The Influence of Cognitive Bias Attributes on Decision-making Style of the Project Manager: The Moderating Role of Narcissistic and Voice Behaviour

دراسة تأثير سمات التحيز الإدراكي على أسلوب اتخاذ القرار لمدير المشروع: الدور الوسيط للسلوك النرجسي والصوتي

by

OMAR SALEM OBEIDAT

A thesis submitted in partial fulfilment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY IN PROJECT MANAGEMENT
at
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Thesis Supervisor
Dr. Sulafa Badi

Approved for award:

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ABSTRACT

This thesis investigates the influence of cognitive bias attributes (CBA) on the decision-making (DM) style of project managers (PJM): the moderating role of narcissistic behaviour (NB) and voice behaviour (VB) in Information Technology Software Development (ITSD) projects in Dubai. The research classified sources of bias under two families: (1) perception and behavioural bias, (2) belief and probability estimation bias; these families consist of six groups that contain 21 sources of bias.

The research followed a positivism philosophy using a deductive approach based on a quantitative analysis methodology and a survey instrument strategy to collect data; 381 responses were collected through an electronic survey. The study used confirmatory factor analysis to validate the constructive validity of the variables, Cronbach's alpha to test the reliability of the variables, a pilot study conducted prior to survey distribution and multiple regression analysis through IBM SPSS statistics version 20 to test research hypotheses.

The results indicated that: 1) CBA influences the decision-making style of project managers, 2) the relationship between CBA and the experiential decision-making style of the project manager is significant, whereas the rational decision-making style of the project managers is less affected by CBA, 3) using the experiential style to make a decision under uncertain events has a relatively negative influence on the success of projects as it is connected to CBA, 4) using the rational style to make a decision under uncertain events has a relatively positive influence on the success of the projects as it is less connected to CBA, 5) voice behaviour negatively moderates the relationship between cognitive bias and the decision-making style of project managers; however, the relationship was weak, and 6) NB does not moderate the relationship between CBA and the DM style.

The researcher developed a de-biasing DM model which can be used to mitigate the influence of the biased decisions. The study enriched the body of knowledge of the CBA through extensively exploring various sources of bias and their impact on the DM process; and expands on the knowledge of the DM styles provided by CEST by exploring the negative influence posed by CBA. The study imparts elaborate information about the role of project managers' NB and VB in the context of PM and provides a model that will help mitigate the risk of CBA on the decision-making process. The thesis recommends testing the group and social bias family, effect, and memory bias family in future research.

ARABIC ABSTRACT

تبحث هذه الأطروحة في تأثير سمات التحيز الإدراكي على أسلوب صنع القرار لمديري المشاريع: الدور المعتدل للسلوك النرجسي والسلوك الصوتي في مشاريع تطوير برمجيات تكنولوجيا المعلومات في دبي. وقد طور البحث فرضية بحثية وإطار مفاهيمي يستند إلى الأدب الإداري للإجابة على الأسئلة البحثية وتحقيق أهداف الأطروحة.

اتبع هذا البحث موضوعا جديدا لتحديد مصادر التحيز الإدراكي؛ ويستند هذا المسعى على عائلات من التحيز التي تتكون من مصادر معينة من التحيز. وقد صنفت الدراسة ست مجموعات تحيز تحت عائلتين رائدتين تتكونان من 21 مصدرا للتحيز: (1) عائلة التحيز في الإدراك والسلوك (2) عائلة التحيز في الاعتقاد وتقدير الاحتمالات.

وقد تم جمع الردود من 381 مدير مشروع من مديري المشروع في دبي من خلال استبانة الكترونية، واتبعت الدراسة منهجية تحليل كمي لاختبار موثوقية وصحة أدوات البحث. استخدمت الدراسة تحليل العامل التأكيدي للتحقق من الصحة البناءة للمتغيرات و(كرو نباخ ألفا) لاختبار موثوقية المتغيرات، وأجريت دراسة تجريبية قبل بدء عملية التواصل مع العينة الشاملة.

وأشارت النتائج إلى أن سمات التحيز الإدراكي يؤثر على أسلوب مدير المشروع في صنع القرار؛ كما أشارت النتائج إلى وجود علاقة بين سمات التحيز الإدراكي وأسلوب اتخاذ القرار لمدير المشروع (النهج التجريبي)؛ وعلاوة على ذلك، أشارت النتائج إلى أن أسلوب اتخاذ القرار لمدير المشروع (النهج العقلاني) أقل تأثرا سمات بالتحيز الإدراكي. وأشارت النتائج أيضا إلى وجود علاقة بين أسلوب اتخاذ القرار لمدير المشروع سواء كان عقلانيا أو تجريبيا ونتائج المشروع؛ وإلى جانب ذلك، تظهر النتائج وجود علاقة بين سمات التحيز الإدراكي ونتائج المشروع.

وأشارت النتائج التي توصل إليها الباحث إلى وجود علاقة ما بين السلوك الصوتي وبين سمات التحيز الإدراكي وأسلوب صنع القرار لمديري المشاريع؛ ومع ذلك، كانت العلاقة ضعيفة، وأشارت النتائج إلى أن السلوك النرجسي لا يتوسط العلاقة بين سمات التحيز الإدراكي واتخاذ القرارات.

طور البحث نموذجا لاتخاذ القرارات لإزالة سمات التحيز الإدراكي استنادا إلى نتائج الأطروحة، ويمكن استخدام هذا النموذج لتقليل أو القضاء على تأثير القرارات المتحيزة. وقد تم التحقق من صحة هذا النموذج استنادا إلى ورش عمل مديري المشاريع واستبيان على أساس سبعة أبعاد: العلاقة المنطقية، والوضوح، والمعلوماتية، والرؤية التخطيطية، والأهمية، وقابلية التطبيق، والتنفيذ في الممارسة العملية. تظهر نتائج عملية التحقق من الصحة أن معظم مدير المشروع غير مدركين لسمات التحيز الإدراكي وأوصوا باستخدام هذا النموذج في المؤسسات الخاصة بهم. توصي الأطروحة باختبار العائلات والتحيزات الاجتماعية والتحيزات المتعلقة بالتأثير والذاكرة، والتحيز التمثيلي للأبحاث المستقبلية؛ واختبار العلاقة بين السلوك النرجسي والسلوك الصوتي وسمات التحيز الإدراكي باستخدام منهجية مختلفة. وأخيرا، قدمت هذه الأطروحة توصيات لمدير المشروع لاتخاذ قرارات رشيدة وقدمت قائمة بمصادر التحيز التي يمكن لمدير المشروع مراجعتها لتجنب التحيز.

DEDICATION

To my Wife, who believed in me, encouraged me, supported me with all possible means, and loved me more than her soul.

To my mother, the victorious, who raised me as a man.

To my father, who gave me peace within a cruel world.

To my soul mate, my brother Amer, the man I love more than life itself.

To my Father-in-Law, the wise, the teacher, and the godfather of my journey.

To Dr. Sultan Al Rumaithi, my eldest brother, and role model.

For the light that left us in the middle of the summer night, to Nour Edine. May his soul rest in peace.

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I wish to express sincere feelings for all who supported and encouraged me along this long journey, and I also would love to thank Mr Masoud Sakijha, who opened up the world of Project Management to me, to my family, and to my faithful friend Ibrahim Hammad, who always sees me as an example of success.

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LIST OF ABBREVIATIONS

BPEB: Belief and probability estimation bias

CB: Cognitive Bias

CBA: Cognitive Bias Attributes

CFA: Confirmatory Factor Analysis

DM: Decision-making

DV: Direct Variables

EFA: Exploratory Factor Analysis

IDV: Indirect Variables

ITSD: Information Technology Software Development

NB: Narcissistic Behaviour

PBB: Perception and behavioural bias

PJM: Project Manager

PM: Project Management

VB: Voice Behaviour

CHAPTER 1: INTRODUCTION

This chapter outlines the study context and background. The study area of focus is the influence of cognitive bias attributes on the decision-making style of project managers during Information Technology Software Development projects in Dubai. This chapter presents the motivation for initiating the study and defines the study problem, gap in knowledge, and significance. The following section of the chapter defines the study aim, objectives, questions, and hypotheses. Overall, this chapter provides insight into the thesis structure and framework.

1.1 Study background

The project management (PM henceforth) discipline is thriving (Bryde, 2003; Leybourne, 2007; Shamim, 2022; Kerzner, H., 2022; Azevedo, A. et al, 2022) in the past decades, indication shows that most organizations will adopt a PM methodology to plan and execute projects (Bryde, 2003; Ferreira, et al., 2022; Saif, U., et al, 2022), which later becomes extremely difficult to manage projects without applying a robust and viable methodology (Karlsen, 2002). Projects consist of integrated factors that determines the performance of the projects like scope, time, and cost (Bryde, Unterhitzenberger & Joby, 2018) .In this context, PM has a leading role in shaping the future of advanced technology (Koskela, 2014), as it is becoming an art that integrates the skills of humans and machines into a cohesive whole that works under an intense environment to satisfy the diverse requirements of significant stakeholders (Unterhitzenberger et al., 2020; Boehm & Ross, 2007). Where the input of stakeholders is important to manage the projects effectively (Zoufa & Ochieng, 2017).

As a result of the advanced technological revolution, Information Technology Software Development (ITSD) has emerged as an essential tool that supports business operations (Gardner, 1995), which gives organizations the momentum to use this tool to successfully process all organizational operations (Gingnell et al., 2014). The success of ITSD gives organizations a leading competitive edge and benchmark (Tohidi, 2011). Furthermore, it is well noticed that the ITSD industry is blooming worldwide; factories are using technology to run their productions and services, and financial sectors process thousands of transactions using customized software (AlMajed & Mayhew, 2013).

Implementing PM standards increases the chances of project success (Panda & Sahu, 2013). However, applying PM best practices does not always mean the project will achieve a successful outcome (Tabassi, Abdullah & Bryde, 2018); success can be measured based on the delivered product or service (Tabassi, Abdullah & Bryde, 2018); however, failure may be inevitable (Rezvani & Khosravi, 2018; AlMajed & Mayhew, 2013). For instance, information systems projects have a 70% chance of failure (Panda & Sahu, 2013), & failure rates increase with the emergence of problems during the project life cycle (Guimaraes & Paranjape, 2013). According to the statistical report published in January 2021 by the Standish CAHOS group, the percentage of successful global ITSD projects is 31%, where 50% of projects were confirmed to be challenging; and the failure rate ranged is 19%. Their report in 2016 showed that the success rate ranged between 26 and 30%, and the percentage of challenging projects ranged between 51 and 57%, while the failure rate was high, ranging between 17 and 23% (Gaikema et al., 2019). These statistics show that the percentages are almost the same, and any increase in the success rate is debatable. Nevertheless, most researchers connect failure to the Project Managers' (PJM henceforth) decisions made during the project (Keil, 1995) and to the PJM’s cognitive bias (CB henceforth) (Cunha, Moura & Vasconcellos, 2016); where it was found that lack of PJMs skills is the core factor that determine the success of projects (Ugonna, Ochieng & Zoufa, 2021).

Making project decisions seems simple when operating within a limited conflict environment; PJM make decisions sometimes based on their experiences (Krystallis, Locatelli & Murtagh, 2020); however, if the organization's strategic direction is unclear and the plans are ambiguous, the environment of the project becomes complex (Cunha et al., 2014) and shall increase/change the level of influence and interest for involved stakeholders (McCray, Purvis & McCray, 2002; Mirzaei & Mabin, 2014; Tabassi, Abdullah & Bryde, 2018; Unterhitzenberger et al., 2020); this affects the decision-making (DM henceforth) process and makes it arbitrary (Parkin, 1996). Decision theories assume that humans make decisions to fully utilize self-interest and rationality (Eweje, Turner & Müller, 2012), and they focus on how humans should make decisions as they are crucial for an organization's strategic directions and an efficient performance indicator (Eweje, Turner & Müller, 2012). According to psychologists, the human thinking capacity is limited when perceiving, absorbing and processing information (Kiełczewski, Matel & Poskrobko, 2016); the process of DM is affected by multiple factors that limit the capability of PJMs to make the right decision. Besides, an uncertain environment pushes PJMs to utilize their experience and background to decide what to do next since they are looking forward to making faster and more straightforward decisions. Thus, this increasing intensity caused by the uncertain environment requires logical situation analysis, which urges PJMs to make critical decisions based on logical and rational thinking (Prieto-Remón et al., 2015; Stingl & Geraldi, 2017). Hence, to achieve the desired project outcomes, the role of the PJM in making an accurate decision is becoming an essential skill (Parkin, 1996).

1.2 Study problem

Problem background

Regardless of the various tools and techniques that aimed to eliminate CB, the human judgment is still not immune for heuristic and biased decisions (Neal *et al.*, 2022); CB influence the way that human collect, perceive, and interact to information (Quigley-McBride *et al.*, 2022); hence people tends to have a confidence in their judgment, and interpret certain situation form their perspective (Berthet, 2022). People make decisions based on their own feelings, attitude, memories, and perception which may lead to undesirable results due to ignorance of sufficient information and details of the event (Tanaiutchawoot, 2022). Literature indicates that the DM process is still facing difficulties to apply (Ketchen & Craighead, 2022) where most of these decisions fall under the pressure of lack of information, time constraints, and uncertainty (Tanaiutchawoot, 2022).

Due to the prosperity of Information Technology past two decades, PM has become an instrumental science in which the human factor is considered a significant cause of project success or failure (Cunha et al., 2014). During projects, PJMs dedicate 75%-90% of project time to communicating with stakeholders (PMBOK, 2017) and resolving conflicts during the planning and execution phases (Tabassi, Abdullah & Bryde, 2018), where they face uncertain events that require to make a decision that satisfy all parties.. Nonetheless, decisions and judgments are subject to bias due to psychological heuristic impacts of perceptions of the project's constraints and the PJM's experience (Armstrong & Fildes, 1984); Virine & Trumper, 2008; Mohanani et al., 2018 Kaczyński, M., 2019).

Problem focal point

At the local level, a recent report by the Dubai Chamber of Commerce expected the IT software development market to reach 22 billion AED in 2019, while IT markets were expected to contribute more than 1% to the emirate's Gross Domestic Product GDP (Economic Research Department Dubai, 2019). Thus, Dubai took the initiative to transform into a smart government and services (Al Batayneh et al., 2021) to conceptualize the process that is entitled "To make Dubai the happiest city on earth" by designing IT services that make digital transactions more convenient (Al-Obthani & Ameen, 2019). Thus, to achieve that endeavour, the emirate is counting on the advancement of ITSD projects supported by a solid IT infrastructure (Al-ali & Ameen, 2018). This mission has encountered challenging environments that limit the ability to achieve these objectives, such as the lack of coordination and communication between major stakeholders and weak top management support (Al-Obthani & Ameen, 2019).

ITSD projects have become a pressing area of research according to the increasing failure percentage compared to other industries (Hassan, Ahmad & Zuhaira, 2018), and this failure causes enormous financial losses (Keil, 1995) and waste of resources (Leprevost & Mazur, 2005). ITSD projects fail to meet the scope of projects when excessive requirement gathering and gold plating[1] practices increase (Shmueli, Pliskin & Fink, 2015). In effect, the success or failure of ITSD projects is considerably associated with the PJMs' decisions (Cunha, Moura & Vasconcellos, 2016), which are frequently considered to be a challenge, particularly when their judgment is characterized by bias or distortion of information that leads to irrational judgment and consecutively affects the quality of project deliverables.

