditions.

Factor A	Factor B	
SBSC Architecture	Risk Levels	
	Without Risk	**With Risk**
SBSC-4	SBSC-4 Without Risk	SBSC-4 With Risk
SBSC-5	SBSC-5 Without Risk	SBSC-5 With Risk

Figure 0.1: 2 × 2 Factorial Design for Two-way ANOVA

The current study considers the effect of two independent variables (SBSC-4 and SBSC-5) on the dependent variable (environmental investment decision-making) at two levels; *without risk* and *with risk*. Therefore, we have two (2) factors; SBSC architecture (SBSC-4 and SBSC-5) and two levels of risk (without risk and with risk). According to Pandis (2015), a Two-way ANOVA typically tests three sets of conditions. The samples across the levels of the first factor are equal (row factor) just like a 1-way ANOVA.

(i) The samples across the levels of the second factor are equal (column factor) just like a 1-way ANOVA.

(ii) There is no interaction between the two factors. No interaction means that the first factor affects the dependent variable, similarly, on average, in each level of the second factor, and vice versa.

Considering the research objectives and the obvious similarity of parameters in the current study, a Two-way ANOVA is deemed to be best suited for this experiment.

5.7.1 Interpreting Results of Two-Way ANOVA Test

Best practices in the interpretation of results of a two-way ANOVA, is explained in detail by Pallant (2016), where the study states that the primary focus is to examine the significance of the '*interaction effects'* and not the '*main effect'*. The significance will be determined by the p-value, where p-values (< 0.05) will be considered significant. Therefore, if an interaction effect is statistically significant, the relationship between a factor and the response differs by level of the other factor. Furthermore, Pandis (2015) states that in a two-Way ANOVA, one must not interpret the main effects without considering the interaction effect.

To test related hypotheses (H1a and H1b), two-way ANOVA was applied (Table 5.9). The results indicate that the interaction between SBSC architecture (SBSC-4 and SBSC-5) and risk (without risk and with risk) on environmental investment decision-making was statistically significant ($F (1, 90) = 7.141$, $p = 0.009$, $\eta 2 = 0.074$). The results also show that the main effect of the SBSC architecture (SBSC-4 and SBSC-5) on environmental investment decision-making was statistically significant ($F (1, 90) = 52.39$, $p < 0.001$, $\eta 2 = 0.368$). Furthermore, the main effect of risk (without risk and with risk) on environmental investment decision-making was significant ($F (1, 90) = 83.541$, $p < 0.001$, $\eta 2 = 0.481$).

Table 0.9 : Summary of ANOVA for Environmental Investment Decision-Making (Test of the Between-Subjects Effect)

Source	df	MS	F-Value	p-Value	η2
SBSC architecture	1	244.807	52.39	<0.001	0.368
Risk	1	390.369	83.541	<0.001	0.481
SBSC architecture* Risk	1	33.37	7.141	0.009	0.074

Dependent Variable: Environmental Investment Decision Making, Significant at p < 0.05

5.7.2 Test of Hypothesis 1 (H-1a & H-1b)

H-1a: When managers utilize SBSC architecture for decision-making, both SBSC-4 and SBSC-5 will have significantly different effects on environmental investment decision-making.

H-1b: When managers utilize SBSC architecture for environmental investment decision-making, the difference between SBSC-4 and SBSC-5 will be significant when risk indicators are presented along with the SBSC architecture.

To compare the impact of SBSC architecture on environmental investment decision making, two-way ANOVA and Bonferroni Post Hoc Test (Lee and Lee, 2018) was applied. Based on the results (Table 5.10), the interaction effect of the SBSC architecture (SBSC-4 and SBSC-5) on environmental investment decision-making was statistically significant (MD = 4.424, η^2 = 0.384, p = 0.001). Therefore, the results suggest that both SBSC architectures (i.e., SBSC-4 and SBSC-5) have significantly different patterns of impact on environmental investment decision-making, thus supporting hypothesis H-1a.

To test the related hypothesis (H-1b), the difference in the interaction effect on environmental investment decision-making for both SBSC architectures (SBSC-4 and SBSC-5) with risk was statistically significant as indicated by the p-values. The mean

difference with risk was significant (MD = 2.038, $\eta^2 = 0.106$, p = 0.002). Therefore, the results indicate that the difference between SBSC-4 and SBSC-5 are significant with risk being presented to decision-makers, thus affirming that H-1b is supported.

Table 5.10 : **Pairwise Comparison for SBSC Architecture and Risk Indicators**

H1	Risk level	SBSC arhitecture		MD	SE	P-value	95%CI for difference LB	UB	η2
H1-a	Without risk	SBSC-4	SBSC-5	4.424*	0.638	0.001	3.157	5.692	0.384
H1-b	With risk	SBSC-4	SBSC-5	2.038*	0.625	0.002	0.797	3.279	0.106

** The mean difference (MD) is significant at the 0.05 level. Adjustment for multiple comparisons: Bonferroni Post hoc Test.*

5.8 Test of Hypotheses 2 (H-2a and H-2b): Mediation Analysis

H-2a: SBSC knowledge mediates the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making.

H-2b: SBSC knowledge mediates the relationship between SBSC architecture (both SBSC 4- and SBSC-5) and environmental investment decision-making when risk indicators are presented along with the SBSC architecture.

To test hypotheses H-2a and H-2b, mediation analysis was undertaken using Hayes and Preacher's (2012) SPSS PROCESS Macro Model 4 as shown in Figure (5.2).

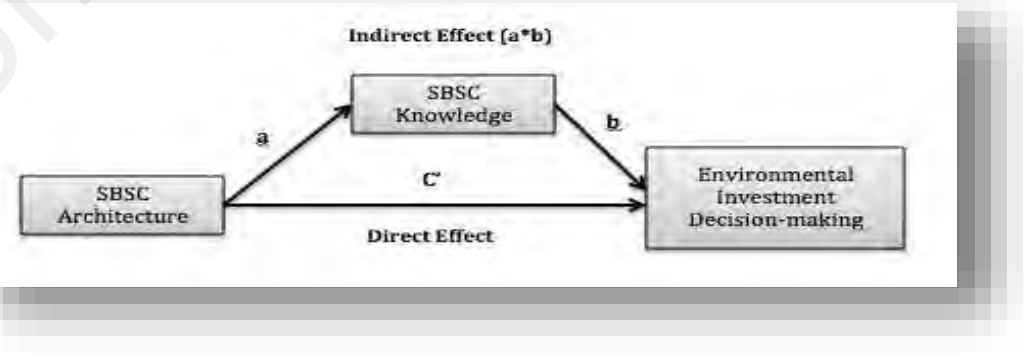


Figure 0.2: Mediation (direct and indirect effects)

The first table below (Table 5.11) shows the computed results from bootstrapping for the mediation effect of SBSC knowledge between SBSC architecture and environmental investment decision-making. The results reveal significant effects of SBSC architecture on SBSC knowledge (IV to Mediator) where (B = - 0.697, $p < 0.05$). Furthermore, SBSC knowledge also significantly affected environmental investment decision-making (Mediator to DV) (B = 1.606, $p < 0.001$). Finally, the results indicated that the direct effect of SBSC architecture on environmental investment decision-making (IV to DV) was negative and statistically significant (B = - 3.305, $p < 0.001$). Additionally, the indirect effect of SBSC architecture on environmental investment decision-making through SBSC knowledge as mediator was also negative and significant (B = - 1.119, $p < 0.001$). Finally, the indirect effect of SBSC architecture on environmental investment decision-making through SBSC knowledge as mediator (IV-Mediator-DV) was negative and significant (B = - 1.119, $p < 0.05$). The above results indicate that SBSC knowledge mediates the relationship between SBSC architecture and environmental investment decision-making. Therefore, hypothesis (H-2a) is supported.

Table 0.11 :Path Coefficient for the Mediation Effect of SBSC Knowledge

Path	B	SE	T/Z	p-value	LLCI	ULCI
IV to Mediators (path a)						
SBSC Architecture ->SBSC Knowledge	-0.697	0.334	-2.085	<0.05	-1.371	-0.023
Mediator to DV (path b)						
SBSC Knowledge --> Env. Investment Decision Making	1.606	0.210	7.641	<0.001	1.182	2.030
Direct Effect (path c')						
SBSC Architecture -> Env. Investment Decision Making	-3.305	0.488	-6.766	<0.001	-4.290	-2.320
Indirect Effect (path ab)						
SBSC Architecture -> Env. Investment Decision Making	-1.119	0.561	-1.996	<0.05	-2.046	-0.165

Significant at 0.05 level

The second table below (Table 5.12) shows the computed results from bootstrapping for the mediation effect of SBSC knowledge between SBSC architecture and environmental investment decision-making when risk indicators are added into the SBSC architecture. The results reveal that in the presence of risk, there was significant effect of SBSC architecture on SBSC knowledge (IV to Mediator) where (B = - 1.557, p < 0.001). Also, SBSC knowledge significantly affected environmental investment decision-making (Mediator to DV) (B =1.633, p < 0.001). Furthermore, the indirect effect of SBSC architecture on environmental investment decision-making through SBSC knowledge as mediator (IV-Mediator-DV) was negative and significant (B = - 2.542, p < 0.001). However, the results indicated that in the presence of risk indicators, the direct effect of SBSC architecture on environmental investment decision-making (IV to DV) was not statistically significant (B = - 0.503, p = 0.323). Therefore, based on the above results, in the presence of risk, SBSC knowledge mediates the relationship between SBSC architecture and environmental investment decision-making (Preacher and Hayes, 2008; Zhao et al., 2010). Therefore, hypothesis (H-2b) is supported.