Gap in knowledge

Literature considered that people make decisions according to their perception and information they recall when making a decision (Berthet, 2022; Quigley-McBride *et al.*, 2022) where further investigation is required according to literature to highlights more sources of CB and their influence on the DM process (Neal *et al.*, 2022). Furthermore, and despite the taxonomy of sources of bias under major taxonomy (Virine & Trumper, 2008), more research is needed to contribute CBA to the DM process and more awareness must be created to ensure that CBA are analysed and defined (Al-Ali, Emes & Leal, 2018).

[1] In Project Management, Gold Plating is the process of working on a project after fulfilling the requirements in a late phase called diminishing returns by adding new features that are not included in the scope plan; this is considered to be a bad practice as it poses new risks and takes additional testing.

Literature discussed the impact the PJMs biased decisions on the project and how these decisions can determine the direction of the projects toward success of failure (Conlon & Garland, 1993; Masiello, 2009;Meng & Boyd, 2017), literature asserted that more investigation is required to address the relationship between PM and PMJs CB from one side and the behaviour of the PJMs during the projects form another side (Stretton, 2022).

CEST proved to be a good theory to explain the way people make decisions, it has demonstrates the rational and experiential DM process that influence the judgment of people (Epstein *et al.*, 1996; Björklund & Bäckström, 2008;Schutte *et al.*, 2010); literature indicated that more investigation is required to explore the relationship between CEST and CBA (Monacis *et al.*, 2016), and further research is required to assess the DM process when conducted by professional PJMs (Harper, 2016).

PJMs are very important resources for the organizations (Keane, 2022), cognitive social theory demonstrate that successful characteristics of the successful individuals but also asserted the focus on the behaviour of the people (Keane, 2022); literature have asserted that the behaviour of PJMs determine the success/failure of the project and impact the project team performance (Richard, Idris & Bobbo, 2018). Furthermore, more studies are required to demonstrate the competencies of the PJMs and their ability to make rational decisions (Bushuyev *et al.*, 2020).

Literature have demonstrated the impact of PJMs behaviour on the performance of the organizations as their decisions lead the directions of the strategy (Ouimet, 2010;Pinto & Patanakul, 2015); for instance, the NB have a negative impact on the performance of the organizations due to the toxic environment that narcissistic manager create; While recent research alerts the influence of changes of technology on people behaviour, as the increase of using mobile phones and social media platforms increases the narcissistic behaviour of the users (Panek, Nardis & Konrath, 2013); however lack of research linked the NB to the PJMs and DM style (Ouimet, 2010;Pinto & Patanakul, 2015) where literature suggested to do more research to link the NB to PM (Panek, Nardis & Konrath, 2013) and lack of researches that linked NB to CBA.

Theory of self-consistency stress the influence of VB on the improvement of DM and positive impact on the project work environment (Ekrot, Rank & Gemünden, 2016); VB increase the engagement level with the stakeholders in the upper management according to literature (Rees, Alfes & Gatenby, 2013); VB encourage PJMs to express their thoughts and feelings toward specific decision, however the impact of the PJMs VB requires further investigation within the context of PM (Ekrot, Rank & Gemünden, 2016); and the link between the CBA and VB requires a theory that shape the relationship of fast and hasty decisions (Wilkinson *et al.*, 2018). Literature demonstrated that CBA influence the project success, and asserted that biased decisions increase the possibility of project failure, however literature investigated few sources of bias and didn't link the DM style of PJMs when formulating decisions under uncertain events (Rzeszutek, 2018;Cunha, Moura & Vasconcellos, 2016; Al-Ali, Emes & Leal, 2018).

However, literature demonstrated that further research is necessary to understand the relationship between PJMs and CBA when making decisions (Cunha, Moura & Vasconcellos, 2016), beside, literature demonstrated that CBA that includes more than one sources of bias were not explored thoroughly in literature (Al-Ali, Emes & Leal, 2018)

In this context, a few studies have examined the role of the DM style of PJMs and CBA and their impact on project outcomes. A few recent studies have examined the relationship between the ability of PJMs to make a rational decision free of CB when deciding on the action course of project deliverables (Cunha, Moura & Vasconcellos, 2016). Moreover, these recent studies that investigated the impact of CB on project management (Al-Ali, Emes & Leal, 2018) showed promising; however, no single study has investigated many sources of CBA on the DM style of

PJMs. In addition, from the study point of view, a few empirical types of research have investigated sources of bias in ITSD projects and the impact of CBA on project success (Eweje, Turner & Müller, 2012). Nevertheless, no research has been carried out to examine the moderating role of some critical factors such as NB and VB and their impact on the DM style of PJMs and CBA (Pinto & Patanakul, 2015); moreover, there is a lack of exploration of NB and VBs within the PM context (Pinto & Patanakul, 2015).

Relevance of the problem

The initiative to transform the Emirate of Dubai into a smart city through adopting ITSD projects has so far seen results that have come against the expectations in terms of the relatively high rates of failure in these projects, which have resulted in considerable losses in terms of budget and resources (Al-Hajj & Sayers, 2014; (Al-Obthani & Ameen, 2019). Due to the limited research that has attributed this failure to CB but has not thoroughly explored this aspect, the current study is interested in investigating the CBA and assess the role as the experiential and rational DMS approaches of the PJMs, the moderating role of NB and VB, which will be reasonably explained and related to this aspect. Based on this endeavour, a solid foundation and knowledge is provided to unveil the importance of these factors in defining the critical role of PJMs in determining the failure or success of projects. Moreover, studying this aspect will link the relation between these critical factors and the DM process, explain how the behaviours of PJMs can affect their decisions based on their beliefs, emotions, reactions, and perception, and outline a viable reference to be followed by PJMs and organizations in the future to avoid making the same mistakes and instead take the correct course of actions for projects.

Earlier studies investigated a few sources of bias in past cases using secondary data (Mohanani et al., 2018; Virine & Trumper, 2008; Kiełczewski, Matel & Poskrobko, 2016; Prater, Kirytopoulos & Ma, 2017); or investigated a single source of bias like optimism on one project constraint like risk (Fabricius & Büttgen, 2015); although risk is major key constraint that determines the success of the project (Zoufa & Ochieng, 2014).

Although many sources of bias like optimism, overconfidence, planning fallacy, illusions of control, and IKEA[2] bias is connected to NBs (Pinto & Patanakul, 2015; Stingl & Geraldi, 2017), no research has been carried out to investigate the relationship between bias and NBs. These decisions are profound and influence constraint-related decisions like resource allocations, investment, scope creep and high cost (Pinto & Patanakul, 2015). In addition, no single study has investigated the impact of VB in the context of DM during ITSD projects.

1.3 Study aim and objectives

The study aims to examine the impact of CBA on the DM style of the PJMs during ITSD projects in Dubai and the moderating role of NB and VB. The study examines the DM styles of the PJMs using the cognitive-experiential self-theory (CEST) model, which comprises both experiential and rational approaches. The study proposes a CB model that comprises the psychological and mental state of CB, NB and VB to assess the DM of PJMs in projects. A de-biasing model and recommendations are proposed to PJMs to eliminate or at least mitigate their bias in effectively managing ITSD projects in Dubai. Thus the study objectives are:

1. Explore the influence of cognitive bias attributes on the decision-making style of project managers during ITSD projects in Dubai.
2. Assess the moderating impact of NB on the relationship between cognitive bias attributes and the decision-making style of the project managers.

[2] The Swedish furniture company and the name stands for Ingvar Kamprad, IK, where Kamprad's childhood – Elmtaryd KE is the name of the farm on which the founder grew up.

3. Assess the moderating impact of the VB on the relationship between CBA and the decision-making style of the project managers.
4. Examine the influence of the decision-making style of the project managers on ITSD project success in Dubai

1.4 Study questions

With a focus on IT software development projects in Dubai, the main questions that underpin the study are:

1. What is the relation between cognitive bias attributes and the decision-making style of the project managers?
2. Does Narcissistic behaviour act as a moderator in the relationship between cognitive bias attributes and the decision-making style of the project managers?
3. Does the Voice behaviour act as a moderator in the relationship between cognitive bias attributes and the decision-making style of the project managers?
4. Does the decision-making style of the project managers influence the success of ITSD projects in Dubai?
5. Do the cognitive bias attributes influence the ITSD project success?

1.5 Study significance

The results of this thesis are expected to contribute significantly to the PM discipline in terms of CBA, PJM DM style, and behaviours. This contribution is important to the UAE, the Middle East, and the globe, with different academic and practical implications due to the lack of and shortage research within the context of PJM DM style, PJM voice and NBs, and CBA in the area.

The academic contribution illustrated by exploring the source of CBA and the classifications of these sources under two main families: perception and behavioural bias and belief and probability estimation bias. The impact of the sources of bias families, groups, and a single source of bias add a different view of the impact of multiple sources of CBA on DM style since a PJM may fall under more than one source of bias when making a decision. On the other hand, the study is expected to explore the behavioural aspects of the PJMs represented by VB and NB; such behaviour has a positive and negative impact on the DM style, which plays a role in the success or the failure of projects.

The argument of that thesis is based on five foundations that explore the influence of CBA on PJM DM style and how that impacts the success of projects: (1) PBB and the DM style of the PJMs, (2) BPEB and the DM style of the PJMs, (3) NB as a moderator of the relationship between CBA and the DM style of the PJMs, (4) VB as a moderator of the relationship between band the DM style of the PJMs, and (5) the impact of the DM styles on the success of the ITSD projects.

Cognitive bias has been explored in medical, psychological, and behavioural fields (Ishikawa et al., 2017; Biswas & Murray, 2017). The results of these studies emphasized the role of the CBA impact on decisions; they have asserted the relation between DM and CBA. However, few empirical studies have explored the relationship between PM and CBA in ITSD projects in particular (Cunha et al., 2014), and those that have not examined DM's style, either rational or experiential. Understanding how ITSD PJMs make decisions is critical and requires further investigation to mitigate/eliminate bias (Cunha et al., 2014; Mohanani et al., 2018; Stacy & Macmillan, 1995) ensure that project deliverables achieve the desired outcomes.

In recent years, a few studies have investigated some particular behavioural aspects of PJMs; for instance, Ekrot, Rank & Gemünden (2016) examined PJMs' behaviours from the communication of ideas perspective, whilst Randeree & Faramawy (2011) and Pinto and Patanakul (2015) investigated the NB of project champions on project decisions (not as PJMs).

These results linked the impact of behaviours to DM, but they did not define sources of bias that influence the DM styles of PJMs, and they did not explore the DM style of the PJM. Hence, this study explores the moderating role of NB and VB on DM style and PJMs' CBA.

Furthermore the study adopted the cognitive-experiential self-theory model to assess the difference between rational and experiential PJM, besides investigating the impact of the CEST model and the PJM's behaviour (Schutte et al., 2010). However, no empirical studies have tested the DM process in the ITSD industry using the CEST model with ITSD projects (Epstein et al., 1996).

From a practical perspective, the study intends to provide a framework that integrates sources of bias with PJMs' DM styles, aligned with the PJMs' behaviour and the impact on ITSD projects; taking into consideration that studies of the CB sciences have increased the interest in studying neuroscience within the context of organizations. It is worth mentioning here that this approach has not yet been fully developed (Stingl & Geraldi, 2017).

In addition, the necessity to develop a de-biasing model that integrates the DM style with PJMs' behaviour will enhance the ability of PJMs to make decisions based on practical perspectives that encourage them to follow particular steps to avoid bias, eliminate NB and improve the impact of VB on decisions. Hence, the consequences of their decisions will lead to a favourable outcome instead of project failure.

1.6 Study framework

Figure 1.1 depicts the study framework for the entire thesis and shows each chapter's logical steps and output and how they are linked together.

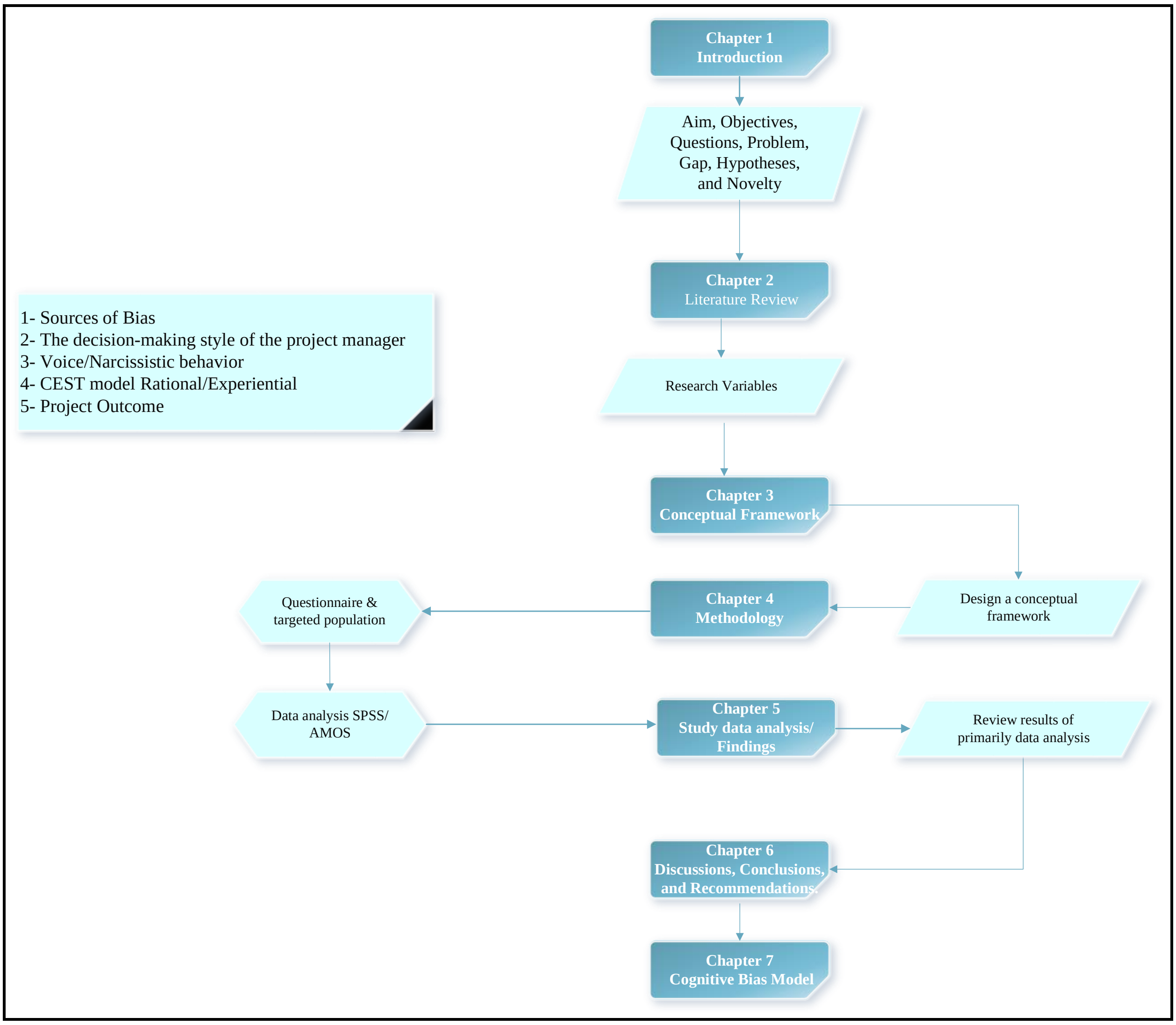


Figure 1.1: Study framework

1.7 Thesis structure

The structure of this thesis consists of 11 chapters, references, and appendices. The design of this thesis follows the logical outline summarized below

Chapter 1: Introduction

Chapter 1 reviews the study context and the motive to commence this thesis; it provides an overview of the study aim, objectives, questions, and hypotheses. In addition, the chapter discusses the study knowledge gap and practical and academic contributions.

Chapter 2: Literature review

Chapter 2 introduces the study literature review starting with the ITSD context in Dubai and highlights the role of ITSD in the development of Dubai and the impact of the ITSD industry on the emirate's economy and its transformation into a smart government. It will discuss the role of PJMs in projects and discuss DMS and CEST in addition to the investigation of CB and CBA. This chapter also discusses the aspects of behaviour and links the DM process with the VB and the NB.

Chapter 3: Conceptual Framework

Chapter 3 consists of the relationship between study variables and the roles of independent, dependent, and moderating variables. The chapter defines study measurements, introduces the study demographic variables, and demonstrates the thesis hypotheses and sub-hypotheses.

Chapter 4: Methodology

Chapter 4 focuses on the study philosophy strategy, and the justification for pursuing the quantitative research method. Furthermore, this chapter introduces the research pilot study, sample size and population, and data collection method. This chapter introduces the data analysis techniques and testing hypotheses. Chapter six explains the concept of reliability and construct validity and their value for assessing the research data collection instrument. The last section of chapter five defines study variables measurements and the ethical consideration of the study.

Chapter 5: Study data analysis and findings

Chapter 5 focuses on analysing data collection and respondents' answers to the study questionnaire; and how the respondent's perceived the CBA; it provides data filtering and checks for missing values replacements to accommodate incomplete questionnaires. It also demonstrates the testing of outliers, tests the validity of the variables through CFA, EFA, and the reliability of the questionnaire through Cronbach's alpha factor in addition to test KMO and

Bartletts test. It provides a complete description of the thesis demographic variables, the standard deviation for study items, correlations, and testing of study hypotheses.

Chapter 6: Discussion, Conclusions and Recommendations

Chapter 6 provides a complete discussion of the study results; it demonstrates the questionnaire results in a literature and study context. Furthermore, this chapter discusses the results of the thesis hypotheses, answers the study questions, and assesses the achievement of the study objectives. The last section of this chapter discusses the practical and academic implications of the study and the study limitations. It also discusses the study conclusions and recommendations, defines the significant study contribution to academic study, and illustrates significant recommendations for both academics and the ITSD industry. The last section of the chapter assesses the necessity for future study.

Chapter 7: Cognitive Bias Model

This chapter presents the process of model validation by project management practitioners in Dubai and the validation process results. The chapter's primary purpose is to fulfil the fifth of the study objectives concerned with developing the CB model. It explains the basic assumptions and foundations of the model and depicts the validation of the model.

1.8 Chapter summary

Chapter one has presented the prelude to the study, providing an insight into the research background, context, and research problems. It has identified the study aim, objectives, and hypotheses to align the study problems with the study framework to investigate the influence of CBA on the DM style of the PJM: the moderating the role of narcissistic and VB during ITSD projects in Dubai.

The chapter has also demonstrated the major challenges in ITSD industry projects and illustrated the study's significance and implications for academic and practical practices.

Furthermore, this chapter presents the study framework and study structure that the author followed to achieve the study objectives.

CHAPTER 2: LITERATURE REVIEW

This chapter introduces the study literature review; this chapter is divided into three sections, the first section provides an overview of the Emirates of Dubai social, economic, and political context; and explores the country's socio-economic development. In addition to the recent development in ITSD projects in Dubai and the industry's performance, key challenges, and problems. The second section demonstrates the role of the PJM during ITSD projects, and the impact of the PJM decision on the project outcomes; and third section discusses the theoretical background of the CBA, DMS, and the PJM behaviour.

2.1 Section one: An overview of the Emirate of Dubai

Located along tens of kilometres on the long shores of the Arabian Gulf (Murtagh et al., 2022), the Emirate of Dubai is a centre for commerce and international trade. With a unique infusion of multicultural backgrounds, the Emirate of Dubai is one of the rarest cities in the world inhabited by multiple nationalities (Ricca, 2018); the population of Dubai lives in harmony and tolerance and comes from different cultures and backgrounds. Dubai is the largest population in the UAE (Ricca, 2018); it has diverse religions and cults that perform their worship in peace and serenity (Yas et al., 2020). Furthermore, the characteristic of the youth population drives the wheel of moving toward smart IT solutions (Yas et al., 2020). A unique combination of different educational background like western, Indian, European, and Asian created a remarkable texture that is one of a kind (Zaidan, 2016). That unique combination of diverse cultures appears obviously in many shapes like heritage dresses, faith and religious rituals, national occasions (Zaidan, 2016). The emirate of Dubai has provided different urban areas for living and investment that range from luxuries housing to normal housing depending on the size of property, location, property type, and services (Zaidan, 2016); the income is also differ from one nationality to another, where the western have the most paying salaries. However, the city has provided a complex transport system like the metro to help the residents mobilize to their work locations; where the routes and directions are clearly explained and can be used by mobile application, in addition, the city provided a vast transportation network like busses for a low fair, where taxi is the most expensive commuting channel (Zaidan, 2016).

Economic outlook

The Emirate of Dubai has a leading economic position in the region (Alshamsi et al., 2019); its economy is a major driving factor toward development supported by an advanced IT infrastructure (Alshamsi et al., 2019). The prosperity of Dubai's economy declined during the 80s due to the drop in oil prices, the Iraq-Iran war, and the withdrawal of Sheikh Maktoum from public life (Al Faris & Soto, 2016). Despite the discovery of oil in 1966, Dubai's rulership decided to invest in the advanced future; the emirate launched several investment projects starting with the construction of Jebel Ali Port in 1972; an aluminium factory; natural gas refinery; Dubai cables company; and the establishment of Jebel Ali Free Zone Authority (JAFZA).

The vision of H.H. Sheikh Mohammed Bin Rashid Al Maktoum, the crown prince of Dubai, transformed the perspective of the emirate's economy. Dubai was transformed into a business hub; the vision made Dubai a central global trading centre and the capital of ITSD and e-commerce (Al Faris & Soto, 2016). Furthermore, the Emirate of Dubai developed its banking system with large-scale investment in financial tools (Al Faris & Soto, 2016).

Despite the financial crisis in 2008, Dubai is ranked 37th out of the top 50 financial cities in the world; it is a major hub for financial services, information technology industry, and media; it is worth mentioning that the economy of Dubai is mainly based on tourism, export, and real estate sectors (Ricca, 2018).

The Emirate of Dubai has the lowest risk indicator globally in terms of foreign direct investment, which encourages investors to start up their businesses in Dubai (Joghee, Alzoubi & Dubey, 2020).

The Emirate of Dubai has established innovative strategic objectives that are looking forward to integrating the past and the future in a framework that reserves the city's tradition and maintains the advancement of technology (Ricca, 2018). During the last 15 years, the city has transformed from a few palm trees into a major city globally (Ricca, 2018); and it has made solid steps toward a strong economy that supports various industries (Lamouchi & Alawi, 2020).

Dubai's economy is rapidly growing, supported by major industries like tourism (Yas et al., 2020); this indicates the necessity of a solid IT infrastructure that can facilitate the process of issuing visas, regulate airport check-in services, enhance the work of the hotel booking systems, and monitor the mobility of tourism through Dubai (Yas et al., 2020). Furthermore, the Emirate of Dubai is pursuing clean energy and reducing the emission of carbon dioxide to position itself among global cities as a place with a green environment (Shahin et al., 2020).

The political context

Sheikh Mohammed Bin Rashid Al Maktoum is the ruler of Dubai, the prime minister, and vice president of the UAE (Yas et al., 2020). The UAE consists of seven emirates: Abu Dhabi (the capital), Dubai, Sharjah, Ras Al Khaimah, Ajman, Al Fujairah, and Umm Al Qaiwain. The supreme council sets the policy in the UAE; each emirate has a local government with flexible distribution of authority; most people in the UAE gather in "Majlis" to interact with and approach the rulers.

The political function in Dubai is part of the UAE's federal constitution, but the Emirate of Dubai has a separate jurisdiction function that coordinates with other functions in the UAE (Yas et al., 2020). Furthermore, due to the flexible political function in Dubai, the city attracts many investments and expatriates to work, invest and live there; and the city hosts and organizes many sports events; hence, it has emerged as a global metropolis in the world.

Long-term and short-term goals of Dubai

Dubai is looking forward to positioning itself as a world-class metropolitan by adapting to new technology and transforming most transactions into smart services (Mahmoodi & Nojedeh, 2016). Thus, the emirate has identified particular objectives to achieve its vision. Dubai's rulers have identified specific strategic objectives to accomplish this mission, for instance, the transformation of smart government services (Mahmoodi Nojedeh, 2016). This mission is based on a few goals and starts with delivering convenient and accessible services to Dubai's inhabitants; eliminating redundant and unnecessary processes within the government regulations; integrating the process of different sectors into a whole cohesive system to facilitate the flow of information and reduce cost; and ensuring transparent systems (Mahmoodi & Nojedeh, 2016).

His Highness Sheikh Mohammad Bin Rashid Al Maktoum, the vice-president and prime minister of the UAE and the ruler of Dubai asserts that IT plays a vital role in the advancement of the city; and is an enabler of the progress of the emirate that maximizes the happiness of its residents as its primary objective (Bishr, 2017).

Furthermore, the emirate launched a five-year strategy starting in the year 2021; the basic foundations of this strategy align with the rulership's vision of the emirates and consist of integrated goals that work in a straightforward direction (Bishr, 2017). Hence, the emirate is striving to take advantage of the digital transformation, achieve a positive impact, enhance the interaction between government and individuals to improve services and make whoever lives in or visits Dubai a happy person (Bishr, 2017).

The adoption of information technology in Dubai

The adoption of the IT services journey in Dubai started in 1999; the government launched its first strategy, which evolved to establish the internet city, Dubai smart government, and Dubai e-government. Recently, companies have been striving to change their operations and functions due to the advancement in IT services (Mahmoodi & Nojedeh, 2016); Thus, the government of Dubai is adapting to the advancement of technology to increase the effectiveness of its online services, reduce the timeframe to deliver services, and reduce the cost of services (Mahmoodi & Nojedeh, 2016; ElSherif et al, 2016).

The majority of Dubai's population is comprised of young people who are IT-oriented and adaptable to technology (Yas et al., 2020); the foundations of tourism, government and real estate are all related to the IT industry. The number of IT and internet users has doubled over the last decade; for instance, the UAE has the most satellite services and smartphones users in the region (Yas et al., 2020). The Road and Transport Authority launched the first urban metro project in 2009, a fully automated train that is completely administered and functions remotely. Dubai is an advanced city that processes most of its government services through web-based or mobile applications (Alshamsi et al., 2019); currently, it is looking forward to transforming all its services online, supported by its solid ITSD infrastructure (Alshamsi et al., 2019). The transformation of these services also targets the automation of traffic services to reduce traffic jams and enhance the healthcare systems to facilitate the inpatient process (Yas et al., 2020). Dubai's IT industry is the most active sector among all the emirates of the UAE and is making steady progress as an important sector in the Middle East (Joghee, Alzoubi & Dubey, 2020).

The superior IT infrastructure in Dubai gives the emirate a competitive edge to attract businesses from different industries to invest as it uses the latest technology to facilitate the business setup process (Joghee, Alzoubi & Dubey, 2020). Therefore, Dubai is focusing on information technology projects that aim to provide adequate support to the transformation initiative within the emirate (Mahmoodi & Nojedeh, 2016)

Recent developments in ITSD projects in Dubai

The development of projects from different sectors like real estate, services and manufacturing cannot achieve a competitive edge and resilience without integrating ITSD projects and the technology related to these projects (Mahmoodi & Nojedeh, 2016).

The government of Dubai has launched several initiatives to take advantage of IT development; for instance, the government now is transforming all services into e-government, which enables people to get access to all services through mobile applications and web portals (Bishr, 2017)., The smart city concept is firmly associated with the development of real estate projects like Ain- Dubai, Dubai Creek Harbour, Bluewater's Island, Meydan One and Dubai Harbour (Joghee, Alzoubi & Dubey, 2020). The use of IT projects to achieve clean energy projects has played a vital role in the city's recent development; Dubai is applying smart systems that decrease carbon emissions and increase the reuse of renewable energy through the installation of solar roof-top photovoltaic cells (Shahin et al., 2020).

Launched with Emirates Integrated Telecommunications Company, the Dubai government initiated the first phase of the Dubai smart platform, enabling individuals and entities to collect data from different resources through IT systems to make users happier (Haddad et al., 2020). To this end, Dubai intends to ensure that all citizens, businesses, and organizations get access to fast internet connectivity which will enable them to access all available services and perform their transactions while feeling secure that their personal information will remain private, as the government ensures the take into consideration the sensitivity of the cyber security that protect the information. In addition, the IT development will enable people to supervise their vital resources like water and electricity, making them conscious consumers. Furthermore, the government intends to support all entrepreneurs by providing them with the latest digital services to start up their businesses, setting simple regulations and accessible services, and providing incubators (Bishr, 2017).

Performance and challenges of ITSD projects in Dubai

Most multinational IT companies have representatives or operating offices in Dubai (Yas et al., 2020); the ITSD industry in Dubai is one of the fastest-growing sectors in the world, according to the latest report by the Road and Transport Authority (RTA) (ElSherif et al, 2016). Furthermore, according to the 2021 Global Smart City Index, Dubai ranks 20th among the 50 smartest cities worldwide (Visit Dubai, 2021).

The Dubai Chamber of Commerce expected the IT software development market to reach 22 billion AED in 2019, while the IT markets were expected to account for more than 1% of the Gross Domestic Product GDP of the emirate.

Even though IT services are effective, the Emirate of Dubai faces a few challenges; for instance, the gap between the IT infrastructure and the implementation of e-policy, which requires a revision of procedures to facilitate the initiation of ITSD projects (Mahmoodi & Nojedeh, 2016). On the other hand, applying the development of ITSD projects requires safety very safe and secure IT environment; this limitation has impeded the process of ITSD projects due to the security checks (Mahmoodi & Nojedeh, 2016). Maintaining users' privacy and consumer rights raises a debate about whether IT projects are convenient for development or whether more time is needed to adapt to the complete cycle of full IT project development and implementation (Mahmoodi & Nojedeh, 2016). Furthermore, system readiness is necessary to achieve the big data concept all over the emirates; hence, it is important to prepare the IT platforms with the latest technology to achieve that goal (Haddad et al., 2020).

In addition, the city is facing external factors that minimize the ability to deliver ITSD projects, for instance, climate change, global competition, digital literacy, and autonomous transport (Bishr, 2017). Furthermore, the engagement and integration of the private and public sectors are important to accommodate the challenges of ITSD projects (Bishr, 2017).

The maturity level of the organizational governance adds another challenge to the ITSD projects in Dubai (Mossalam & Arafa, 2016); ITSD companies should consider the engagement of stakeholders to achieve the project objectives and look beyond the triple constraints (scope, time and cost) during the generation of project deliverables (Mossalam & Arafa, 2016;Zoufa & Ochieng, 2017;Unterhitzenberger & Bryde, 2018). Furthermore, there is a skills gap in the emerging technologies, which results from many traditional jobs being replaced by intelligent automation, so a paradigm shift is important to develop tech-savvy people for every role and level in all organizations and industries (Bishr, 2017).