Table 0.12 : Results of Test for Mediation of SBSC Knowledge between SBSC Architecture and Environmental Investment Decision Making (With Risk)

Path	B	SE	T/Z	p-value	LLCI	ULCI
IV to Mediators (path a)						
SBSC Architecture -->SBSC Knowledge	-1.557	0.252	-6.180	<0.001	-2.064	-1.049
Mediator to DV (path b)						
SBSC Knowledge --> Env. Investment Decision Making	1.633	0.218	7.493	<0.001	1.194	2.071
Direct Effect (path c')						
SBSC Architecture -> Env. Investment Decision Making	-0.503	0.504	-0.999	=0.323	-0.511	1.518
Indirect Effect (path ab)						
SBSC Architecture -> Env. Investment Decision Making	-2.542	0.536	-4.743	<0.001	-3.640	-1.695

Significant at 0.05 level

5.9 Test of Hypothesis 3 (H-3): The Moderating Effect of Risk

Hypothesis (H-3) predicts that '*Risk Indicators*' will moderate the direct relationship between SBSC architectures (both SBSC-4 and SBSC-5) and environmental investment decision-making. Previously, in the results of the two-way ANOVA (Table 5.9), the interaction effect of SBSC*Risk (IV*Moderator to DV) was significant.

Therefore, to test the hypothesis (H-3), a comparison was made between the levels of impact of both SBSC architectures (SBSC-4 and SBSC-5) on environmental investment decision-making at both risk levels (i.e., without risk and with risk) using the Bonferroni Post Hoc test (Table 5.13). Based on the result of Bonferroni test, the difference of environmental investment decision-making with both risk levels (i.e., without and with risk) in case of both SBSC-4 and SBSC-5 were statistically significant (i.e., they were different). This mean difference is observed to be greater in the case of SBSC-5 (MD = -5.273, $\eta^2 = 0.447$) compared to SBSC-4 (MD = -2.887, $\eta^2 = 0.182$). This is also substantiated by the values of the confidence intervals (CI) that do not straddle zero-value (Hair et al., 2017). The negative values of MD shown in the table 5.13, are due to the coding of the variables, for instance SBSC-4 was coded as 0 and SBSC-5 was coded as 1. If the coding of the variables were reversed then the negative signs would have become positive. Hence, only the absolute values of MD are of significance in this particular analysis. The implications of the differences in the mean difference are discussed in chapter-6.

Table 0.13: Pairwise Comparison Between Risk Levels For Both SBSC Architectures

SBSC Architectur	Risk		MD	SE	p-value	95% CI for Difference		η2
						LB	UB	
SBSC-4	Without Risk	With risk	-2.887*	0.645	<0.001	-4.168	-1.607	0.182
SBSC-5	Without Risk	With risk	-5.273*	0.618	<0.001	-6.501	-4.046	0.447

** The mean difference (MD) significant at the .05 level. Adjustment for multiple comparisons: Bonferroni.*

As it can be seen in Figure 5.3, the environmental investment decision-making shows higher values of mean difference (MD) when risk indicators are included with SBSC architectures (for both SBSC-4 and SBSC-5). This means that when risk indicators are presented to decision-makers when they utilize SBSC-4 and SBSC-5 to evaluate between environmental investment-alternatives, the strength of the relationship is influenced. The figure 5.3 shows that in general SBSC-4 has a stronger relationship with environmental investment decision compared to SBSC-5. However, with the inclusion of risk indicators as a moderator, the gradient of the line for SBSC-5 is sharper than the gradient of the line for SBSC-4. This means that the influence of risk indicators is greater on SBSC-5 compared to SBSC-4.

Therefore, risk indicators moderate the above relationship suggesting that hypothesis (H-3) is supported. The implications are discussed in chapter 6.

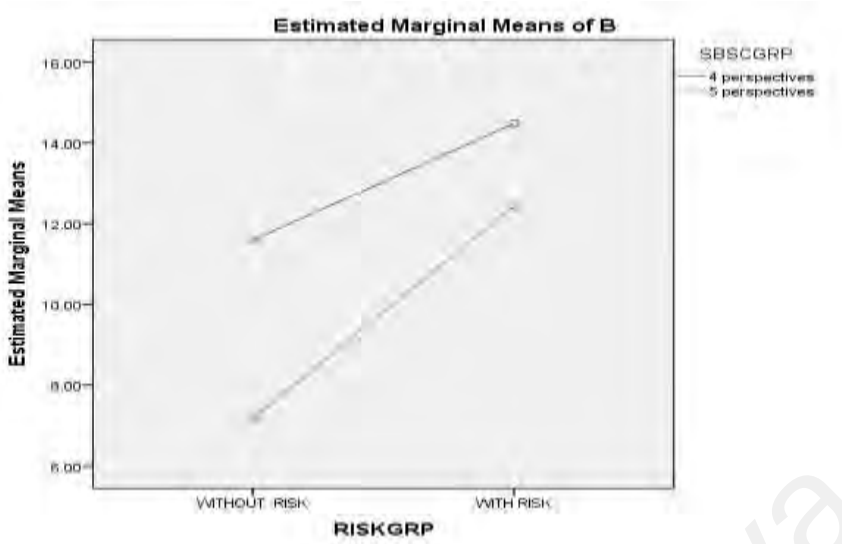


Figure 0.3 : Levels of Environmental Investment Decision Making with SBSC Architecture (*without and with risks*)

5.10 Test of Hypothesis (H-4): Moderated-Mediation Model

Hypothesis H-4 represents an integrated moderated-mediation model. Specifically, it predicts that the SBSC architecture (SBSC-4 and SBSC-5) would affect environmental investment decision-making directly and also indirectly through SBSC knowledge as a mediator, and that such effects are contingent upon presence of risk indicators as moderator on both (direct and indirect) paths**.** Based on the conceptual model for this study, SBSC knowledge is shown as a mediator between SBSC architecture and environmental investment decision-making, while risk is shown as a moderator for both the direct and indirect effects. Therefore, it resembles the Moderated-Mediation Model-8 (conditional direct and indirect effect) under SPSS Process MACRO of Hayes (2013).

The test of this model is performed through two different regression models (Figure 5.4) based on the guidelines of Hayes (2013). The first regression model estimates the following three paths, with SBSC knowledge as the outcome variable: (i) SBSC architecture to SBSC Knowledge (IV to Mediator, without risk), (ii) SBSC architecture with risk to SBSC Knowledge (IV to Mediator, with Risk), and (iii) SBSC*Risk to SBSC Knowledge (Interaction Effect of SBSC and Risk to Mediator).

The second model estimates the following four paths, with environmental investment decision making as the outcome variable: (i) SBSC to environmental investment decision making (IV to DV, without Risk) (ii) Risk to environmental investment decision making (Effect of Moderator on DV), (iii) SBSC*Risk to environmental investment decision making (Interaction Effect of SBSC and Risk on DV), and (iv) SBSC knowledge to environmental investment decision making (Mediator to DV). In order to test the moderated-mediation effect, bootstrapping was used. The bootstrapping method is supported for this type of analysis because the sampling distribution of the conditional indirect effect tends to be irregularly shaped (Preacher et al., 2007), and bootstrapping makes no assumptions regarding a normal sample distribution (Hayes, 2013). The values on the diagram for each path are unstandardized coefficient values (B).

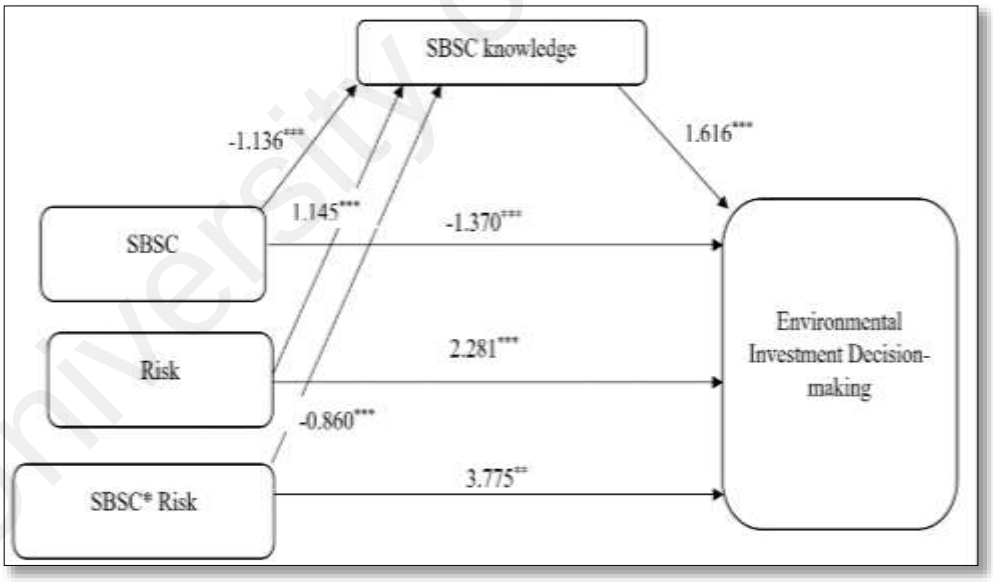


Figure 0.4 : Conditional Process Model-8 (Moderated-Mediation)

Hypothesis (H-4) proposed an integrated moderated-mediation model. Specifically, it predicted that SBSC architecture would affect environmental investment decision-making directly and also indirectly through SBSC knowledge, and these effects are conditional on the presence and absence of risk information. Such effects are

referred to as conditional direct and indirect effects (Preacher et al., 2007). The effects were tested using SPSS Process Macro by Hayes (2013) to assess moderated-mediation based on Model-8. As described in the preceding paragraphs, the Model-8 is tested in phases and the results are displayed below.

The Table 5.14 below displays the results of the first regression model, where SBSC knowledge is shown as the outcome variable. The results show the interaction of SBSC architecture and Risk (SBSC*Risk) having significant effect on SBSC Knowledge (B = - 0.860, p = 0.048). Furthermore, none of the values in the confidence intervals straddle a zero-value, indicating statistical significance. This means that the conditional effect of SBSC architecture on the mediator, are significant.

Table 0.14: **Results of Moderating Effect of Risk with SBSC Knowledge as the Outcome (1st Regression Model)**

	B	SE	t-value	p-value	LLCI	ULCI
Constant	3.585	0.106	33.760	<0.001	3.374	3.796
SBSC	-1.136	0.211	-5.382	<0.001	-1.555	-0.717
Risk	1.145	0.214	5.360	<0.001	0.721	1.569
SBSC *Risk	-0.860	0.424	-2.025	0.046	-1.703	-0.016

Significant at p < 0.05

Table 5.15 displays the results of second regression model, where environmental investment decision-making is the outcome variable. Results show that the interaction effect of SBSC architecture and risk (SBSC*Risk) on the relationship between SBSC architecture and environmental investment decision-making is significant (B = 3.775, p < 0.001). Furthermore, none of the values in the confidence intervals straddle a zero-value, indicating statistical significance. This means the conditional direct effect of SBSC architecture and environmental investment decision-making is significant.

Table 0.15: The Moderating Effect of Risk with Environmental Investment Decision Making as the Outcome (2nd Regression Model)

	B	SE	t-value	p-value	LLCI	ULCI
Constant	5.600	0.712	7.865	<0.001	4.186	7.015
SBSC Knowledge	1.616	0.185	8.729	<0.001	1.248	1.984
SBSC	-1.370	0.388	-3.529	0.001	-2.142	-0.599
Risk	2.281	0.302	7.543	<0.001	1.680	2.882
SBSC *Risk	3.775	0.632	5.971	<0.001	2.519	5.032

Significant at $p < 0.05$

The last part of the analysis requires a comparison between higher levels of the moderator and lower levels of the moderator on the direct and indirect paths together (i.e., the moderated-mediation effect). However, in this case, the moderator is a dichotomous variable (i.e., without risk and with risk) and not a continuous variable. Hence, the conditional direct and indirect effect(s) of SBSC architecture on environmental investment decision-making at values of the moderator (without risk and with risk) were computed (Table 5.16). Upon examination of the confidence intervals, it appears that except for '*direct effect with risk*', all other effects were statistically significant, as the confidence intervals did not straddle a zero-value. All other relationships were significant in the moderated-mediation model.

Table 0.16 : Conditional Direct and Indirect Effect(s) of SBSC Architecture on Environmental Investment Decision Making Without Risk and With Risk

Effect	Risk	Effect	SE	LLCI	ULCI
Direct	Without risk	-3.298	0.511	-4.313	-2.282
	With risk*	0.477	0.490	-0.497	1.452
Indirect	Without risk	-1.126	0.503	-2.276	-0.215
	With risk	-2.516	0.490	-3.570	-1.671

**Direct effect of SBSC architecture (with risk) not significant. Effects are all non-standardized values.*

Table 5.16 shows that, the direct effect of SBSC architecture with risk (B = 0.477, not significant), while the direct effect without risk (B = - 3.298, significant). The indirect effect of SBSC architecture with risk (B = -2.516, significant), while the indirect effect of SBSC architecture without risk (B = -1.126, significant). This means that when the regression models are combined together, all effects are significant except the direct effect between IV and DV with risk as moderator.

The next part of the analysis requires computing the Index of Moderated Mediation (IMM) (Hayes, 2015). The IMM produced by the PROCESS Macro assesses the equality of the conditional indirect effects in the groups being compared. This is especially required when the moderator is dichotomous, as in the case of the current study. IMM is a test of equality of the conditional indirect effects in the two groups. When the index is not significant, these effects are equivalent (Hayes, 2015). According to the results (Table 5.17) of Bootstrapping, it shows that confidence intervals do not straddle zero-value meaning that IMM index was statistically significant. This indicates that there is a significant moderated-mediation effect (Hayes, 2015).

Table 5.17: Index of Moderated Mediation

Mediator	Index	SE(Boot)	Boot LLCI	Boot ULCI
SBSC Knowledge	-1.389	0.717	-2.992	-0.216

In order to provide a visual representation of the results for index of moderated mediation (IMM), Figure 5.5 (below) shows a graph with simple slopes for the direct effects (line on top) and the indirect effect (line on bottom) under two conditions (i.e., without risk and with risk). In the absence of risk indicators, the direct effect has positive value and the indirect effect has negative values. While in the presence of risk indicators, the direct effect becomes more positive while the indirect effect (i.e., through the mediator) becomes more negative. Since, both the lines are not parallel, the index of

moderated mediation is expected to be significant (Hayes, 2015), which has been reported in Table 5.17 (i.e., the confidence intervals do not straddle a zero-value). Therefore, a significant IMM value suggests that there is a significant moderated-mediation effect, indicating that hypotheses H-4 is supported.

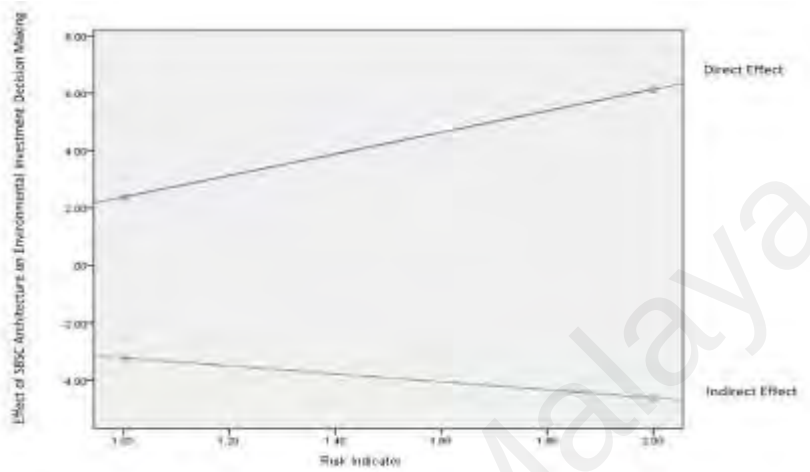


Figure 0.5: **Conditional Indirect and Direct Effects of SBSC architecture (With and Without Risk) on Environmental Investment Decision Making)**

To summarize the results of H-4 presented in the Tables 5.14, 5.15 and 5.16 and visually represented in Figure 5.4, reference is made to Pallant (2016, pp.276-277) and Southwood (1978, pp.1154-1203). The aforesaid authors caution researchers about the difficulties of analyzing the main effect in the presence of an interaction effect. Based on their guidelines, the focus should be on the interaction effect only and hence the reporting for this hypothesis test should be about two paths:

(1.) Path-1: SBSC*risk and SBSC knowledge (Table 5.14)

(2.) Path-2: SBSC knowledge and environmental investment decision-making (Table 5.15).

Therefore, the summary of the results from the above tables and Figure 5.4, are:

1. There is a significant negative impact of the moderating variable SBSC*Risk on the relationship with SBSC knowledge (B = - 0.860).
2. There is a positive and significant relationship between SBSC knowledge and environmental investment decision-making (B = 3.775).

Therefore, there is a significant moderated-mediation effect, and hence the hypotheses (H-4) is supported. Table 5.18 presents a synopsis of the results of all the hypotheses tested in this research.

Table 0.18: Summary of the Results

Hypothesis	Description	Results
H-1a	When managers utilize SBSC architecture for environmental investment decision-making, the difference between SBSC-4 and SBSC-5 will be significant.	SUPPORTED
H-1b	When managers utilize SBSC architecture for environmental investment decision-making, the difference between SBSC-4 and SBSC-5 will be significant when risk indicators are presented along with the SBSC architecture.	SUPPORTED
H-2a	SBSC knowledge mediates the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making.	SUPPORTED
H-2b	SBSC knowledge mediates the relationship between SBSC architecture (both SBSC 4- and SBSC-5) and environmental investment decision-making when risk indicators are presented along with the SBSC architecture.	SUPPORTED
H-3	Risk indicators moderate the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making.	SUPPORTED
H-4	Risk indictors will moderate the indirect effect of SBSC architecture on environmental investment decision-making through SBSC knowledge as a mediator. Therefore, a significant moderated-mediation effect exists.	SUPPORTED

5.11 Chapter Summary

This chapter presented an analysis of the data collected for conducting the experimental study that mainly attempts to determine the answers to several research questions centered around understanding the impact of SBSC architecture (both SBSC-4 and SBSC-5) on environmental investment decision-making, directly and indirectly, with presence of SBSC knowledge as a mediator and risk as moderator. Finally, the chapter also tests the effects of the moderated-mediation of risk and SBSC knowledge on SBSC architecture and environmental investment decision-making.

An experiment was conducted on two separate groups of participants at two separate time periods. The first of group of participants (39 respondents) were from Experimental Group-1, while the second group (55 respondents), and were from Experimental Group-2. A sample t-test revealed that there was no significant difference between the two groups in terms of their response.

Results of the analysis, based on a total of 94 participants, showed that environmental investment decision-making was different based on which SBSC architecture (SBSC-4 or SBSC-5) is being used and this difference is significant whether risk information is presented or not presented to the decision-makers. The results of mediation analysis suggest that SBSC Knowledge mediates the relationship between SBSC architecture and environmental investment decision-making. The results also indicate that 'Risk Indicator' moderates the relationship between SBSC architecture and environmental investment decision-making.

The final hypothesis was a moderated-mediation analysis and it suggests that both the direct effect of SBSC architecture on environmental investment decision-making and the indirect effect through SBSC Knowledge and mediator is conditional upon the risk indicators as moderator. All of the effects were significant except the direct conditional effect (i.e., with risk present).

The detailed discussions on the results shown in this chapter are presented in the next chapter along with the implications of the findings.

CHAPTER 6: DISCUSSIONS, IMPLICATIONS AND CONCLUSION

This chapter discusses the findings derived in Chapter 5, and also presents the implications and conclusions of this research work. The chapter is divided into six sections. The first section presents an overview of the research. The second section elaborates on discussions on the findings. The subsequent sections explain the theoretical, methodological and practical implications of the findings. Section five highlights the limitations of this research work. The signposts for future research directions are suggested in section six, followed by a section that concludes the thesis.