In addition, due to the diverse nationalities, the language barrier is another challenge affecting ITSD projects in Dubai; although the common language is English, the level of proficiency differs, which affects the PJMs' DM process (Denhere, Hörne & Van Der Poll, 2015). Gender bias also has a major role in deciding who will manage a project, and there is a lack of confidence in assigning project work to women (Denhere, Hörne & Van Der Poll, 2015). Besides, the salary scale is biased; evidently, the salary scale for PJMs is different from that for multinational PJMs (Denhere, Hörne & Van Der Poll, 2015).

From a technical perspective, Dubai's ICT infrastructure is efficient, and the utilization of this advantage is necessary to communicate project plans and reports. For instance, many companies provide web-based, and ICT tools for the project team for use during the project planning and execution but not all of these tools' features are utilized (Denhere, Hörne & Van Der Poll, 2015).

Failure of ITSD projects in Dubai

ITSD PM is an art, while integrating ITSD, economy and humans into a cohesive context is not straightforward (Boehm & Ross, 2007). ITSD projects are people-oriented work that continues for an extended period that involves the contribution of people with different skills. In the modern-day, ITSD has become the basis for benchmarking and successful organizations (Tohidi, 2011).

Managing projects becomes a challenge for PJMs due to many factors that control the environment beyond the PJMs' control, especially when completing ITSD projects, as there is a rapid technological change that becomes a key driver to complete projects earlier than scheduled to compete with these technological changes in the market (Gingnell et al., 2014). Furthermore, PJMs face unforeseen issues that place them in a situation where they have to decide which course of action to take and which tools to adopt, which in some cases leads them to make wrong decisions that result in project failure

The failure of ITSD projects has sparked many studies to look into the reasons for the root causes of such failure (Dalcher & Benediktsson, 2006). Failures lead to project termination, which causes a loss in capital, loss of market share, and a missed opportunity to invest in more profitable projects. It is worth mentioning that the ITSD industry suffered a loss of 81 billion USD in the United States of America only, whereas Europe suffered over 150 billion every year due to IT project failure (AlMajed & Mayhew, 2013)

The environment of ITSD projects is complex and ever-changing; they are subject to more risks and failure rates than other fields. The CHAOS Report by the Standish Group showed that more than 32% of IT projects succeeded, and 44% of IT projects faced many challenges like lateness, going over budget, fewer features or functions, while 24% of these projects failed as they were either terminated or failed as they could not fulfil their budgets, delivery, and objectives. In this essence, ITSD in Dubai reported many failures in IT projects, although it was difficult to identify an accurate percentage rate of failure as there is a lack of statistical reports issued by the Dubai Chamber of Commerce. On the other hand, the rate of all successful projects is estimated at 65%, and 35% failed (Al-Hajj & Sayers, 2014). This percentage complies with the Standish CHAOS reports for 2016 and 2021, which implies that failure rates for ITSD projects are similar and did not improve during the last five years.

Concerning the key reasons behind the failure of ITSD projects in Dubai, which became an exciting area of research according to the increasing failure percentage (Hassan, Ahmad & Zuhaira, 2018), it was noticed that projects from other industries have a higher success rate than ITSD projects, and a still considerable number of ITSD projects fail to meet the project deadline, exceed project budget or do not meet stakeholder expectations. The main reasons for failure are lack of proper scope definition, lack of end-user engagement, unrealistic stakeholder requirements, unclear objectives, poor planning, and technology incompetence.

However, the analysis of these reasons for failure did not mention PJMs' CBA as input for project failure, although 90% of PJMs' time is devoted to communicating internally with the project team and externally with the stakeholders; and then is subject to human judgment and encounters several crucial factors that PJMs should consider in achieving the project deliverables. Therefore, CBA represented a pivot point in framing the process of DM (Ishikawa et.al., 2017; Aberegg, Haponik & Terry, 2005), which affected the constraints of the ITSD projects and then resulted in scope creep, unrealistic schedule estimation, poor quality of deliverables, poor risk identification, lack of resource management, and unsatisfied stakeholders, it is necessary to shed light on how CBA affects the success of ITSD projects.

2.2 Section two: The Project manager role in projects

PJMs should have adequate experience and qualifications in PM and make decisions related to the project deliverables during the project outputs (Meng & Boyd, 2017). Broadly speaking, as Saladis and Kerzner mentioned (2009) in their book “PMBOK Guide”, a PJM is granted the access to search, select, and make viable arrangements to assign the best resources to a project, and is responsible for planning the process from a leadership point of view. A PJM is not mainly a technician expert but should have an adequate background in technology to be able to coordinate activities and explain issues for clients and with experts, monitor correlations with groups, and make key decisions regarding the performance of the project and amend the plans accordingly. A PJM is responsible for managing the entire project and will be required to oversee a portion of the technical aspect and some outcomes. In other words, a PJM should be able to shift from the managerial role to the technician role and vice versa, which is seen as a sort of a challenge to PJMs as they have to manage projects from a higher level (Masiello, 2009).

Accordingly, these roles and responsibilities are summarized next:

1. Project success: PJMs are responsible for project success/failure and for completing the project deliverables, planning, directing, and controlling project activities and the project team (Bakar et al., 2011).
2. Managing project constraints: plan, execute and control project constraints and balance changes that occur to any constraints against the other constraints (PMBOK, 2017).
3. Lead and direct the project team: monitor the project team, distribute roles and responsibilities, resolve conflict, train team members, motivate the project team, and connect management and team members; Tabassi, Abdullah & Bryde, 2018).

4. Project communication: communicate project reports with the top management like progress and update, prepare earned value measurements (EVM) reports, manage milestones, and provide project forecast reports (PMBOK, 2017; Tohidi, 2011).
5. Provide coaching, training and direction to the project team (Tohidi, 2011).

To cope with conflicts and challenges and the frequent changes and turbulences that occur during a project, the PJM should have particular skills and general competencies. These competencies are divided into three categories (Dziekoński, 2017): the first is knowledge, which refers to how much a PJM knows about PM. The second one is performance, which is the capability of the PJM to achieve project objectives by applying PM knowledge. And the third one is personal, which reflects the PJM's behaviour when completing project tasks and activities, and which is summarized in the PJM's attitude, personality characteristics, and leadership style (Tudor, 2013).

These categories are classified into soft skills and hard skills (Cunha et al., 2014), where the soft skills include the ability of a PJM to lead the project, communicate efficiently, design team-building activities, manage team stakeholder conflict, be creative, innovative, flexible, and, most importantly, have the ability to make decisions under challenging situations and stressful events. On the other hand, hard skills are techniques, tools and processes that the PJM uses to produce project deliverables (Blackstone, Cox & Schleier, 2009).

During projects, PJMs make decisions under some uncertainties, either relatively critical or not; these decisions could be cutting off some project features, schedule crashing and decreasing project cost. Thus, the PJMs apply the heuristic or rule of thumb when making a future decision. Although this decision might be valid depending on the situation, it may lead to bias and bring negative consequences (Cunha *et al.*, 2014; Virine & Trumper, 2018) as it becomes a gap between reality and judgment from one side and uncalculated consequences from another side.

Changes are inevitable in projects and overlap during the project life cycle; the consequences of changes, if not assessed correctly, could damage the project if the decision is inaccurate (Shirazi, Kazemipoor & Tavakkoli-Moghaddam, 2017), where the PJM is accountable for these changes and is considered to be the source for confirming the competencies required to manage changes plans (Cunha et al., 2014). In this context, various factors could influence the PJM's capacity to make the right decision at the right time when things are at stake; these factors are management pressure, profound technology changes, and the absence of top management support (Prieto-Remón et al., 2015). Other factors are related to the PJM's personal traits and skills, which are affected by the CBA that make the decision-makers skip rational and logical aspects and create mind shortcuts in the human brain to make a fast, irrational decision that could have the possibility of "good luck" as the decision is correct or could have fatal consequences and causes project delay (Mackie et al., 2007).

Moreover, it is the responsibility of the PJM to manage and control risk (Hunziker, 2019). In addition, they need to use rational analysis to predict and respond to unpleasant events, as well as overcome overconfidence and behavioural aspects when dealing with risks (Fabricius & Büttgen, 2015), as it was proved that PJM bias impacts the risk management plan, which may lead to project failure if not treated correctly (Kennedy et al., 2019). These expectations and ambitions represent a challenge for the PJMs, which is the root cause of conflicts and irrational decisions that PJMs make under uncertainty and external pressures (Boehm & Ross, 2007).

In the context of ITSD projects, PJMs' main concerns are about achieving satisfaction for all stakeholders: customers, management, developers, end-users and the maintenance team (Boehm & Ross, 2007); each stakeholder has a specific desire regarding the final project results. For instance, the customers expect a reliable product within a short time and with the lowest possible cost; management is looking forward to a satisfied customer and a project with no overrun and no surprises; the maintenance team expects an algorithm that is easy to configure with no bugs; the project team expects promotion, enriched career path, and rewards (Mohanani, Ralph & Shreeve, 2014).

Hence, due to the complications associated with this sort of project, some PJMs have failed to find the proper technique or software to define the complete software project scope (Panda & Sahu, 2013), which places the PJM in a position where they have to depend on their experience, skills and characteristics to define the project scope. During such situations, the PJMs follow their intuition (Leybourne & Sadler-Smith, 2006); thus, a space for CB exists that ends in a wrong decision (Lean Keng & AlQudah, 2017).

In other words, PJMs make irrational decisions that affect their professional integrity (Chung & Cheng, 2018); where rational decisions may be the ideal approach for reaching the best alternative (Murtagh, Lopes & Lyons, 2011); bias emerges due to changes in feelings and emotions following the free choice of arrangements. They fall into one of the categories above and fail to follow the logical steps mentioned earlier when attempting to make the right decision. PJMs are affected by their psychological state under uncertainty; this mental state influences their judgments and leads to either project success or failure (Skitmore, Stradling & Tuohy, 1989).

Realizing the importance of the PJM's role in projects is critical. This is why the decisions made by PJMs affect the project constraints and might determine the project's success or failure; furthermore, the effects of the PJM's decisions and the flow of information they receive have a tremendous impact on project success (Eweje, Turner & Müller, 2012).

Project success

According to a Standish CAHOS report (Gaikema et al., 2019), 32% of projects are considered successful in terms of the theory of constraints; 24% of projects are considered failures; while the remaining 44% failed partially in terms of not completing the project on time and cost overrun, besides not achieving all the stakeholders' requirements.

Projects contain complicated processes and different environmental pressures, which clarifies why some projects do not achieve their objectives (Besteiro, de Souza Pinto & Novaski, 2015). To consider a project successful, PJMs should balance the triple constraints of scope, schedule and cost, as these constraints are challenging to achieve the project objectives (Cuellar, 2010). To deliver a successful project, studies have found that rational project planning, adapting a PM methodology, delivering the project on time, meeting stakeholders' requirements, appropriate team management, creating a project motivational rewards system, and establishing a positive environment are factors that enhance project success (Bhoola, 2015). Some studies have gone beyond the triple constraints to measure success; for instance, Cuellar (2010) found that having a good team, ease of use of systems and ease of maintenance, and system reliability are success criteria that are not limited to scope, time and cost.

Additionally, project team members consider project success based on targets set by top management. On the other hand, Man, Hughes-Narborough and Smith (2016) assume that selecting suitable people to manage the project increases project success. Proper communication channels also determine the success of projects if well designed and managed, where effective communication impacts the DM process that leads to accurate and rational decisions (Man, Hughes-Narborough & Smith, 2016).

In the IT industry, many circumstances surround the success of IT projects; some could be internal organizational factors. On the other hand, there are also external factors like the global business environment, politics, technology changes and the turbulences of financial markets (Bhoola, 2015). Furthermore, the convenient system development process, user satisfaction, quality of software, and the added value of success to the organization like psychological impact and organizational impact are considered success measurements (Cuellar, 2010).

On the other hand, the financial impact of project failure is vast; $150 billion is the estimated loss every year in the USA because of project failure. According to previous studies, the IT software development industry is the fastest growing globally (AlMajed & Mayhew, 2013) and the most impacted by such financial loss. Projects fail when they are terminated before completion and do not achieve the project objectives (Dalcher & Benediktsson, 2006; Cuellar, 2010). Project failure is an essential topic that many academics investigate (Fabricius & Büttgen, 2015a); most organizations are continuously searching to increase the performance of their PM process to decrease the project failure percentage.

A PM professional has defined various factors that make it challenging to achieve project objectives: inadequate management support, changes in technology, poor communications, and cultural differences (Bhoola, 2015). Moreover, Blackstone, Cox and Schleier (2009) implied that projects fail for many reasons like the lack of leadership, inadequate skills and competencies, poor communications between top management and stakeholders, lack of support from top management, lack of precise project requirements, and reduced user involvement. Man, Hughes-Narborough and Smith (2016) have a different opinion regarding project failure, and they assume that the human factor is a major failure factor for projects.

Despite the different reasons for project failure, the below points are the major causes of project failure that are related to the human factor:

Student syndrome: preserving time estimated to finish a particular task because the activity duration estimation is prolonged (Blackstone et al., 2009); student syndrome is another factor that causes project activities not to be delivered on time or as scheduled (Blackstone, Cox & Schleier, 2009).

Parkinson's law: work tends to expand to fill the time available (Blackstone et al., 2009). In other words, the worker who is doing this activity will expand the time devoted to finishing this work to fill the task duration as scheduled because the worker knows that this task takes less time than planned. However, if something goes wrong, like a system bug or unknown risk surfaces, the activity will be delayed, causing the project to be delayed, especially when the activity is on the critical path (Blackstone, Cox & Schleier, 2009).

Poor understanding of customers' demands: inability to understand customer needs and lack of complete stakeholder requirement gathering is considered failure factor. Lack of change management: change is inherent in all projects; a stakeholder may require a change in scope or decrease in the project budget or changes in processes – if these changes are not handled efficiently, a project may fail (Alami, 2016).

Unrealistic schedule: a project has a start and end point. The PJM's lack of coordination with project team members, lack of estimation of project activities' durations based on many techniques like historical data, one-point estimate, and three-point estimate, or being unrealistic about project activity duration will inevitably lead to project failure in terms of finishing the project on time as agreed with stakeholders and customers (Vinaja, 2012).

Lack of PM experience: PJM experience is a critical factor that increases the likelihood of project success; thus, to act as a project champion**,** the PJM should possess technical skills, experience, a positive attitude and education (Alami, 2016).

Lessons learned: before project initiation. It is highly recommended to check the organization's repository of lessons learned from previous projects, and this step will save time and effort in planning and estimation of project time, cost and risk: why re-invent the wheel when many supportive documents are available at the organization that could increase the project success (Gaikema et al.,2019)?

Human resources: improper management of project personnel can end up in project failure; human resources are the only PM area that does not involve technical aspects, and it depends on factors for motivation and handling the project team's conflicts, priorities and attitude (Tohidi, 2011).

Technology limitations: advanced technology and the fast pace of technology changes increase the pressure on PJMs to deliver projects on time and within budget before this technology becomes absolute; furthermore, the lack of technology available in the organization limits the ability to deliver projects (Haddad et al., 2020).

Change management: resistance to change and the lack of a proper change management approach limit project success; changes are related to the people in an organization, and this starts from the top management which, if it fails, the percentage of project success decreases gradually (Bröchner & Badenfelt, 2011).

Conflict of interest: when a group of stakeholders has different expectations of the project outcomes, conflict circumstances will arise and create the risk of failure. Conflicts have many shapes, and it could be challenging for incompetent PJMs. When conflicts arise, the project failure rate will increase. If conflicts are not handled properly and eliminated, all members within the organization will be working in disharmony against the framework of that organization, which will undoubtedly affect all the sought-after objectives (Lambert, 1986).