6.1 Overview of the Research

The primary goal of this study is to examine how different SBSC architecture influence decision-making when environmental investment alternatives are being considered that are aimed at forwarding the environmental stewardship goals of a business organization. The study examines two dominant SBSC architectures in the literature; sustainability parameters embedded into the four traditional BSC perspectives (SBSC-4) and sustainability as a stand-alone 5th perspective along with the traditional perspectives (SBSC-5). The first objective of the study is to investigate if SBSC-4 and SBSC-5 are significantly different when decision-makers utilize them to evaluate environmental investment options, and whether the difference remains significant when risk indicators are presented along with the SBSC architecture. The second objective is to determine if SBSC knowledge mediates the relationship between SBSC architecture and environmental investment decision-making, and whether such a relationship remains significant when risk indicators are presented to the decision-makers along with the SBSC architecture.

The third objective of the study is to examine if risk indicators influence (as a moderator) the relationship between SBSC architecture and environmental investment

decision-making. Finally, the research investigates if an integrated framework connecting all the variables emerges where the direct relationship between SBSC architecture and environmental investment decision-making, as well as the indirect path through SBSC knowledge as mediator are significant, when both the direct and indirect paths are moderated by risk. Hence, a significant moderated-mediation effect is posited in the research model.

The relationships between the independent variables, the mediator and the dependent variable in the research framework were developed, by deploying the theoretical lens provided by the ADMF (Payne et al., 1993). The incorporation of risk into the research framework was achieved by leveraging the 'loss-aversion' component of the Prospect Theory along with ADMF (Kahneman and Tversky, 1979).

A set of hypotheses were developed by drawing support from the above-mentioned theories and past empirical works in the literature, and the hypotheses were tested through an experimental research design following the guidelines of similar studies (e.g., Alewine and Stone, 2013; Cheng et al., 2018). The experiment was conducted through participation of 94 out of 108 individuals who serve in managerial positions in globally recognized manufacturing organizations. The participants are currently using BSC in their respective organizations and are familiar with ERM. The careful selection of real-world managerial decision-makers in this study distinguishes this research from most experimental studies in the literature on SBSC that were conducted on students as surrogates for industry practitioners.

The rationale for undertaking this study is based on four (4) important elements, and revolves mainly around the research gaps in the extant literature on SBSC architecture and environmental investment decision-making. First, the literature indicates that empirical studies have presented conflicting findings on whether SBSC-4 or SBSC-5 are significantly different when it comes to utilizing them for environmental

investment decision-making, and whether the differences are significant in the presence and absence of risk indicators. Second, the study explored whether SBSC knowledge mediates the link between SBSC architecture and environmental investment decision-making, which appears to have been overlooked in past research. Third, whether risk indicators moderate the relationship between SBSC architecture and environmental investment decisions has not been dominant in empirical studies on SBSC and environmental investment decision-making behavior. Finally, as far as this researcher has been able to ascertain, no study so far has proposed an integrated framework that demonstrates the relationships between SBSC architecture and environmental investment decision-making when this relationship is mediated by SBSC knowledge while being moderated by risk (i.e., a moderated-mediation model).

Based on a set of research objectives (see Table 6.1), this study presented two different environmental investment options to decision-makers with a total budget of USD $ 20 million. This was to be allocated based on the SBSC architectures presented to the participants of this experimental study (SBSC-4 and SBSC-5) under two separate risk scenarios (i.e., without risk and with risk). Using an experimental 'Two-factor (2×2) Factorial Design' Method (Cohen, 1988), the study was able to draw conclusions related to all the research objectives.

This research was conducted in three primary phases. In the first phase, a systematic literature review of past and recent peer-reviewed articles, books, journals and dissertations were conducted to examine the current state of knowledge related to SBSC, SBSC architecture and environmental investment decision-making. Five research gaps were identified from examination of the literature, which formed the basis of the justification to pursue this research endeavor. Thereafter, a theoretical framework emerged, leveraging on the support of the Adaptive Decision-Maker Theory and the Prospect Theory. Finally, based on support from empirical studies published in top-tier

peer reviewed journals lead to the development of hypotheses, linking the variables in the research model.

In the second phase of the research, the instrument for conducting the experimental study and to test the model was developed. The measurement scales were adapted from existing scales used in studies published in top journals by business scholars (e.g., Alewine and Stone, 2013; Cheng et al., 2018; Kaplan ,2009). Thereafter, the instrument was pre-tested for face and content validity with the assistance of an expert panel comprised of five (5) individuals with experience in SBSC architecture, as well as substantial grasp of environmental investment policies and the strategies of business organizations. Based on feedback of the expert panel, the experimental instrument was refined before commencing collection of the actual experimental data. Prior to commencing the data collection, ethical clearance was obtained from the University of Malaya Research Ethics Committee (UMREC).

The sample for this study was drawn from a population that is comprised of managerial decision-makers in large multinational manufacturing companies. Initially, 108 participants were selected for the experiment. However, after screening based on eligibility criteria described in Chapter 4, 94 participants were eventually qualified for the study. The subjects of the experiment were divided into four (4) groups, each group with a different scenario (i.e., SBSC-4 without risk, SBSC-4 with risk, SBSC-5 without risk, and SBSC-5 with risk). Each group was asked to distribute a limited amount of funds between two hypothetical investment projects. Once the raw data was available, it was filtered through a data cleaning process following the same procedures implemented by Alewine and Stone (2013) and Cheng et al. (2018).

In the third and final phase of the research work, the data was analyzed using SPSS (v.22). The two-way ANOVA was applied to determine significant differences among the groups, which is a common practice in experimental study with multiple

levels and groups. Furthermore, SPSS Process MACRO developed by Hayes (2013) was applied where appropriate. This study attempted to derive answers to the four research questions by developing corresponding hypotheses that were tested with the experimental data. Table 6.1 below shows a summary of the research objectives, questions and hypotheses, and the results of the hypotheses tests. Elaborate discussions on the findings of this research are presented in Section 6.2.

Table 6.1: Summary of Research Questions, Objectives, Hypotheses and Findings

Research Question	Research Objectives	Hypotheses	Findings
RQ1a: Is there a significant difference between the two SBSC architecture (SBSC-4 and SBSC-5) when, decision-makers utilize them to make environmental investment decisions?	**RO1a:** To examine whether significant difference exists between the two SBSC architecture (SBSC-4 and SBSC-5) when decision-makers utilize them to make environmental investment decision.	**H1a:** When managers utilize SBSC architecture for decision-making, both SBSC-4 and SBSC-5 will have a significantly different effect on environmental investment outcomes.	**Supported**
RQ1b: Is the difference between the two SBSC architecture (SBSC-4 and SBSC-5) significant, when risk indicators are presented along with SBSC architecture to make environmental investment decisions?	**RO1b:** To determine if the difference between SBSC-4 and SBSC-5 remains significant when risk indicators are presented to decision-makers along with the two SBSC architecture to make environmental investment decisions.	**(H1b):** When managers utilize SBSC architecture for environmental investment decision-making, the difference between SBSC-4 and SBSC-5 will be significant when risk indicators are presented along with the SBSC architecture.	**Supported**

Table 6.1, continued

RQ2a: Does SBSC knowledge mediate the relationship between SBSC architecture and environmental investment decision-making? **RQ2b:** Does SBSC knowledge mediate the relationship between SBSC architecture and environmental investment decision-making when risk indicators are presented along with SBSC architecture?	**RO2a:** To determine if SBSC knowledge mediates the relationship between SBSC architetcure and environmental investment decision-making. **RO2b:** To determine if SBSC knowledge mediates the relationship between SBSC architecture and environmental investment decision-making, when risk indicators are presented along with SBSC architecture.	**H2a:** SBSC knowledge mediates the relationship between SBSC architecture (SBSC 4- and SBSC-5) and environmental investment decision-making. **H2b:** SBSC knowledge mediates the relationship between SBSC architecture (both SBSC 4- and SBSC-5) and environmental investment decision-making when risk indicators are presented along with the SBSC architecture	**Supported** **Supported**
RQ3: Do risk indicators moderate the relationship between SBSC architecture and environmental investment decision-making?	**RO-3:** To determine whether risk indicators moderate the relationship between SBSC architecture and environmental investment decision-making.	**H3:** Risk indicators moderate the relationship between SBSC architecture (SBSC-4 and SBSC-5) and environmental investment decision-making.	**Supported**

Table 6.1, continued

RQ4: Is there a significant mediating effect of SBSC knowledge and moderating effect of risk indicators (moderated-mediation effect) between SBSC architecture and environmental investment decision-making?	**RO-4:** To determine if there is a significant mediating effect of knowledge and moderating effect of risk indicators (moderated-mediation effect) between SBSC architecture and environmental investment decision-making.	**H4:** Risk indictors moderate the indirect effect of SBSC architecture (SBSC-4 and SBSC-5) on environmental investment decision-making through SBSC knowledge as a mediator. Therefore, a significant moderated-mediation effect exists.	**Supported**

6.2 Discussions on the Research Findings

In this section all the findings summarized in the Table 6.1 are discussed at length, binding together the research objectives to the findings and comments of other studies that are closely related to the research objectives of this study. Where applicable, the discussions refer back to the theoretical lenses used in this study; the Adaptive Decision Maker Framework and the Prospect Theory. Lastly, the discussions also present the understanding derived by the author of this study from the findings.