Theory of Constraints

Goldratt (1990) stated that the process of constraints identification is to set priority to avoid deviation of the project objectives, he asserted that constraints that affect the PJMs to deliver successful projects can be controlled if prober concertation is applied. Five steps were formulated in general to control the process: (1) define project constrains, (2) define how to exploit constraints, (3) decisions, (4) constraints elevations, and (5) review process and repeat if necessary.

Thus, PJMs focus on basic elements to assess the project's key performance indicator and follow-up progress: the project scope, the project time, and the project budget (Patrick, 2006; PMBOK, 2017, p.6). furthermore, these constraints have many acronyms; for example, the triple constraints, the iron triangle due to the sides of the triangle (Cuellar, 2010), or the project constraints (Mirzaei & Mabin, 2014).

According to Dalcher and Benediktsson's (2006) research, project duration, cost of the contracts, limited human resources and personnel, and project performance are significant project constraints. These constraints are the challenges that a PJM encounters when balancing one constraint against another whenever a change occurs; these changes seem out of the PJM's control and may come from external or internal sources. However, project performance success is measured by balancing these elements according to the project baselines.

Figure 2.1 depicts the theory of constraints from a different perspective, which is discussed further in the following sections. It is evident that most authors have concluded that scope, time and cost are the main elements that PJMs should consider when planning, executing and controlling projects (Umble & Umble, 2000; Blackstone, Cox & Schleier, 2009; Jacob, 2001; Steyn, 2002; Mirzaei & Mabin, 2014; Walker & Kwong Wing, 1999).

The theory of constraints provides a complete panacea for the challenging constraints that deal with the issues' root causes (Jacob, 2001). It highlights each PJM's challenges that lead to project delay and failure (Mirzaei & Mabin, 2014). The theory of constraints also proposes solutions that include reliable planning processes, efficient scheduling techniques, methodologies, excellent control of project work, and excellent behaviours that lead to outstanding performance.

Mirzaei and Mabin (2014) indicate that the theory of constraints encourages the management of projects based on constraints, which can be implemented in all PM industries, increases project performance and enables PJMs to achieve project deliverables. Many studies have shed light on the constraints and define them as elements that limit the PJM's ability to attain project objectives (Mirzaei & Mabin, 2014).

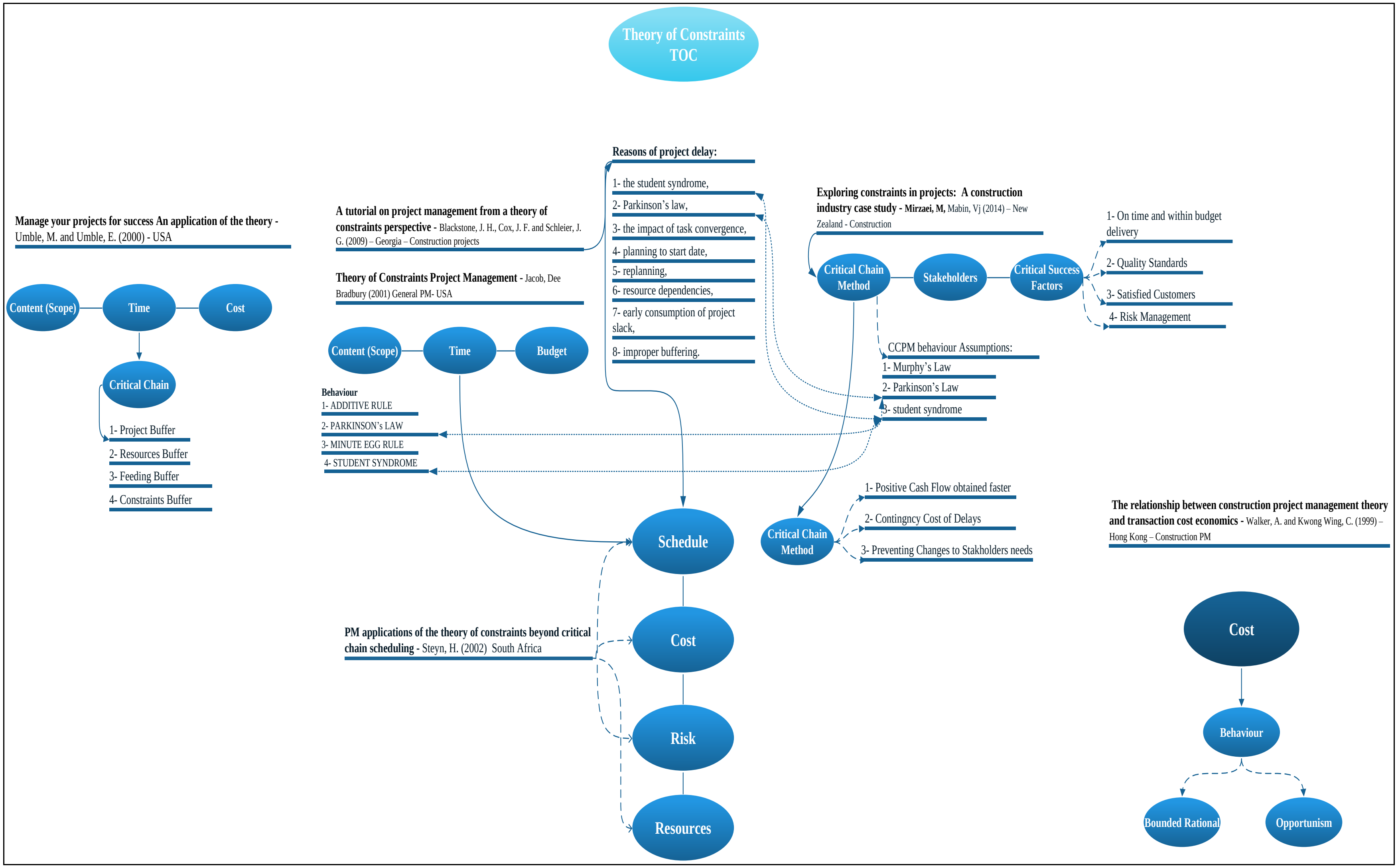


Figure 2. 1: Theory of constraints.
Source: Author

Discussion of the theory of constraints

Umble and Umble (2000) investigated the theory of constraints based on the assumption that projects are always late, exceed the budget, and are not completed according to the project scope. They suggest that critical chain PM (CCPM) is the best solution for PJMs to avoid project delay by adding a **project buffer** that results in an extended project duration that is 10-15% of the estimated schedule, adding a **feeding buffer** to the critical path tasks, and having slack to ensure that tasks on the critical path can be completed without delay.

It is also important to add a resources buffer by maintaining the resources needed to execute a task on the critical path and adding a constraints buffer by synchronizing the current project according to other projects running simultaneously to avoid resource conflicts. Mirzaei and Mabin (2014) investigated the theory of constraints from the critical chain PM (CCPM) perspective and assumed that delay is a significant root cause of project failure. In addition, they stressed that the use of CCPM itself is not enough, as a PJM should control their behaviours while planning and estimating activities' duration. They emphasized that controlling behaviours like Murphy's Law, Parkinson's Law, and Student syndrome affect the project team's rationality to estimate accurate activities' duration and prepare an adequate schedule.

Furthermore, Mirzaei and Mabin (2014) encouraged PJMs to involve stakeholders while planning and executing projects and recommended considering critical success factors like quality, stakeholder satisfaction and risk management. This study agrees with them, up to a point, but contradicts the fact that they considered quality, stakeholder satisfaction and risk management as critical success factors and did not treat these factors as project constraints as mentioned by (PMBOK, 2017 p.6), which does consider these factors to be project constraints. Blackstone, Cox and Schleier (2009), Steyn (2002), and Jacob (2001) also asserted that PJMs are responsible for keeping the project on track, and they are the main factors that impact the project outcomes. On the other hand, Walker and Kwong Wing (1999) linked cost constraints to PJMs' behaviours when making decisions, according to their investigation of the relationship between PM theory and cost. These authors suggested that PJM behaviours affected the process of cost estimation and emphasized using a bounded rational approach when planning the project budget instead of being opportunistic, which is linked to the study problem when the PJM makes decisions if a rational and analytical approach is followed.

According to these three theories, PM operates under uncertainty; constraints are the major challenge that PJMs should assess and balance; moreover, the PM process, including planning, executing, and controlling, determines a project's chances of success or failure. On the other hand, most literature focuses on the role of the PJM to lead all these processes and bring the project pieces into a cohesive unit (Blackstone, Cox & Schleier, 2009; Steyn, 2002; Jacob, 2001; Mirzaei & Mabin, 2014).

2.3 Section three: Decision-Making, Cognitive Bias, and Project Manager Behaviour

This part of the study discusses the decision-making process and theories, and explore the cognitive-experiential self-theory, furthermore the study explored CBA and review sources of bias, the last part of this section discusses the project manager behaviour and the NB and VB

2.3.1 Decision-making

People make decisions as a daily routine process. These decisions are expected to solve a particular issue; the consequences of a decision vary depending on the outcome's value (Ireland & Miller, 2004). For instance, the consequences of having a cup of coffee instead of tea have less value than deciding if the company is taking part in a million-dollar investment. DM is a process that includes thoughts, judgments and actions to reach an optimum alternative to achieve the desired objectives (Harper, 2016; Krystallis, Locatelli & Murtagh, 2020). The decision results from a particular opinion and judgment generated after a considerate evaluation of alternatives or simple thinking efforts (Harper, 2016) and is considered the output of processed alternatives that have a potential consequence on the activities (Harper, 2016).

Top management claims that managers are capable of making the right decision for the organization; hence, they are expected to deploy the strategic objectives and enhance the performance of the organization (Ireland & Miller, 2004), and their decisions have a critical influence on project deliverables (Eweje, Turner & Müller, 2012). Furthermore, these managers are expected to have analysis skills, superior personality traits and professional behaviours (Ireland & Miller, 2004); where the value of correct information is significant to reaching the right decision and eliminating unfortunate events that may occur, and solving the conflicts between plans and results (Eweje, Turner & Müller, 2012).

Thus, people generate alternate solutions for rectifying issues that arise due to uncertain events and select the most appropriate alternatives to solve the problem (Lean Keng & AlQudah, 2017); In some cases, these alternatives solutions are not sufficient enough to solve the issue due to similarities, immorality, or against the cultural perspectives (Beach, 1993). In such cases, people tend to postpone the decision to gather more information or wait for a better alternative that may come in time; but the timeframe in which to make the decision and the urgency of the situation can often leave managers no choice except to make a biased decision (Beach, 1993; Tversky & Kahneman, 1978).

The decision results from judgment and opinion reached after considerable thinking (Eweje, Turner & Müller, 2012). It is a chain of consecutive interrelated processes consisting of multiple assessments of alternatives and different consequences (Eweje, Turner & Müller, 2012). The defined decision is a conscious and definitive action aimed to achieve particular results consisting of thinking and judgment; thus, the DM process includes gathering and assessing information and deploying decisions into action to reach the desired results. Individuals make decisions to maximize utility based on self-interest and rationality (Mackie et al., 2007); however, this theory focuses on how individuals should make decisions and assume ideal situations.

The DM process is a subjective and cognitive process that interacts with several factors and dimensions, which are assumed to be dynamic and measured (Cunha, Moura & Vasconcellos, 2016). A decision consists of key factors incorporated to define the concept of the DM process; these factors are selected among different alternatives, consequences of the decisions and desired outputs (Lunenburg, 2010). These factors integrate into a six-step DM process that aims to generate the best solution; these steps are summarized in table 2.1 (Lunenburg, 2010):

Table 2. 1: DM process

Process	**Description**
Problem identification	People understand the problem boundaries and the consequences of that problem for the activities. This step defines the quality of the decision in later stages.
Generation of alternatives	Generating alternatives depends on the object of the project; thus, these alternatives should contribute to the project's primary objective.
Evaluation of alternatives	This process includes the feasibility of the alternative, how far the alternative is satisfactory, and the effect on the stakeholders.
Selection of alternatives	The PJM selects the most appropriate alternative; however, this may include more than one feasible, acceptable, and satisfactory alternative.
Decision implementation	This process is critical, and the PJM should clearly explain the alternatives to stakeholders and gain acceptance and provide an adequate number of resources to deploy the alternative.
Evaluation of the decision effectiveness	The last step is assessing to what extent the applied alternative matches the desired objectives; that process may require repetition if desired results do not satisfy stockholders.

Seiler et al., (2008) agree with Lunenburg's (2010) approach for defining the process of DM according to the below steps:

1. Problem recognition: this stage is considered the key driver of each decision.
2. Identification of alternatives: The human mind generates multiple options at that stage.
3. Evaluation of alternatives: this stage relates to the assessment of each option.

4. Selection of alternatives: at this point of the DM process, the human mind picks the best option for the human brain.

Critical and strategic DM may have a substantial impact on a project. It is defined as "devoting critical resources, setting priorities, and generating alternatives of different levels of critical decisions" (Elbanna, 2006); these decisions are new, not structured, and involve a high level of complexity (Elbanna, 2006). Strategic decisions are the responsibility of top management and stakeholders who have the power to change and take action under uncertain events; they show the cooperation of different management levels within organizations and the level of coordination in a particular environment (Ginsberg, 1988). These decisions are affected by psychological, cultural, and political factors that interact with the organizational context (Elbanna, 2006). Moreover, these decisions are critical to the organization and require adequate resources due to the involvement of risk factors that affect the organization's survival. But within uncertain events, these decisions are irreversible: once applied, the management cannot reverse the consequences of the decision (Organizations, 1987).

Many factors determine the influence of the selected decisions; one is the decision quality, which is determined by matching the consequences of the decision with the organization's objectives (Vroom, 2000). Another is the implementation of the selected decision; this factor determines its effectiveness and contribution to success (Vroom, 2000). The cost of the decision is another factor; it is similar to the cost-benefit relationship, assuming that the costs of the information and resources that participated in making specific decisions equal the benefits of that decision to the organization (Vroom, 2000). The engagement of the organization's members in the DM process develops a knowledge base and competencies, enhances teamwork and effectiveness, and enriches the concept of VB that contributes to the organisation's innovation (Vroom, 2000).

Many studies have been carried out to classify the DM model; that classification suggests that DM models are: Descriptive, Prescriptive and Normative, based on the methodological foundation (Harper, 2016). Table 2.2 illustrates the differences between the models.

Table 2. 2: DM models

Model	Area of investigation	Category	Details
Descriptive	This model focuses on what people have actually done or do.	Non-compensatory	The process eliminates alternatives based on a single attribute regardless of other attributes, even if the other attributes perform well.
Prescriptive	This model focuses on the action that people can do or should perform.	Compensatory	This process assumes that decision-makers will select alternatives based on a high value of one dimension compared to a low value in other dimensions.
Normative	The focus of this model is on the action that people can do or should perform theoretically.		

Literature divides DM into three general taxonomies (Parkin, 1996): (1) the body of knowledge that is based on theories of DM like operations research, economy, and analysis of the decision, which are helpful under stable and specific environments but do not describe the actual human behaviour when making decisions; (2) is derived from the psychological perspectives, focusing on the human mind's limitations in making decisions, the pressure and the stress surrounding the DM process, the human bias, and the individual behaviour; (3) Revolves around the organization and context of DM, the formality and procedures of making decisions in the organization, and how far these decisions are based on a random approach or systematic approach (Parkin, 1996).