6.2.1 SBSC Architecture and Environmental Investment Decision-Making

The first hypothesis (H1a) posited is that when decision-makers deploy SBSC as a decision-making tool for evaluating environmental investments alternatives, their decisions are significantly different between the use of SBSC with four perspectives with sustainability parameters embedded into each perspective (SBSC-4) and SBSC with sustainability parameters as a stand-alone fifth perspective (SBSC-5). The fact that this hypothesis was supported by the results of the analysis, suggests that there is a clear significant difference in the level of complexity between SBSC-4 and SBSC-5, and consequently the amount of cognitive effort required to be exerted by decision-makers when they utilize them. Furthermore, the configurations of the two SBSC provide a significantly different view of how the tradeoff between financial goals and environmental goals of the organization ought to be balanced. Clearly with the SBSC-4, managers favored investment-B that had lower financial risk compared to investment-A. Whereas, in the case of SBSC-5, when risk indicators are considered along with the SBSC architecture, investment-A appeared to be more attractive in terms of lower environmental risk.

The above finding is in consonance with the recent discourse in the existing literature where Hansen and Schaltegger (2016) argue that since sustainability parameters are generally qualitative in nature, it is quite challenging to embed them into

the other four scorecard perspectives where most metrics are typically quantitative. This makes the architecture more complex compared to clustering the sustainability information into a separate, stand-alone perspective. Furthermore, studies by Kaplan and Wisner (2009) and also by Alewine and Miller (2016) provide some important clues that support the fact that the way decision-makers utilize the two SBSC architectures (SBSC-4 and SBSC-5) cause their impacts on the outcomes to be different.

In an experimental study to investigate how judgments differ when SBSC-4 and SBSC-5 are used under conditions of high and low levels of management communication, Kaplan and Wisner (2009) discovered that when environmental data was clustered into a separate perspective (i.e., SBSC-5), decision-makers gave less emphasis to environmental features as compared to when they were scattered throughout the four perspectives (i.e., SBSC-4). The findings of the current study are also in alignment with Kaplan and Wisner's (2009) findings suggesting that the manner in which environmental data is presented impacts the decision-making behavior of individuals using SBSC for evaluating investment alternatives.

In a separate experimental study by Alewine and Miller (2016), the authors explored the relative saliency of decision-makers towards environmental features in dual-natured environmental measures (in both SBSC-4 and SBSC-5). Alewine and Miller (2016) found that the environmental features are more salient when the measures are embedded into the four perspectives (i.e., SBSC-4) rather than being clustered together in a separate perspective (i.e., SBSC-5). However, Alewine and Miller's (2016) study also includes the conditional effect of '*past environmental reputation of the organization*' in the relationship between SBSC and investment outcome. They found that when organizations have a positive environmental reputation to protect, it changes the behavior of decision-makers and shows higher saliency of experimental participants towards SBSC-5 compared to SBSC-4.

In addition to the preceding discourse, from the perspective of the ADMF theory (Beresford and Sloper, 2008, pg.6) it is suggested that: "*simpler decision processes (heuristics) save on cognitive effort by only processing some of the decision-relevant information*." Therefore, in experimental conditions, it has been demonstrated that the greater the number of different attributes presented to the decision-maker, the poorer the accuracy and resultant effort (Beresford and Sloper, 2008). In this regard, processing SBSC-4 vs SBSC-5 architecture requires different levels of intensity in terms of cognitive effort. For instance, grouping environmental data into a stand-alone perspective (i.e., SBSC-5) increases its' saliency and needs less cognitive effort, increasing the decision weight of the separate parameter (in this case sustainability) (Boeree, 2000; Wertheimer, 1944). Furthermore, information chunking (Miller, 1956) and its usage in strategies such as the 'divide and conquer' cognitive heuristic (Shanteau, 1988) may lead to less decision weight for environmental data embedded in a scorecard (SBSC-4) (Kaplan and Wisner, 2009; Lipe and Salterio, 2002). Therefore, the results of this part of the experiment are in alignment with the premise of the ADMF theory, which argues that decision-makers are influenced by the manner in which information is presented to them (Payne et al., 1993). Hence, there is a discernable difference between SBSC-4 and SBSC-5 when decision-makers use them to make environmental investments.

The Table 5.10 in the previous chapter reports the mean differences between SBSC-4 and SBSC-5 (without any risk indicators presented along with the SBSC architecture) as significant and positive. The direction (positive or negative sign) of mean difference value reported for this part of the study is not consequential, because the variables in the present study model are all dichotomous variables. For instance, SBSC-4 has been coded as '0', while SBSC-5 is coded as '1'. If the coding were reversed then the sign would have changed to positive. However, what is noteworthy in

the results is that the mean difference is statistically significant.

Nevertheless, the result from the Bonferroni post-hoc test does imply that since the absolute value of mean difference is positive, SBSC-4 has a greater significant relationship with environmental investment decision-making compared to SBSC-5. Therefore, the findings of the first part of the research objective are represented by hypothesis (H1a) to determine if both SBSC-4 and SBSC-5 significantly differ when decision-makers apply them to take environmental investment decisions was supported.

The results found from the current study related to the above hypothesis are in alignment with the theory and prevailing views of scholars that have conducted similar studies but with different variables and in different contexts. Furthermore, it is to be noted that the current experimental study was conducted using managers working in large global organizations, unlike most prior studies in the literature that were conducted using students as surrogates for industry practitioners. Therefore, the findings of the current research are likely to be more dependable and robust.

The second part of the research objective and the corresponding hypothesis (H1b) assumed that the difference between SBSC-4 and SBSC-5 is also significant when risk indicators are presented to decision-makers along with the SBSC architecture. This hypothesis was also supported by the results and it appears that when risk is presented, the difference between SBSC-4 and SBSC-5 is significant and positive. The positive mean value reported by the Bonferroni post-hoc test indicate that SBSC-4 has a higher mean difference compared to SBSC-5 in terms of its impact on environmental investment decision-making. Therefore, in both cases (i.e., with or without risk), SBSC-4 has a greater significant influence on environmental investment decision-making compared to SBSC-5.

The outcome of this part of the experiment, mentioned in the preceding paragraph, is in concordance with the following statement from the study on role of

cognitive effort and emotions in decision making by Kaplan and Wisner (2009) who mentioned that: "*much of experimental research on BSC has been grounded on cognitive psychology, where individuals are portrayed as having limited cognitive capacity*" (*pg. 40*). Hence, a large number of parameters added to a decision scenario (e.g., adding risk to SBSC) will make the decision process more complex, requiring additional cognitive effort. Furthermore, Beresford and Sloper (2008) state that "*general measures of cognitive ability have been found to be associated with decision making performance, with performance being adversely affected by increasing decision task complexity*" (pg. 35). Therefore, by presenting risk to the already complex decision scenario with SBSC frameworks, the amount of cognitive effort demanded is much higher, and as a result, decision-makers opt for the scenario that requires lower levels of cognitive effort to reach a decision. Therefore, SBSC-4 and SBSC-5 significantly differed when risk information was added to the decision scenario.

6.2.2 The Mediation Effect of SBSC Knowledge between SBSC Architecture and Environmental Investment Decision-Making

SBSC knowledge is defined as the knowledge about SBSC measures and how they are applied in making more effective investment decisions (Kang and Fredin, 2012). The second research objective of this study sought to investigate whether SBSC knowledge mediates the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making under two circumstances; without risk indicators (H-2a) and when risk indicators were presented (H-2b) to decision-makers. The summary of the hypotheses test for H-2a from Table 5.11 in the previous chapter indicates the following:

1. There is a negative significant influence of SBSC knowledge on the relationship between SBSC architecture and environmental investment decision-making. The

negative significant influence may be explained by the negative relationship between SBSC architecture and SBSC knowledge, but with a positive and significant relationship between SBSC knowledge and environmental investment decision-making.

2. The mediating effect of SBSC knowledge on the relationship between SBSC architecture and environmental investment decision-making is represented by a reduction in the negative impact (e.g., from -3.305 for the direct effect to -1.119 for the indirect effect (i.e., mediating path '*ab*')).

The results of the analysis revealed that SBSC knowledge mediates the relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making, and the mediation effect is significant for conditions without risk. Hence, the hypotheses; H-2a, is supported.

With regards to H-2b (i.e., mediation effect with risk indicators), summary of the results from the previous chapter indicates that:

(a) There is a negative significant influence of SBSC knowledge on the relationship between SBSC architecture (in the presence of risk indicators) and environmental investment decision-making.

(b) The negative significant influence may be explained by the negative relationship between SBSC architecture (in the presence of risk) and SBSC knowledge, but with a positive relationship between SBSC knowledge and environmental investment decision-making.

(c) The mediating effect of SBSC knowledge on the relationship between SBSC architecture (in the presence of risk indicators) and environmental investment decision-making is represented by a higher significant negative impact (-2.542) for the indirect

(mediating path '*ab*') effect compared to the not significant negative direct effect (-0.503).

(d) The mediating effect of SBSC knowledge on the relationship between SBSC architecture (in the presence of risk indicators) and environmental investment decision-making has a significant and higher negative impact (-2.542) compared to the negative mediating effect (-1.119) of SBSC knowledge on the relationship between SBSC architecture (without risk indicators) and environmental investment decision-making.

The above findings suggest that H-2b is supported and are in conformity with logic as well as prior discourse in the literature, because SBSC architecture have complexity in terms of their configurations (Kalender and Vayvay, 2016). The scorecard measures are based on lead and lag measures that are inter-connected, based on each perspective of the SBSC architecture. For instance, if we consider the customer perspective of the scorecard, we may consider the metrics used to measure 'customer satisfaction' as a lag measure, while 'faster response-time to customer complaints' as a lead measure. Actions on the lead measures will impact the lag measures (Kaplan and Norton, 1992). In the case of sustainability parameters such as environmental objectives, both lead and lag measures may be more complex than the other four traditional perspectives.

In addition to having conceptual clarity on lead and lag measures, decision-makers need to understand the inter-connectivity between perspectives. For instance, when the peoples' growth and development perspective is addressed through training of employees, this leads to higher levels of efficiencies in the internal processes at the operational level, which in turn will impact customer level perspectives such as shorter lead times in service or product delivery, and thus, impacting customer satisfaction.