Decision-making theories

Theories related to DM are associated with the science that focuses on the individual’s reasoning for reaching a particular decision. These decisions are affected by personal feelings, emotions, values and beliefs, which means that DM theories combine the individual's ability to select among different alternatives from one side and behaviours that integrate the DM process (Harper, 2016; Krystallis, Locatelli & Murtagh, 2020). Decision theories are concerned about the motives that make the decision-makers take particular choices (Harper, 2016); this involves internal factors like intelligence, emotions, values and morals that affect the selection of alternatives and the behaviours of the decision-makers (Harper, 2016).

For instance, the descriptive decision theory Edwards, (1961); Kr Maccrimmon (1968); Meissner & Wulf (2017) focuses on how individuals should make decisions. It states that people look for decisions that satisfy their personal needs or interests even if they do not have sufficient information to make that decision; in other words, people rely on the bias when making decisions under uncertain events. This concept is related to the descriptive theory, bounded rationality, and prospect theory; these theories focus on the limited human mental capacity to make a rational decision and assume that thinking is imprinted in human nature.

Prospect theory is concerned with the DM process under uncertain events (Tversky & Kahneman, 1978); this theory assumes that the DM process consists of two dimensions, the framing and the valuation. The framing process is an initial analysis of expectations presented by decision-makers that results in a constructed perception of the challenges tailored to different outcomes possibilities; during that phase, decision-makers depend on experience and heuristics or rule of thumb. The second phase is valuation, where decision-makers begin to assess the prospect outcome of each decision (Kahneman & Tversky, 2018).

Image theory focuses on behavioural DM rather than the normative perspective (Beach, 1993). Three major considerations shape image theory: first: how choices are supposed to be; this image is associated with the decision-makers values, beliefs, and morals. The second image is the concept of how decision-makers imagine their future to be, and the third image is concerned with the safety of decision-makers (Beach, 1993). DM theories focus mainly on the selected alternative (Beach, 1993); on the other hand, image theory states that the screening process before selecting content determines how decision-makers reached that choice. Thus, decisions are made to achieve particular objectives without breaking the decision-maker's integrity;

however, these decisions are planned and processed based on screening different feasible alternatives (Beach, 1993).

Some theories focus on the interaction between different variables, like game theory (Harper, 2016). This theory focuses on the conflicts of different decision-makers who build up their decisions based on rational and analytical models (Harper, 2016). Hence, the game theory involves two major factors: social factors and decision-makers (Harper, 2016).

The science of psychology deals with studying human behaviours; it focuses on all the aspects of interactions between people (Jones & Deckro, 1993). The psychology study is fixated on the human behaviours within the project context under the term role theory. This theory has emerged due to several attempts to explain how humans interact with society and be part of it (Jones & Deckro, 1993). It has defined many desired and undesired behaviours of people who have a particular role in organizations, like PJMs, where they have certain activities to complete, which defines the major role of the occupant. Furthermore, type theory indicates that the human personality is a combination of different psychological factors interrelated and interact in a complex manner (Culp & Smith, 2001). People are born different from each other, and they carry unique characteristics that make them perceive the world from a certain angle; this perception determines how individuals reach a conclusion that leads to a certain decision (Culp & Smith, 2001).

Theories of Psychology provide a precise analysis of the human reaction and interpretation of perceived information and how humans conclude and organize this information in return with the outside world (Culp & Smith, 2001). The personality of the decision-maker plays an important role in selecting the right decision due to particular preferences (Culp & Smith, 2001). Based on the Myers-Briggs Type Indicator (MBTI), people might be introvert or extrovert; sensing or intuitive; judging or perceiving or thinking or feeling. For instance, individuals are systematically different in what they perceive and how they make inferences, so it is obvious that they will be different in their concerns, reactions, values and skills, which impacts the quality of their decisions (Culp & Smith, 2001). These differences cause interpersonal conflicts as it is challenging to understand how people think and interact with each other, particularly when people in workplace environments have different beliefs, reactions, and temperaments.

Thus, according to the psychologist, processing information differs from one person to another (Epstein et al., 1996). There are two primary categories of human behaviours to process information. One is related to the basic human instincts like making decisions based on intuition (Jung, 1986), human nature (Tversky & Kahneman, 1981), the automatic responses to situations (Bargh, 1989), the biased (Tversky & Kahneman, 1978), the typical (Leventhal, 1984), the fictional (McH. & Bruner, 1987), the implicit (Weinberger & McClelland, 1990), the imaginary (Bucci, 1985), the experienced (Kirkpatrick & Epstein, 1992), and the mythologist (Labouvie-Vief, 2012). The second is related to human rational thinking like being logical (Jung, 1986) (Leventhal, 1984), rational (Kirkpatrick & Epstein, 1992), deliberate (Bargh, 1989), and evident-based (Weinberger & McClelland, 1990).

Each category drives a different course of action when making decisions and yields different results that impact the final project outcomes. These facts are the foundations of cognitive-experiential self-theory (CEST) (Epstein et al., 1996), which focuses on the personality of decision-makers and assumes that the human mind works in parallel interactive systems that consist of heuristic and rational thinking that define the human DM process. Table 2.3 illustrates the major differences between experiential and rational thinking:

Table 2. 3: Experiential vs Rational systems

Experiential	Rational
- Holistic - Use minimum efforts and respond automatically - Reactions affected by experience and belief in self-experience - Transform reality into metaphors, images	- Analytical - Use full efforts - Use logical analysis - Behaviour is determined by event assessment - Transform reality into numbers and figures

- Emotional reaction to sensitive issues resists changes - Use generalization for issues	- Flexible to changes - Manage feelings and thoughts - Search for a logical explanation for specific events

Table 2.3 shows the main differences between information-processing systems which determine the DM process. The differences show that some people tend to make quick judgments depending on their experiences and emotions. They react to events quickly and based on initial input of the situation supported by experience; they resist changes and focus on specific thoughts. Unlike the experiential system, rational people are logical and analytical-oriented people who assess situations and decide based on facts separately from their emotions or beliefs; they control their feelings and thoughts and adapt quickly to changes.

Justification to use CEST

Literature indicated that DMS is either based on analytics and gathering of information or is based on and emotional feelings (Yener, 2020); DMS influence the people attitude toward making decisions and their reaction for uncertainty (Peter, Thunholm, 2009). Hence, CEST global theory of personality deals with the intuition and analytical DMS process based on the concept that human mind process information in two ways: the conscious level which is related to the analytical approach and the emotional level which is related to the experiential approach (Epstein *et al.*, 1996); furthermore, CEST assumed that processing these two types based on independent level and can predict the information processing as orthogonal and present high support for factor analysis (Björklund & Bäckström, 2008); in addition, the CEST is proved to conceptualize and clarify the managerial cognition either is built on rational approach or experiential approach (Leybourne & Sadler-Smith, 2006). For instance, suggested traditional decision model is associated the human capabilities to control conscious which is mostly linked to rational thinking; on the other hand, CEST postulate that human who are experiential more likely to lose control over their consciousnesses and don’t follow logical tree analysis to reach for the more favourable decision (Schutte *et al.*, 2010). CEST model proved to be reliable and valid to assess individual measure in different contexts, and statically adaptable when applying central tendencies measure, correlation and CFA (Monacis *et al.*, 2016); The rational/ experiential inventory provide large sets of scales that helps measure the DMS of PJMs and proved to have internal consistency when applied for different types of researches (Reyna & Ortiz, 2016); furthermore, the measurements used in CEST applied for psychometric analysis which is related for the use of quantitative for assessing psychological trends (Reyna & Ortiz, 2016). Thus, the study adopted that approach for its feature to fit the nature of this study.

Cognitive-experiential self-theory

Cognitive-experiential self-theory (CEST) is a global behavioural theory that assumes that individuals receive and process information according to dual parallel systems consisting of two significant dimensions, the *experiential* and *rational* (Epstein et al., 1996). The experiential approach illustrates that individuals react automatically by pre-consciousness and a holistic view of events, whilst the rational approach illustrates that individuals react to events by analysing the situation and considering the consequences of the results.

Based on these assumptions, the experiential approach is linked to heuristic bias, fewer efforts and the absence of cognitive awareness (Monacis et al., 2016), while the rational approach is governed by the process where high potential, efforts and high cognitive awareness need to be followed (Monacis et al., 2016). CEST considers that individuals who follow the former rely on quick decisions and do not spend any effort balancing the alternatives for particular decisions where their reaction is based on their intuition and feelings (Schutte et al., 2010). On the other hand, individuals who follow the latter approach take logical and slow steps to make decisions, follow methodologies for analysing events, process information and make final decisions (Schutte et al., 2010). Thus, decisions result from an implicit or explicit assessment of uncertain events' potential results and consequences (Harper, 2016), where individuals interpret the information through these approaches and behave accordingly (Reyna & Ortiz, 2016).

According to previous studies in the field of DM, it was concluded that CEST, which was founded by Epstein et al. (1996), is appropriate for measuring the impact of rational and experiential approaches on individuals’ differences in processing information and making decisions (Leybourne & Sadler-Smith, 2006; Björklund & Bäckström, 2008; Schutte et al., 2010; Monacis et al., 2016; Harper, 2016; Reyna & Ortiz, 2016). This theory defines the measurement for assessing the type of decision-maker, either experiential or rational, using the Rational-Experiential Inventory (REI). This measurement consists of two significant scales: the Need for Cognition (NFC), which measures the rational thinking system and consists of 19 items, and the Faith in Intuition (FII), which measures the experiential thinking system and consists of 12 items. Figure 2.2 illustrates the measurement for each scale and defines the items that determine the systems of the DM process.

Scale and item
Need for cognition
I would rather do something that requires little thought than something that is sure to challenge my thinking abilities. (R)
I don't like to have the responsibility of handling a situation that requires a lot of thinking. (R)
I would prefer complex to simple problems.
I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something. (R)
I find little satisfaction in deliberating hard and for long hours. (R)
Thinking is not my idea of fun. (R)
The notion of thinking abstractly is not appealing to me. (R)
I prefer my life to be filled with puzzles that I must solve.
Simply knowing the answer rather than understanding the reasons for the answer to a problem is fine with me. (R)
I don't reason well under pressure. (R)
The idea of relying on thought to make my way to the top does not appeal to me. (R)
I prefer to talk about international problems rather than to gossip or talk about celebrities.
Learning new ways to think doesn't excite me very much. (R)
I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
I generally prefer to accept things as they are rather than to question them. (R)
It is enough for me that something gets the job done, I don't care how or why it works. (R)
I tend to set goals that can be accomplished only by expending considerable mental effort.
I have difficulty thinking in new and unfamiliar situations. (R)
I feel relief rather than satisfaction after completing a task that required a lot of mental effort. (R)
Faith in Intuition
My initial impressions of people are almost always right.
I trust my initial feelings about people.
When it comes to trusting people, I can usually rely on my "gut feelings."
I believe in trusting my hunches.
I can usually feel when a person is right or wrong even if I can't explain how I know.
I am a very intuitive person.
I can typically sense right away when a person is lying.
I am quick to form impressions about people.
I believe I can judge character pretty well from a person's appearance.
I often have clear visual images of things.
I have a very good sense of rhythm.
I am good at visualizing things.

Figure 2. 2: Experiential vs Rational systems
Source: Epstein et al. (1996)

The *Need for cognition* scale measures the extent to which individuals desire to engage with or avoid cognitive events, whilst *Faith in Intuition* measures individuals' confidence in their feelings. Studies in that field imply that individuals show higher preferences for one system over another (Schutte et al., 2010). However, the highest score in experiential statements assumes that individuals are emotional, agreeable, and extroverted. On the other hand, individuals who score high in rational items are more likely to control the environment and make decisions rationally (Epstein et al., 1996).

The impact of project manager decisions on projects

During ITSD projects, the DM process goes side-by-side with the analytical process, which is considered an essential input for decision-makers (Al-Ali, Emes & Leal, 2018). That process is complex and is intended to reflect the stakeholders' perception of the project outcomes; making poor decisions will affect the project deliverables and cause project failure (Gaikema et al., 2019). The DM process is considered the most challenging and riskiest task for PJMs (Leybourne & Sadler-Smith, 2006).

These decisions are opinions, judgments and results of deliberate thinking about a specific situation after particular consideration of inputs of different events (Eweje, Turner & Müller, 2012). These decisions aim to solve a conflict under uncertain events to achieve specific objectives; once made, the PJM communicates these decisions to concerned stakeholders for acceptance and implementation (Eweje, Turner & Müller, 2012).

Decisions determine the organization's performance, and failure to make accurate decisions affect the business's overall performance; hence, the PJM's decisions significantly affect project success (Eweje, Turner & Müller, 2012). The accuracy and quality of these decisions are derived from the sufficient flow of information and feedback. Organizational behaviour theory suggests that PJMs should have sufficient control over resources to make accurate decisions, contributing to projects' success (Eweje, Turner & Müller, 2012).

Insufficient information creates a conflict within projects; there is a positive relationship between the DM processes and information based on analysis and rational calculations (Eweje, Turner & Müller, 2012).

The theory of decisions has focused on how PJMs should make decisions but skipped how they made these decisions which may change an organization's course of action (Lunenburg, 2010). Thus, the PJMs improve and decide based on intuition and ignore the rational process (Leybourne & Sadler-Smith, 2006).

A new approach that focuses on how the PJM makes decisions is the descriptive decision theory (Eweje, Turner & Müller, 2012). This theory states that individuals make decisions according to bias and their interests even if they do not have enough information to make accurate decisions; thus, PJMs use the rules of thumb to make sensible decisions (Cunha et al., 2014). Tversky and Kahneman (1978) investigated the theory of bounded rationality and prospect theory. The two theories found a limitation in the human mind when making decisions under uncertainty, especially when events are uncertain, and people are not given enough time to analyse and make an adequate calculation of the information feed.

The PJM's DM process is affected by accurate and reliable information, inaccurate input, wrong execution of decisions, changes in project context after decisions are made, and the quality of decisions, which are all factors related to project failure (Eweje, Turner & Müller, 2012). On the other hand, Parkin (1996) assumes that the DM process is derived from the psychological state of the human mind – it is affected by individual stress and behaviour, which limits the ability of the PJM to make rational decisions; hence, the PJM makes cognitive decisions based on bias. Hence, the DM process in ITSD projects involves stakeholders, project teams, resources, tools and techniques, which requires a balancing of project constraints to ensure these decisions are correct and based on analysis and proper selection of alternatives (Cunha, Moura & Vasconcellos, 2016).

Based on what has been mentioned in the previous sections, a PJM is a human who commits mistakes and makes incorrect decisions; their ability to make decisions depends on many factors that determine the quality of the decision. Thus, making decisions is not convenient under uncertain events, especially when the PJM works in a complex environment, and these decisions affect project constraints and outcomes.

2.3.2 Cognitive bias

Human behaviour does not work in a vacuum; people's actions are not arbitrary, as individuals hold a mentally programmed nerve system based on different experiences, situations, emotions, norms, cultures and values that appear explicitly through their reactions (Biswas & Murray, 2017; Tversky & Kahneman, 1981).

Millions of human neurons are connected miraculously to the nerve systems, and these neurons can decode, encode and decipher data in seconds; however, if the brain counts on these neurons to process these data solely, it would take a long time to perform regular tasks like walking, eating or speaking (Seiler et al., 2008). Thus, the human brain tries to find a shortcut, depending on previous experience and inner beliefs, build assumptions and make decisions based on the relation between the input of the current status and lessons learned from the past to fill the data analysis gap and react faster to the current situation (Cunha et al., 2014).

The evolution of CB in the DM process was in 1979 by Kahneman and Tversky, followed by another publication in 1982 (Kiełczewski, Matel & Poskrobko, 2016), where they paid special attention to the relation between the DM process and CB and their impact on behaviours relating to consumers' mental state when making purchases. Bias plays an essential role in making decisions, where the human mind focuses on a few parts of the problem and ignores many important parts (Al-Ali, Emes & Leal, 2018). Kahneman and Tversky (1982) asserted that the human mind's thinking perspective could be divided into two different ways: the first one is fast and spontaneous, and the other way is slow but more realistic and calculative (Cunha et al., 2014; Al-Ali, Emes & Leal, 2018); people tend to use the 'lazy' way when they have to carry out activities that require focus and control (Liu et al., 2017). The DM process is affected by human bias, which is a state of the human mind to select a shortcut for quick decisions (Al-Ali, Emes & Leal, 2018), which leads to wrong or right choices.

According to Virine and Trumper (2008), CB is categorized into four families:

1. Sources of bias that are linked to human perception and behaviour.
2. Sources of bias that are linked to human estimation of beliefs and probabilities.

3. Sources of bias that are linked to the human group and society.

4. Sources of bias that are linked to human memory.

Table 2.4 shows all sources of human CB as extracted (Virine & Trumper, 2008).

Table 2. 4: CB Codex model

<table>
<tr><th>Belief and probability estimation biases</th><th colspan="2">Perception and behavioral biases</th></tr>
<tr><td>- Optimism bias.
- Ease of recall no associated with probability.
- Ignoring regression to mean.
- Misapplied risk
- Base rate fallacy
- Continued influence effect
- Insufficient adjustment
- Distinction bias
- Illusion of validity
- Anchoring trap
- Belief bias
- Expectations bias
- Neglect of probability
- Narrow belief as doctrine
- Overestimating the probability of conjunctive events
- Regressive bias
- Ignoring base-rate frequencies
- Overconfidence
- Availability cascade
- Conjunction fallacy
- Gambler’s fallacy
- Illusory correlations</td><td>- Zero risk bias
- Wishful thinking
- Status quo bias
- Similarity heuristic
- Sunk cost bias
- Recognition heuristic
- Student syndrome
- Selective search of evidence
- Post-purchase rationalization
- Repetition bias
- Personal reference drives the approach
- Source credibility bias
- Professional viewpoint effect
- Preference for intuition
- Parkinson's law
- Preference for details
- Premature termination for evidences
- Planning fallacy
- Prudence trap
- Pseudo certainty effect
- Misinterpretation of data
- Curse knowledge
- Choice supportive bias
- Confirmation bias
- Contrast effect
- Congruence bias
- Biased covariation assessment
- Automation bias</td><td>- Omission bias
- Outcome bias
- Lexicographic heuristic
- Illusions of control
- Loss aversion
- Impact bias
- Inconsistency
- Invisible correlations
- Information bias
- Inappropriate bias
- Inertia
- Frequency illusion
- Framing
- Hyperbolic discounting
- Failure to consider alternatives
- Focusing effect
- Elimination by aspect heuristic
- Endowment effect
- Escalating commitment
- Experiential limitations
- Disconfirmation bias
- Dunning-Kruger effect
- Bias blind spot
- Ascription of causality
- Availability bias
- Ambiguity effect
- Bounded rationality
- Attentional bias</td></tr>
<tr><th>Group and social biases</th><th colspan="2">Effect and memory biases</th></tr>
<tr><td>- Egocentric bias
- False consensus bias
- Outgroup homogeneity bias
- Self-serving bias
- Bandwagon effect
- Self-fulfilling prophecy</td><td colspan="2">- Hindsight bias
- Peak end rule
- Generation effect
- Recall ability trap
- Context effect
- Picture superiority effect</td></tr>
</table>

- Courtesy bias - Trait ascription bias - Polarization effect - Identifiable victim bias - In-group bias - Cheerleader effect - Third person effect Social comparison bias	- Exposure effect - Misinformation bias - Reliance on profound events - False memory - Negative bias Zeigarnik effect

Sources of bias

Based on previous research, secondary data from literature and various science disciplines like managerial, sociological, and psychological sciences, the sources of bias have been identified as primary factors that cause the human mind to deviate from taking the correct decisions and force decision-makers to skip the logical, statistical, and expert options when confronting uncertainties and complicated issues. Sources of CBA have been classified under four influential families and eight groups; the primary classification is considered the umbrella for bias sources, whilst the groups include more details.

The study compared sources of bias that have been investigated in previous studies and categorized them according to the primary classification completed by (Al-Ali, Emes & Leal, 2018), who designed this classification according to bias in the DM process. On the other hand, 33 sources of bias categorized under groups were identified based on previous studies; figure 2.4 illustrates the main families, and groups under these families:

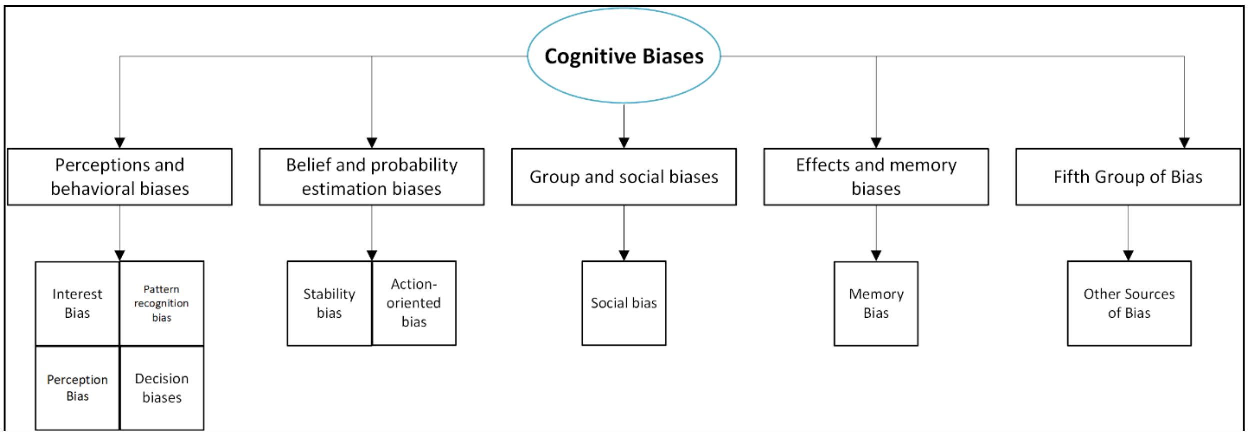


Figure 2. 3: Families and groups of CBA

The study combined two significant studies in the design of a conceptual framework, families were extracted from a study carried out by (Al-Ali, Emes & Leal, 2018), who grouped bias into four significant families. After careful consideration, the study investigated a study completed by (Mohanani et al., 2018), who broke down these families into eight more detailed groups. Based on these two studies, the study looked into all sources of bias available in PM studies and placed them under the sub-groups as the first step. Then, they were positioned under the main groups. That CB classification shows differences in human bias according to certain factors like interest, perception, pattern, decisions, stability, actions, social and memory bias, except for two significant sources of bias: representativeness and information bias.

Table 2.5 illustrates the main families, groups, and sources of bias associated with these groups; the following section discusses each family in detail; it worth to mention that individual who fell under perceptions and behavioural bias absorb the information based on their perception and behave accordingly, where individual who fell under BPEB absorb the information based on their belief and make estimation accordingly; thus the components of these families are interrelated; which means that group of bias can't be classified under perception or behavioural bias separately and the same goes for BPEB.

Table 2. 5: Bias families, groups, and sources of bias

Bias families	Groups	Sources of bias
Perceptions and behavioural bias	Interest bias	Confirmation
		Wishful thinking
		IKEA
	Pattern recognition bias	Availability
		Fixation
		Mere exposure effect
		Semmelweis reflex
	Perception bias	Framing
		Selective perception
		Primacy and recency effect
	Decision bias	Sunk cost bias
		Planning fallacy
		Omission bias
Belief and probability estimation bias	Stability bias	Anchoring
		Status quo
		Familiarity
	Action-oriented bias	Overconfidence

		Illusion of control
		Gambler fallacy
		Miserly information processing
		Misleading information
Group and social bias	Social bias	Self-efficacy
		Bandwagon effect
		Cultural
Effects and memory bias	Memory bias	Hindsight
		Time-based bias
Fifth family	Other sources of bias	Representativeness,
		Information

Based on Virine and Trumper (2008) codex model, and sources of bias families categorizations, group and social bias family has one group beyond which is the social bias, where effect and memory bias family have one group beyond which is the memory bias.

The study relied on matching between codex model families of bias and groups of biased that placed under each of that family, this is justifying the limited number of groups for the third and fourth family, where Representativeness and information bias are not categorized under any of these families. However, group and social bias family concerned more about DM within groups and based on the reaction of the individual that associated with the group attitude toward certain event, for instance. Bandwagon effect is associated with individuals believing in an opinion most people follow, although it might be wrong (Rikkers, 2002). Furthermore, there is lack of research that investigated effect and memory bias family which consist of memory bias group; for instance, hindsight bias was investigated in a study in 1982, and time-based bias appeared once in CB research by the systematic mapping review conducted by (Mohanani et al., 2018).

<u>First family: Perception and behavioural bias</u>

This family of biases is related to making a judgment, observation, or belief about a decision according to the PJMs' perception. It also refers to decision-makers feelings and thinking where bias influences their behaviours and reactions (Al-Ali, Emes & Leal, 2018; Virine & Trumper, 2008). Four sub-groups are categorized under that family; these sub-groups of bias are: 1) Interest, 2) Pattern recognition, 3) Perception, 4) Decision and they are explained next:

1. <u>Interest bias</u>

This source of bias is associated with people's preferences, thoughts and emotions that lead them to deviate from being logical with other individuals (Mohanani et al., 2018). Five sources of bias are placed under this sub-group: confirmation, wishful thinking, IKEA, valence, and validity. Definitions, examples, and the impact of these biases are illustrated next. However, not enough literature links the valence and validity bias to project constraints decisions. Accordingly, the study removed both sources of bias from the questionnaire.

- **Confirmation:**

This source of bias occurs when PJMs confirm a hypothesis or belief without verifying if it is right or wrong; it searches and uses the information to support a previously selected belief and ignores evidence that may help make the decision (Wirfs-Brock, 2007).

Sleegers, Proulx and van Beest (2019) defined confirmation bias as "the tendency to look for, explain, and remember information that confirms pre-existing beliefs or theories". PJMs seek supporting evidence to back up their beliefs and ignore other rational proofs involved in the DM process. They are against anything that goes against their understanding of how they want to solve the issue; in other words, any piece of information that does not align with the decision-makers rationality is avoided and neglected. When given evidence, the human mind works in different ways, and skilful PJMs pick the most relevant evidence that supports their decisions; selecting one piece of evidence over another based on the decision-maker's appetite will result in unrealistic outcomes. This happens due to their failure to give proper consideration to different hypotheses. Studies have found that confirmation bias strategically impacts social areas and DM (Sleegers, Proulx & van Beest, 2019), even if the information and the beliefs they have in mind prove harmful. Rather than changing their values and perspectives about these beliefs, people look for any specific details that support their decisions.

- **Wishful thinking:**

Mohanani et al., (2018) defined the wishful thinking bias as "underestimation probability of undesirable results", whilst (Babad & Katz, 1991) defined it as "expecting favourable results". It explains the relationship between human preferences and social expectations; this bias is positioned under the Interest bias related to human personal preferences and thoughts. The human mind ignores rationality and logical inputs for a specific situation; wishful thinking is a psychological state and is concluded as a factor that affects human reactions and behaviours (Babad & Katz, 1991). It has been considered a significant source of bias when predicting future outcomes.

People pretend to "know" when they encounter uncertain events with less information; once they reach the desired outcomes, they stop and consider the outcomes as facts. In a few scenarios, people look for validation of their conclusions as a sign of an excellent decision.

Wishful thinking is linked to the PJMs' behaviours. Their reaction changes based on the consequences of the decision outcomes.

- **IKEA:**

This source of bias is named after the Swedish furniture manufacturer, which produces furniture in separate pieces, so customers have to assemble the parts. It is defined as "people tend to add more positive value for items they design and produce" (Mohanani et al., 2018); it is also called "*I designed it myself*".

This concept is applied to physical items based on the requirement to assemble different components. Shmueli, Pliskin and Fink (2015) examined the impact of IKEA bias in ITSD and found a relation between IKEA bias and PJMs' behaviour.

According to their contribution to the system features, this relation is associated with PJMs' emotional involvement; emotional involvement tempts PJMs to add extra features that were not required in the product/software scope. From a behavioural perspective, challenge motivates people and improves performance and job satisfaction. The effort that PJMs spend in managing software projects increases their sense of responsibility over time, and that situation is translated psychology into the mental state that forces PJMs to be obsessed with design (Sarstedt, Neubert & Barth, 2017). That relation between IKEA bias, responsibility and psychology shapes the DM process that affects the ITSD project constraint-related decisions.

2. **Pattern recognition bias**

This source of bias refers to an individual who favours familiar information (Mohanani et al., 2018). The following text defines each source of bias under Pattern Recognition bias.

- **Availability:**

Sometimes PJMs perform excellent data analysis regarding a specific issue like buying a new service from a vendor. They conduct scientific criteria to select the right supplier to ensure their decision is based on deep analysis. However, due to external factors like a friend's experience with this supplier, the PJM's decision may deviate based on a single observation about this supplier. The PJM ignores the results of the analysis and considers their friend's experience, which results in biased decisions.

Availability is when people judge certain future events based on how easy these events crossed their imagination (Virine & Trumper, 2008). It refers to the human desire to link a particular situation according to the easiness that this situation can remember (Cunha et al., 2014). PJMs rely on a simple strategy to decide instead of taking advantage of the detailed analysis made before their DM process.

The availability bias is significant in PM when estimating project duration, cost, and resources. PJMs build their estimation based on previous experiences. However, they do not consider that they have left many essential pieces of information behind.

“Why do the PJMs do not conduct a detailed analysis of the project?” is an emerging issue that will benefit the project. The answer to this question is:

1. The fact is that a decision requires energy and mental effort.
2. Limited information.
3. The inherited CB in the human mind and.
4. Lack of available time to make decisions.

PJMs must consider other risks associated with the DM process and calculate the impact of upcoming events, but they may do it incorrectly; for instance, despite reliable statistics about the effects of smoking on human lives, some people tend to look for one case where a smoker lived to an old age and disregard information and results about medical reports of the damage caused by smoking. Several sites and cities in the world are safe, and hundreds of tourists visit these places without any disturbance or problem, but one case of an unfortunate event could make these tourists make a significant decision about not visiting that place, ignoring all the safe journeys and all the police force reports about that place. This theory is also applied in ITSD projects where PJMs hesitate to acquire Oracle and go for Microsoft SQL because of a single issue in the past or a similar company. They do not take into consideration all the successful programs installed and working correctly.

In their research into availability bias, Cunha et al., (2014) indicated the following root causes of availability bias:

1. Lack of lessons learned.
2. People pay great attention to previous negative situations.

- **Fixation:**

This source of pattern recognition bias indicates that the human mind inappropriately focuses on a single angle of a situation due to barriers that the brain creates (Mohanani et al., 2018). This source of bias is associated with project requirements and decreases the innovation of designs with high-end quality features. Fixation bias was first introduced by Freud, who linked it to unordinary sexual habits; fixation bias increases the human mind's focus on particular objects, individual events and unusual situations due to the brain's imaginary perception (Mohanani, Ralph & Shreeve, 2014). For example, some PJMs turn their focus to system resilience and ignore the speed of data processing; this bias minimizes the ability of the human mind to make thoughtful decisions, and it requires, in some cases, a prototype to be designed to avoid this source of bias.