Consequently, higher levels of customer satisfaction will impact repeat sales and thus affect the financial perspective. Therefore, the perspectives are linked to each other in a manner that creates a domino effect. Hence, adding sustainability to the scorecard perspective, whether embedded or separate, will require an even higher level of clarity about the architecture of SBSC.

The above discourse suggests that decision makers would be required to have a firm grasp of the concepts and applications of SBSC (whether SBSC-4 or SBSC-5) and also have experience in utilizing such tools to make decisions related to the objectives of an organization's environmental stewardship. Hence, it would make sense that SBSC knowledge mediates the relationship between SBSC architecture and environmental investment decision-making. Adding risk indicators along with the SBSC architecture will require even higher levels of SBSC knowledge.

The discovery made through the hypotheses (H-2a and H-2b) may be crucial to the success of organizations by realizing that the SBSC measurements need to be well understood by the decision-makers who are required to use them. When decision-makers enhance their understanding of the firm's sustainability strategies along with their ability to use strategically linked investment analysis tools such as SBSC, their ability to take environmental investment decisions will be more effective. Therefore, it is imperative for the organization to ensure that managerial decision-makers have a comprehensive understanding of SBSC architecture and how to utilize it in environmental decision-making, under both circumstances of without and with risk information.

6.2.3 The Moderating Effect of Risk Indicators between SBSC and Environmental Investment Decision-Making

The third research objective delved into deconstructing the moderating influence

of risk indicators on environmental investment decision-making with both the SBSC architecture (SBSC-4 and SBSC-5). Particularly, the hypothesis (H3) aimed at determining whether risk indicators moderate the direct relationship between SBSC architecture (both SBSC-4 and SBSC-5) and environmental investment decision-making.

The results of Bonferroni post-hoc tests shown in the previous chapter indicate that the mean difference for SBSC-4 without and with risk is -2.887 and significant. The negative sign appears because of the manner in which the dichotomous variable 'risk indicators' (i.e., without risk and with risk) are coded, and the sign will be positive if the coding was reversed. However, the magnitude of the values of the mean difference does imply that the influence of SBSC-4 (with risk indicators) is stronger than SBSC-4 (without risk indicators). In the case of SBSC-5, the mean difference between 'without risk' and 'with risk' is -5.273 and significant. This suggests that influence of SBSC-5 on environmental investment decision-making with risk indicators is stronger than SBSC-5 without risk indicators.

The visual representation in Figure 5.3 depicts both the slopes that are not parallel, suggesting presence of moderation. Furthermore, the slope for SBSC-5 shows that the gradient of this slope from 'without risk' to 'with risk' is sharper than the gradient of the slope for SBSC-4, which is also reflected in the absolute values of the mean differences (i.e., 2.887 for SBSC-4 and 5.273 for SBSC-5). Therefore, the slopes in Figure 5.3 clearly suggest that even though overall SBSC-4 appears to have a stronger influence on environmental investment decision-making, however in the presence of risk indicators as a moderator, the difference in strength of SBSC-4 and SBSC-5 in terms of their impact on environmental investment decision-making becomes narrower. Therefore, the results of the analysis indicate that hypothesis (H-3) is supported.

The above findings are in alignment with one of the core premises of the Prospect Theory (Kahneman and Tversky, 1979), which states that individuals react more to issues framed as losses than to gains (Kahneman and Tversky, 1979). In the organizational setting, integrating risk indicators in the SBSC architecture allows managers to evaluate the performance of the existing strategy in light of its' effect on the organizations' overall risk exposure, as well as to appraise investments that achieve environmental targets (Kaplan, 2009).

Hypothesis (H3) being supported indicates that for both SBSC-4 and SBSC-5, the scenario presented to decision-makers with risk integrated into the SBSC architecture is more prioritized by the decision-makers, compared to a scenario without risk. Therefore, having risk integrated in the SBSC architecture is a pertinent strategy in decision-making, because managers typically try their best to prevent negative outcomes by trying to forecast potential risks associated with a decision.

6.2.4 Moderated-Mediation Effect of SBSC Architecture on Environmental Investment Decision-making with SBSC Knowledge as a Mediator and Risk indicator as a Moderator

The broad objective of the last and final research objective of the study is to investigate whether there is conditional indirect effect of SBSC architecture on environmental investment decision-making, with SBSC knowledge as a mediator and risk indicator as a moderator. Therefore, a moderated-mediation model was proposed and tested in hypothesis (H-4).

The findings reported in the previous chapter, indicate that the indirect conditional effects are both significant, which supports the previously argued logic that SBSC knowledge can reduce the cognitive efforts required to discern the complexity of SBSC architecture, which may be further compounded by presence of risk indicators in the

decision framework. Knowledge about the SBSC should enable decision-makers to effectively utilize all the SBSC perspectives along with risk criterion when deploying it to choose between investment alternatives. Findings of previous studies that considered the association of risk indicators with traditional BSC measures and organizational performance (e.g., Cheng et al., 2018) are in consonance with the findings of the current research that examines SBSC architecture and environmental investment decision-making.

With regards the direct effect of SBSC architecture on environmental investment decision-making, only one option was found to be significant. That option is the direct link between SBSC architecture and environmental investment decision-making, without risk as a moderator. However, when the moderator (risk information) is applied to the direct path, the effect is non-significant. The reason that may be attributed to this is that in the absence of substantial SBSC knowledge, adding risk parameters to the decision scenario creates further complexity that leads to greater cognitive effort on the part of decision-makers who are already struggling to cope with the additional sustainability parameters, whether integrated or stand-alone. The preceding justification is also aligned with Alewine and Stone's (2013) findings, where they argue that additional cognitive efforts influence the way participants in experimental studies utilize SBSC architecture when making environmental investment decisions.

Based on the arguments made above, this study predicts that risk moderates the mediated relationship between SBSC architecture and environmental investment decisions, such that the indirect effects of SBSC architecture on environmental investment decision-making (through SBSC knowledge as mediator) are significant when risk indicators are presented, and significant in the direct effect only when risk was not considered. The association between risk and BSC measures on organizational performance has been considered in a few studies (e.g., Cheng et al., 2018; Kotze et al.,

2015). However, this appears to be the first study that considers all four possible interactions between SBSC architecture, risk indicators, SBSC knowledge and environmental investment decision-making in an integrated moderated-mediation framework.

6.3 Significant Implications of the Research

This experimental research undertaking provided a more nuanced understanding about the relationships between SBSC architecture and environmental investment decision-making. The findings carry significant theoretical and practical implications, and also make a methodological contribution to the body of knowledge.

6.3.1 Theoretical Implications

This study offers several theoretical contributions to the body of knowledge on SBSC architecture and environmental investment decision-making. First, the current study provides further evidence to the notion that the way the SBSC architecture is designed and presented to decision-makers makes a significant difference in the outcome of environmental investment decision-making. Prior experimental studies show that scholars differed on this issue, and conflicting findings have been presented in several studies (e.g., Alewine and Stone, 2013; Alewine and Miller, 2016; Jiangtao and Pin, 2010; Kaplan and Wisner, 2009). Recent publications by SBSC scholars such as Hansen and Schaltegger (2016; 2018) and Hahn and Figge (2018) have shown that a finer-grained understanding was warranted to determine whether significant difference exists between SBSC where sustainability is integrated within the four (4) perspectives of the BSC (i.e., SBSC-4) and SBSC architecture with sustainability parameters clustered together in a separate perspective (i.e., SBSC-5). A clear determination of a significant difference in the architectures when used for environmental investment

decision-making presented by the current study is expected to make significant strides towards understanding the reasons for conflicting findings in past literature.

Second**,** presenting risk information along with SBSC architecture for environmental investment decision-making adds to the complexity of the SBSC configuration, thus requiring additional cognitive effort on the part of the decision makers. This finding is in conformity with one of the key premise of ADMF that as the complexity of the information presented to decision-makers increases, the performance of the decision-makers will be adversely affected by the enhanced levels of cognitive effort required to effectively use the information to apply to desired outcomes (Beresford and Sloper, 2008).

Third, the study considers the mediating role of SBSC knowledge on the relationship between SBSC architecture and environmental investment decision-making by examining whether the association between SBSC and environmental investment decisions is mediated by SBSC knowledge. The outcome of the study indicates that SBSC knowledge strongly mediates the above relationship (with and without risk indicators), implying that the direct link is weak and is strengthened when the mediator is present. The issue of organizational knowledge of SBSC configurations has been alluded to in previous studies but not exclusively tested (e.g., Alewine and Miller, 2016; Banker et al., 2011; Kaplan and Wisner, 2009). Therefore, the finding of the current study suggests that by increasing the levels of understanding of the concepts and applications of SBSC among managerial decision-makers, the cognitive effort needed to effectively use SBSC-4 and SBSC-5 is significantly addressed when they are being used to evaluate investment options with sustainability goals.

Fourth, the existing cluster of studies in the literature appears to have overlooked the issue of investigating how risk indicators impact the association between types of SBSC architecture and investment decisions geared towards environmental objectives

(Alewine and Stone, 2013). Therefore, an important contribution to the existing literature made by the current study is to examine how environmental investment decisions are impacted by integrating risk indicators as a moderator in the relationship between SBSC architecture and environmental investment decision-making

A number of studies in the past have attempted to integrate risk into the traditional scorecard and examined its' impact on firm performance (Cheng et al., 2018; Kotze et al., 2015). However, the current study examines a different context by showing that there is a significant difference between scenarios of integrating risks versus not integrating risks for SBSC architecture (both SBSC-4 and SBSC-5). The results indicate that overall, the impact of SBSC-4 on environmental investment decision-making is greater than SBSC-5 (with and without risk). In the case where risk indicators are presented as a moderator, SBSC-5 shows a sharper rise in terms of its impact on environmental investment decision-making compared to SBSC-4. The above results make an important contribution to theory by including the dimension of risks to the sustainability balanced scorecard, when deciding on investment options that relate to environmental stewardship goals.

Finally, to extend the theory about our understanding of how in SBSC architecture, SBSC knowledge and environmental investment decision-making interact in the absence and presence of risk information. This study proposed a moderated-mediation model that explains that the mediating role of SBSC knowledge on the relation between SBSC architecture and environmental investment decision-making has theoretical implications. The outcome of this part of the study clearly suggests that the conditional indirect effects are both significant (with and without risk), as the cognitive abilities of the decision-makers are already enhanced due to the presence of SBSC knowledge. However, the conditional direct effect with risk was not significant, which is a clue that the premise of cognitive efforts suggested by the ADMF theory comes into

play here. Therefore, an integrated model emerging from this study opens up prospects for further research with regards to SBSC architecture and environmental investment decision-making by including both risk indicators as well as SBSC knowledge in the framework.

6.3.2 Practical Implications

In addition to theoretical contributions, this study also offers several practical contributions for the benefit of industry practitioners. SBSC architecture as a performance evaluation mechanism is a holistic lens for mangers when choosing between investment alternatives. Managers using SBSC as a tool for making investment decisions aimed at achieving environmental strategic objectives of their organization will benefit from the finding that there are significant differences between the use of SBSC-4 versus SBSC-5.

Managerial decision-makers may be advised to select the appropriate architecture in the context of the type of information that they incorporate under sustainability parameters in their organization. When the sustainability information is more qualitative in nature, it may be extremely challenging to embed this information along with the quantitative data that are usually prevalent in the other four BSC perspectives. In such circumstances, it may be more prudent to utilize the SBSC-5, where the sustainability information is clustered into a separate perspective. Furthermore, decision-makers will be able to deploy the appropriate SBSC architecture (SBSC-4 or SBSC-5) depending on whether they want to consider risk indicators in their decision analysis. Based on the results of this study, the general assumption would be that SBSC-4 has a stronger influence than SBSC-5 on environmental investment decision-making and thus would be a better tool. However, once risk indicators are also considered, the difference between SBSC-4 and SBSC-5 is less significant in terms of

responsiveness to environmental investment decision-making. Managerial decision makers can thus benefit from this discovery.

The role of SBSC knowledge as a mediator in the relationship between SBSC and investment decision-making is an important finding. Business organizations that deploy SBSC in their assortment of decision-making tools will be able to customize managerial training programs that further enhance in-depth appreciation and understanding of SBSC and ensure that the use of such tools leads to more effective decisions in their organizations. Training and employee development programs in organizations that are committed to environmental stewardship in their investment strategies need to ensure that their personnel at key decision points are well versed with the various concepts and application of SBSC architecture.

Studies in the past have possibly overlooked the need to provide empirical evidence that integrating risk indicators into the SBSC architecture can significantly influence decision-makers to make better investment decisions, compared to SBSC architecture without risk integration. In line with the premise of the loss-aversion tendency of people as stipulated in the Prospect Theory, when managers are deciding on environmental investment options, the results suggest that integrating risks into the SBSC architecture encourages managers to consider environmental investment options with lower levels of organizational exposure to risks.

Furthermore, there is a need for a more holistic organizational evaluation of why sustainability programs adopted by business organizations are missing their mark. The Bain and Company's report on the success of sustainability programs suggests that top-down approaches decrease the program achievement rate (Davis-Peccoud et al., 2016). The outcome of this research is likely to be of benefit to industry practitioners about how they can achieve sustainability objectives while considering risk indicators. The integrated moderated-mediation model presented in this study may provide guidance on

how senior management can address the issue of the high failure rates of sustainability programs. The inclusion of SBSC knowledge and risk indicators, as two vital factors along with SBSC architectures, may be integrated into the strategic plans of organizations that are struggling to achieve their environmental stewardship goals.

The majority of experimental research conducted in the past with SBSC architecture and environmental investment decision-making (e.g., Alewine and Stone, 2013; Alewine and Miller, 2016; Kaplan and Wisner, 2009) have conducted their studies with students of business schools (both undergraduate and post-graduate) as surrogates for industry practitioners. Although Liyanarachchi and Milne (2005) argue that student decisions were similar to professional participants, yet it would be naive to consider them as adequate surrogates for people with practical real-world experience who use sustainability perspectives routinely in their organizational functions (Sarker and Burritt, 2008). Therefore, a distinct methodological contribution of this study is that all participants were professional managers working in large manufacturing companies with sustainability goals, and these managers use SBSC as analysis tools in their decision processes. Hence, the findings of the current study are likely to be more robust.

6.4 Signposts for Future Research Possibilities

The current study opens up windows for future research possibilities related to SBSC architecture and environmental investment decision-making. Firstly, there may be other exogenous variables that may strengthen the explanations of the linkages between the manipulated variables and the dependent variable in the study. For instance, the reputation of the firm in terms of environmental and social impact may be a pertinent variable that influences the relationships. Similarly, the level of communication in the organization on sustainability goals may also have a bearing on outcomes.

Secondly, organizational policies regarding rewards or punishments tied to achievement of environmental objectives may also influence the decisions made by

managers (Burchman, 2018). Considering whether managers get rewarded for achieving such targets or penalized for missing their environmental goals needs to be considered for a more robust explanation of the relationship between SBSC architecture and environmental investment decision-making.

Thirdly, how the mediation effect of SBSC knowledge in the relationships between SBSC architectures and environmental investment decision-making varies over time can reveal useful information. Organizational knowledge is based on the individual who takes decisions in key strategic and operational matters. As time passes, managers move from one organization to another and the level of SBSC knowledge may be fluid. Hence its influence as a mediator needs to be studied over a longer time period.

Finally, other demographic criterion may be at play, such as the participant's gender or age, the number of years in the organization and the industry-type may have an effect on the relationship between SBSC architecture and environmental investment decision-making, which future researchers may consider.

6.5 Conclusion

The primary goal of this experimental study was to determine if the architecture of SBSC matters when decision-makers deploy them to make environmental investment decisions. The experiment was able to demonstrate that SBSC architecture with sustainability parameters such as social and environmental metrics integrated into each of the four BSC perspectives (i.e., *financial, customer, internal business process and learning and growth*) is significantly different from SBSC configuration where sustainability parameters are clustered into a separate fifth (5^{th}) perspective. When decision-makers utilize the above architecture to decide on allocation of investments between the investments options that have tradeoffs between environmental metrics and other traditional performance metrics, both SBSC-4 and SBSC-5 are significantly different, and the difference is also significant when risk information was presented to

the decision-makers. Overall, the current study demonstrates that in terms of impact on environmental investment decision-making, SBSC-4 has a stronger relationship with environmental investment decision-making compared to SBSC-5.

The fact that SBSC knowledge was found to fully mediate the relationship between SBSC architecture and environmental investment decision-making suggests that the complexity of SBSC architectures and the amount of cognitive effort required by decision-makers can easily be minimized if organizations proactively enhance the overall understanding of the concepts and applications of the SBSC as tools for implementing organizational strategies related to environmental stewardship goals. Through continuous training and mentorship under experienced managers, organizations can streamline their sustainability programs for success.

Additionally, the role played by risk as a moderating variable in the relationship between SBSC architecture and environmental investment decisions suggests that decision-makers assign greater decision weight to both SBSC architectures when risk indicators are considered along with the SBSC architecture compared to when risk is absent. This finding is well in consonance with the fact that people are generally averse to loss, and will first focus on minimizing exposure to potential losses before they consider potential gains. However, the increase in strength of relationship between SBSC architecture and environmental investment decision-making is more pronounced in the case of SBSC-5 compared to SBSC-4 in the presence of risk indicators, although overall SBSC-4 appears to have a stronger influence than SBSC-5.

Finally, an integrated moderated-mediation model was proposed and tested using the guidelines developed by Andrew Hayes. The analysis of this model revealed that conditional indirect effects of SBSC architecture and environmental investment decision-making though SBSC knowledge as mediator (both without and with risk indicators) was significant, while the direct conditional effect between the SBSC

architecture with risk and environmental investment decision was not significant. This may be due to the possibility that, in the absence of substantial SBSC knowledge in the organization, adding risk indicators to SBSC architecture simply complicates the deployment of the tool, and enhances the cognitive effort of the decision-makers that may lead to ineffective environmental investment decisions.

In summation, this experimental research work contributes to the body of knowledge on the two dominant schools of thought on SBSC (i.e., SBSC-4 and SBSC-5), particularly in understanding application of such tools in environmental investment decision-making. Additionally, it also reveals new findings for industry practitioners by providing pertinent information on the fact that both SBSC architecture as well as risk indicators have significantly different patterns of influence on environmental investment decision-making. Furthermore, prior knowledge of SBSC architecture among decision-makers is a crucial factor for achieving organizations environmental objectives. Lastly, the moderated-mediation model may serve as a foundation for future theory development related to SBSC architecture and investment decision-making.

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LIST OF JOURNAL PUBLICATIONS

Published

Jassem, S., Azmi, A., & Zakaria, Z. (2018). Impact of Sustainability Balanced Scorecard Types on Environmental Investment Decision-Making. *Sustainability*, 10(2), 541. (ISI, Q2).

Under Journal Review:

Jassem, S., Zakaria, Z. &Azmi, A., (2019). Sustainability Balanced Scorecard Architecture and Environmental Investment Decision-Making. *Accounting, Organizations and Society* (Scopus, Q1)

Jassem, S., Zakaria, Z. &Azmi, A., (2019). Impact of Sustainability Balanced Scorecard Architecture on Environmental Investment Decision-Making; Systematic Review Paper. *International Journal of Productivity and Performance Management* (Scopus, Q2)

APPENDIX-A: RESEARCH INSTRUMENT

SBSC Group 1

Section A: Demographic Information

Before you begin, we need to ask you a series of demographic questions. Your name will only be used to give you credit for participating in this experiment. It will not be linked in any way to your answers, so your responses will be completely anonymous. Please answer the following questions:

Name: _____

Email: _____

Age: _____

Gender: _____

Note:

All details provided in this study will be kept confidential and will not be used to identify you against your responses. It will only be used for the following purposes:

i) To notify you in the event that you have won a prize relating to this study, as described below.

ii) To provide you with information about this study at the conclusion of this study upon your request.

Select from the list below your area of primary professional experience and expertise

____ Accounting ____ General Management

____ Finance ____ Marketing/Sales

____ Operations or Manufacturing ____ Human Resource

____ Others (please specify: _____)

How many years of professional experience do you have? _____ years.

Select the academic degrees you have earned on the list below:

____ Undergraduate degree (e.g. Diploma, BSc, BA)

____ Postgraduate degree (e.g. PhD, MBA, MSc, MA)

____ Professional qualification (e.g. ACCA, CIMA, CFA)

____ Others (please specify: _____)

In your professional career, have you ever used Sustainability Balanced Scorecard performance measurement (i.e. evaluations using several different financial and non-financial performance measures) to evaluate multiple organizational units (departments, divisions, shifts, etc.) under your supervision?

____ Yes. ____ No.

Section B: Sustainability Balanced Scorecard (SBSC)

In line with contemporary global focus on the triple bottom-line concept, investors and corporate managers must make environmental investment decisions, by considering the benefits and drawbacks social and environmental consequences of their investments. Whilst there are many ways to evaluate these opportunities, a common method used by many companies is called a sustainability balanced scorecard (SBSC).

Based on the above description of SBSC, please answer the following questions according to your understanding of SBSC: (please circle your answer)

True/False SBSC can be used as a multi-criteria framework for evaluating investment opportunities.

True/False SBSC provides measurements, but these measurements do not have to help achieve business objectives.

True/False SBSC is a way that managers can evaluate investment opportunities.

True/False Companies can use SBSC to help managers make decisions in meeting the company's targets.

True/False SBSC might help managers in making environmental investment decision.

True/False SBSC evaluates investment opportunities based on financial measures only.

Section C: Case Scenario

Assume that you are a manager for ABC Company, and your company has set the following core strategic business objectives:

(a) Achieve financial benchmarks that meet shareholders' expectations.

(b) Conduct business in a manner that demonstrates major responsibility towards environmental stewardship and also by focusing on mitigating potential risks to the firm, while keeping the firm on track to meet core strategic objectives.

ABC Company is currently considering major expansions at two of its production facilities. Each expansion is a separate investment opportunity. It is also the company's policy to evaluate risk on a scale of 1-25 whereby <15 less priority of risk and >15 high priority of risk based on two dimensions namely likelihood and impact. The company has asked you to evaluate these two potential investment opportunities using a sustainability balanced scorecard approach. Your company has USD20 million dollars at its disposal for investing in the projects, and you may allocate this amount in a way that you deem appropriate, your allocation should be to the nearest USD 1 million. The amount you allocated for investment indicates the degree to which you believe this investment is likely to contribute to achieving the company's strategic business objectives.

As a manager, you will be rewarded based on how well your investment decisions achieve the company's strategic objectives. The sustainability scorecard includes

measurements that determine whether specific goals have been met, through comparison with financial and non-financial measures. If these goals are met, then the strategic business objectives will be achieved.

As a reward for your contribution, you will receive one raffle ticket. Your raffle ticket will enter you into a drawing for a surprise gift. You will be entitled to the raffle ticket once you have made an investment choice that the corresponds satisfactorily with the company's strategic objectives. After all the participants have completed this study, we will draw three raffle tickets out of the pool and award a surprise gift to each winner.

Please take a few minutes to analyze the sustainability balanced scorecards before making your investment decision. The sustainability scorecards contain four (4) different perspectives from which to view the proposals. These perspectives are:

(i) Financial Perspective;
(ii) Customer Perspective;
(iii) Internal Business Processes Perspective and;
(iv) Learning and Growth Perspective

You will see the above perspectives as the title for the page that contains the relevant data. The company's target goals for specific measurements will be shown next to the investment's projected figures.

Section D

Before you see the sustainability balanced scorecard metrics, please answer the following questions:

How many perspectives does the Sustainability Balanced Scorecard contain?

(Circle your answer)

1 2 3 4 5 6 7 8 9 10

Does the company have a policy to safeguard itself from situations of danger, harm and loss?

____ Yes. ____ No.

How will you compensate? (Circle your answer)

A. There is no compensation provided.
B. My investment decisions do not influence my compensation.
C. It depends on how well our investment decisions achieve the company's strategic objective.

Section E; Sustainability Balanced Scorecard

	Goals	Investment A	Investment B
Financial Perspective			
Return on investment	17%	12-14%	16-22%
Annual cash flow increase	$325,000	$100,000-$300,000	$300,000-$400,000
Sales growth	24%	22-27%	18-23%
Payback period	3 years	5years	3years
Energy cost savings	$325,000	$300,000-$400,000	$100,000-$300,000
Customer Perspective			
Customer satisfaction rating	8.2 out of 10	8.5	9
Percentage of sales to new customers	19%	30%	45%
Customer referrals	11	20	25
New product offers to customers	10	7-12	6-8
Number of community complaints about company pollutant emissions	3	1-3	7-9
Internal Business Processes Perspective			
Time to process customer order	2 days	1-4 days	3-6 days
Annual number of stock outs for an order	3	3-5	4-6
On-time deliveries as a percentage of all deliveries	95%	88-92%	92-96%
Time to launch new products to market	3 months	4-6 months	2-5 months
Annual tons of carbon dioxide emissions	30	20-30	40-55
Learning and Growth			
Employee turnover	12%	3%	5%
Number of employee training certifications	22	25	30
Employee satisfaction	86%	89%	93%
Annual production employee work-related accidents	1	1-3	2-4
Number of hours of training per factory employee for environmental emergency responses	275	180-250	240-300

Section F

After analyzing the sustainability balanced scorecards, please answer the following:

The total of your responses should equal to USD20 million dollars. Please only use million-dollar increments.

How much of the 20-million-dollar budget would you spend for?

Investment A?	_____	Million
Investment B?	_____	Million
Sum	_____	Million

What is the reason behind your choice of the 20-million-dollar allocation?

Notice how the sustainability balanced scorecard is divided up into various sections: financial, customer, internal business processes, learning and growth, environmental and risk. Please estimate (as a percentage) how much emphasis you placed on the following subject headings that were used in the sustainability balanced scorecard. There is no right or wrong answer – we simply want to see what you thought was important in making your investment decision. If you placed no emphasis on a specific section, then please enter a "0" next to that section. The total of your responses should equal 100%:

___ Financial

___ Customer

___ Internal Business Processes

___ Learning and Growth

___ Environmental

___ Risk

___Total

Please rate the information that has been given in this case from 1-100 points based on

(a) How easily was it to use? ----------

(b) How easily were you able to understand? ----------

This concludes the study. Thank you for participating!

Definitions of Measurements

Below is a description of various measurements used in the sustainability balanced scorecard. The definitions are given in alphabetical order. You may or may not have all of the measurements listed in your scorecard.

Annual cash flow increase – the increase in actual cash that the company receives each year that the project is active. The increase is based on every 3-million-dollar investment.

Annual number of stock outs for an order – a stock out occurs when a customer places an order for a product, but the company does not have that product in inventory, and thus the company misses a sale.

Annual production employee work-related accidents – the annual number of job-related accidents that are incurred on-site at the project's production facility.

Annual tons of nitrogen dioxide emissions – the amount of nitrogen dioxide that is released into the air each year by the company's factory. These emissions contribute to air pollution and environmental degradation. The more tons of nitrogen dioxide that a factory emits, the more air pollution it causes.

Customer referrals – this is the annual number of times that the company gains a new customer based on the recommendations of an existing customer.

Customer satisfaction rating – the results of a customer satisfaction survey that will be given to the company's customers. The rating is on a scale of 1 (dissatisfied) to 10 (satisfied).

Employee satisfaction – how satisfied employees are working for the company.

Employee turnover – the percentage of the company's workforce that must be replaced each year due to resignations, firings, and retirements.

Energy cost savings – the annual amount of cost savings that are due to energy-efficient and environmentally-friendly technologies used in the project. The savings are based on every 3-million-dollar investment. This amount is not included in the "annual cash flow increase" measurement.

New product offers to customers – the annual number of new products that are developed and sold to customers. Creating new products leads to more sales opportunities.

Number of community complaints about company pollutant emissions – annual number of complaints filed by local neighborhoods and organizations that express their dissatisfaction with the company's pollutant emissions. These complaints normally result in bad press coverage for the company and possible regulatory actions that address the complaints.

Number of employee training certifications – the number of annual specialty certifications that are obtained by the company's employees. An example is a certification for operating a specialized type of factory equipment. More trained employee's lead to high quality products.

Number hours of training per factory employee for environmental emergency responses – the number of preparation hours those employees sped learning and practicing what to do in the event of a chemical spill, explosion, or other environmental emergency at the company's factory. The better trained the employees; the less environmental damage will occur in the event that there is an accident.

On-time deliveries as a percentage of all deliveries – the percentage of sold products that are delivered within the time period that the customer expects the delivery.

Payback period – the amount of time (in years) needed to recover the cost of the investment.

Percentage of sales to new customers – the proportion of overall sales that will involve new customers. Obtaining new customers increases sales.

Return on Investment – the percentage of financial return that the company expects to receive for investing in a project. It is the company's net operating income divided by its average operating assets.

Sales growth – the impact that the project will have on the company's current sales.

Time to launch new products to market – the time required to takes to create a product, design it, produce it, market it, and make it available for customers to buy. Creating new products increases sales.

Time to process customer orders – the time required to receive, process, and deliver a customer order.