The way PJMs perceive project requirements differs. As the level of sensitivity is inconsistent, some PJMs may consider all project requirements as high importance or low importance; hence, this leads to a delay in delivering projects on time or deliverables going over budget, and these decisions related to ITSD projects will become vague (Mohanani, Ralph & Shreeve, 2014).

- **Mere exposure effect:**

This source of bias reinforces people's preference for what is familiar, like some PJMs' preference to keep their current role as it is (Mohanani et al., 2018). Some PJMs assume that what is frequently seen is well known (Kwan, Yap & Chiu, 2015). The human mind is affected by this source of bias only when there is a connected and robust motive. Studies have revealed that the mere exposure effect bias impacts human preferences that affect the process unconsciously due to certain internal and external motives.

The Mere exposure effect also affects human perceptions (Kwan, Yap & Chiu, 2015). Its psychological impact indicates that individuals are not aware of the motive that triggers the reaction. Motives appear suddenly, and decisions are not processed consciously. The Mere Exposure Effect frequently appears with PJMs who get exposed to the same situation in which a certain decision becomes preferred, or they become familiar with the motive that triggers an action (Kwan, Yap & Chiu, 2015).

- **Semmelweis reflex:**

Semmelweis reflex is "the tendency to reject new information when contradicting with the individual beliefs or paradigm without thinking" (Mohanani et al., 2018). Ralph (2011), in his study investigating sources of bias in software development projects, classified the Semmelweis reflex under the "Inertia" group, which consists of tendencies that increase inappropriate preferences for and defence of the current situation.

3. **Perception bias**

Bias under this sub-group refers to an individual's tendency to prejudice new information (Mohanani et al., 2018).

- **Framing:**

This source of bias refers to phrasing statements by selecting certain words that influence the audience's perception; in this case, the sender uses negative or positive words to positively impact the receivers, describing the phrases in a particular order that alters the fears or encouragement to make a specific decision. (Hodgkinson et al., (2002) indicated that framing bias rises with slight changes in how a decision is presented, encouraging gains or losses that may lead to differences in preferences. Wright and Goodwin (2002) suggested that framing bias potentially impacts the DM process. A driver element of framing is used to assess activities that may arise from the decisions. This kind of assessment is built based on framing bias, which fundamentally impacts the way PJMs review decisions; hence, the course of action is chosen. Decision-makers tend to be risk-averse when framing the issues according to profit or gain and ultimately change their course of action when the issues are relatively correlated with losses, which means that different perspectives on the same problem will create different reference points and selections.

People tend to perceive the actual picture of a problem through one reference frame, and once they are hooked to that frame, it becomes impossible to change their opinion, even when the decision is crucial and is a matter of enormous gain or loss. PJMs should switch their minds to evaluate the decision from a different framing point of reference.

Decisions are framed by PJMs' interpretation of the phrases used to demonstrate the situation; the consequences of that source of bias may fall under their point of view. They could have 50-50 possibilities of wrong or right decisions.

- **Selective perception:**

This source of bias is defined as The tendency for people to perceive the same events differently (Mohanani et al., 2018). PJMs believe the project closing phase should complete that project requirements, and incomplete deliverables lead to project delay. However, if PJMs classify deliverables according to whether they are completed or not completed, the judgment will be subjective mainly when that classification is carried out after the closing phase. For instance, team members will perceive classifications differently. Jørgensen and Sjoberg (2000) indicated that an individual's perception is strongly affected by what they are expecting or what they want to find; thus, PJMs should pay attention to the perception of the events under uncertainty, and their decision may be affected, and they have to look for support from experts, especially when the case is out of their field of expertise.

- **Primacy and recency effect:**

This source of bias is defined as “The human tendency to memorize the first and last few items in a sequence more than those in the middle” (Mohanani et al., 2018). A psychologist in CB found that human minds memorize points or items if they are on the top of the list of particular orders. This behaviour is because this item has less competition among the items on the list (Murphy, Hofacker & Mizerski, 2006).

The items at the bottom of the list also receive greater attention from the human mind; the influence of primacy and recency effect may also affect PJM behaviours. For instance, if a number of decisions and alternatives are sorted into a list to reach a consensus, the human mind will memorize the first and the last options and make decisions according to that order. Furthermore, the presentation of information to stakeholders affect the DM process if PJMs position the most critical items in the first and the last slides. Murphy, Hofacker and Mizerski (2006) confirmed that the Primary and Recency effect influences human behaviours. Although few pieces of research have been completed in the PM field, this source of bias is tested and elaborated on to review if it affects the PJMs’ decisions in ITSD projects.

4. <u>Decision bias</u>

These sources of bias affect the quality of the DM process; the quality of decisions is compromised in this kind of bias (Mohanani et al., 2018; Park & Lessig, 1981).

- **Sunk cost bias:**

This source of bias is defined as “PJMs’ willing to invest in a failing project” (Chung & Cheng, 2018). It is the tendency to irrationally use more resources in an investment similar to the same projects that were not accomplished. Mohanani et al., (2018) suggest that this source of bias is inherited in a few PJMs’ personalities, which they concluded as stubborn behaviour and myopia.

Sunk costs are costs previously spent on a specific event that no longer impact the current situation and cannot be redeemed or affect the DM process, although they influence DM and cause bias.

Decision-makers who fall under the impact of losses caused by failing projects are resistant to consider a sunk cost as a loss that leads to more irrational decisions; they are kept hooked on continuing the project to compensate for the losses caused by sunk costs (Chung & Cheng, 2018). Ignoring the truth and denying the immediate effect of the sunk cost will inevitably result in more exhaustion of financial resources. Thus, organizations will miss the opportunity to invest in profitable projects.

- **Planning fallacy - optimism bias:**

Tversky and Kahneman (1978) defined the planning fallacy as “the confidence that PJMs have when expecting their projects will be completed as planned”. (Behavioural Insights Team, 2017) defined planning fallacy as the “human tendency to make extreme optimistic predictions about resources assigned to complete upcoming activities in a project". Yamini and Marathe (2018) defined the planning fallacy as the tendency to underestimate activities’ duration due to personal bias. Studies have indicated that many PJMs tend to be excessively optimistic in estimating the length and the cost of a project; planning fallacy studies focus mostly on the underestimation problem in PM.

PJMs underestimate the duration to complete tasks that seem uncertain, and they believe that these tasks can be efficiently completed later without affecting the project. Being sceptical about completing unpleasant tasks, PJMs tend to procrastinate about starting them, which causes project delay and budget overrun.

Psychologists attribute the planning fallacy to decision-makers who do not rationally assess inputs and fail to evaluate gain/loss probabilities (Yamini & Marathe, 2018). The high expectation for the best-case scenario is usually valid, but rational planning must be carried out. Optimism (another synonym for planning fallacy) is one of the traits that PJMs hold when they are processing their projects; this source of bias causes delusion in the human mind, pretending that it is doing the right thing when it is ultimately the opposite (Prater, Kirytopoulos & Ma, 2017). That source of bias is mainly associated with the project activities' duration estimation; on the other hand, the impact of the planning fallacy cannot be avoided entirely (Prater, Kirytopoulos & Ma, 2017).

Prater, Kirytopoulos and Ma (2017) assume that "the human mind readiness found many people that judge events that may happen in the future positively more than being guaranteed by experience". In other words, when decision-makers are asked to estimate an event in the future, they do not consider prior knowledge.

This source of bias has an extreme impact on estimating the project duration and cost. The project baseline will not reflect reasonable estimation, and activities slippage will inevitably surface; even if PJMs have accurate information about a particular activity cost or duration estimation, the optimism bias persists. Optimism bias is a brain process that guides decision-makers opinions, and it states what the human mind thinks, not what it should consider (Prater, Kirytopoulos & Ma, 2017). It makes the brain believe that the decisions are rational; it is the opposite of logic.

- **Omission bias:**

This source of bias is related to the human mind when preferring omissions to action. In general, people prefer the damage or harm caused by omissions to the damage caused by actual action (Park, York & Boyle, 2017). Even though the existence of omission bias has been challenged, and PJMs know that making a particular decision has a higher rate of success, they still go for a different decision as making this decision may appear to be the right move. Omission bias is more likely to occur with high-stakes DM processes where the preference is for damage resulting from the omissions over less damage caused by action (Baron & Ritov, 2004). This source of bias increases when an uncertain situation is at high stake and decreases in low-stake events.

Second family: Belief and probability estimation bias

This family of biases is based on making a decision based on the plausibility of the decision-makers' point of view instead of considering the facts that make the decision more rational. This bias affects decisions related to the possibility or frequency of particular events. Two sub-groups are placed under this bias: Stability bias and Action-oriented bias (Al-Ali, Emes & Leal, 2018; Virine & Trumper, 2008).

1. **Stability bias**

This bias refers to the fact that decision-makers hold on to previous or familiar options although new information becomes available and could substantially impact their decisions (Mohanani et al., 2018). The following sources of bias are related to stability bias:

- **Anchoring:**

In the analysis of making individual decisions, decision-makers leave out net present value, supply and demand, and future value and compare results according to a mental shortcut to a referred point (Virine & Trumper, 2008).

Anchoring positions in cost and activity estimation, PJMs estimate the cost of an activity based on their experience with a similar project. However, this reference point may not be valid for the current activity, even though PJMs added contingency for the cost of that activity. Comparing the project to a benchmark is another anchoring issue; it is a good practice to apply to the benchmark, but wrong parameters can give false project performance indicators.

Focusing effect is a type of Anchoring bias, and it takes place when decision-makers pay too much attention to a specific side of an issue, discarding other vital aspects of that case.

To overcome an Anchoring bias, PJMs should refer to more than one reference point during DM. Based on the research results by (Cunha et al., 2014), anchoring is caused by many factors that surround PJMs while making their decisions, as illustrated below:

1. Uncertain DM environment.
2. Lack of knowledge.
3. Lack of lessons learned.
4. Customer inflexibility.

- **Status quo:**

This source of bias refers to the tendency of decision-makers to stick to the default alternative (Geng, 2016). This bias grows when even equal values are formed arithmetically, and it has a direct relationship with making investment decisions and voting systems. It is associated with political or social issues. When making decisions, a PJM prefers to select the most familiar options over the more minor ones but still more beneficial options. PJMs weigh the potential of losing more intensively than the potential of gaining.

On the other hand, PJMs continue to stick to time, cost and resources decisions as they have already invested resources in that attempt. Decision-makers may like new options, but when it comes to deciding, they prefer to follow the classic options, although the new alternative options contain desirable features. Many types of research have proved that decision-makers stick to the status quo despite the availability of new options (Hessami & Resnjanskij, 2019).

- **Familiarity:**

This source of bias is associated with the human mind’s close awareness and previous knowledge of assessed risk. The idea of similarity with certain things will impact the process of DM. Seiler et al.,(2008) defined familiarity as "un-specified feelings of remembering where the human conscious is completely absent of recalling previous confront". This is caused by the human mind's familiarity with decisions that PJMs will make based on experience as a supportive pivotal point. Many PJMs do not consider new factors associated with current situations when making decisions related to scope, time and cost since the same decision is similar to the one in hand. Familiarity works in human's favour; this source of bias processes information quicker and enables decision-makers to establish objectives (Seiler et al., 2008). Nevertheless, it sometimes functions against the human mind, as the brain cannot control all the shortcuts that the human mind creates. Even if the decision is less favourable than the other alternatives, decision-makers still select the most familiar option, like considering a precise method to identify scope and estimate time and cost; besides, they look for other classic options, denying any efforts to come with a new way of using a new technique.

2. **Action-oriented bias**

These sources of bias refer to the decision-makers' tendency to make early decisions without considering more options or reviewing more related information (Mohanani et al., 2018). The following sources of bias are categorized under this sub-group:

- **Overconfidence:**

This source of bias refers to overestimating the probability of positive results to an event compared to the probability of going through unpleasant results for the same event (Fabricius & Büttgen, 2015). Overconfidence encourages decision-makers to look for initiatives that strengthen their skills; although this source of bias may yield beneficial results, it could sometimes lead to unfavourable outcomes.

Overconfidence bias is one of the puzzles that have drawn the attention of behavioural scientists and psychologists in the last decades due to its involvement in most of the DM processes (Zia, Sindhu & Hashmi, 2017). Decision-makers have overconfidence in their abilities, which are believed to be more accurate than information.

- **The illusion of control:**

This source of bias refers to the tendency of decision-makers to overestimate their impact on events (Meissner & Wulf, 2016). It has been found that illusions of control decrease the perception of risk, which decreases the accuracy and quality of decisions. Seeking external advice and recommendations from consultants inevitably narrows the illusion of control bias. It is essential to assess this source of bias as it has a critical impact on strategy in an organization, which negatively impacts the decisions. To reduce illusions of control bias, team diversity may decrease bias, and information-sharing increases the possibility of favourable judgment (Meissner & Wulf, 2017).

PJMs tend to control their actions (i.e., project activities). This source of bias is referred to as controllability, the psychological state based on performance, emotions and motivation when making decisions. It is also associated with PJM decision-makers need to get positive outcomes and deny the negative impact of their decision. The concept here is that PJMs exaggerate their ability to make the correct decisions while showing overconfidence. This overrated confidence comes from PJM decision makers' overrated beliefs that they can predict the controllability of the activities that require estimation. There is a positive relationship between controllability and confident decision-makers; the rare controllability perceived by PJM decision-makers increases the chances of optimism.

- **Gambler fallacy:**

Gambler fallacy occurs when PJMs mistakenly predict and believe that positive events will occur according to previous events' sequences of negative impact (McCray, Purvis & McCray, 2002). These predictions may be accurate if there is a relation between the project activities and the outcomes but can never be reliable if PJMs expect events will become right just because they went wrong. The gambler fallacy derives its name from the actual gambling process. It is often seen when people play roulette in casinos, believing that the ball will go into the black because it has settled in the red for many rounds (Tversky & Kahneman, 1978; Virine & Trumper, 2008). In addition, gambling in PM means sacrificing resources, project delays, and going over budget, which is hard to tailor in a dynamic business environment with limited financial and human resources.

Venturesome is a synonym for the gambler fallacy, and it is a personality trait of decision-makers. It is explained as the degree to which decision-makers are ready to take a risk; hence, they are aware of the consequences of the results and are prepared to take their chances. This trait is linked to the fact that the human mind tends to develop low-risk assessments; thus, decision-makers think they are completely controlling the situation. Eventually, PJM decision-makers are gambling.

- **Miserly information processing:**

This source of bias refers to PJMs' avoidance of a rational and careful analysis of complex information (Mohanani et al., 2018). It also refers to the poor understanding and estimation of the inputs. A significant phenomenon of this bias is PJMs' acceptance of project requirements without further consideration of their ability to deliver the expected outcomes or in-depth analysis of the available workforce to complete the activities. Understanding and analysing project requirements are part of the PJM's primary responsibilities. Biased evaluation of requirements results in a series of unfortunate outcomes that affect a project's scope, time, and cost and decreases stakeholders' confidence in the PJM's ability to fulfil future projects.

- **Misleading information bias:**

This source of bias is related to the human tendency to follow information blindly without consideration or self-evaluation (Mohanani et al., 2018). PJMs react differently to misleading information, especially if experts are the sources of information, either accurate or incorrect; misleading information substantially impacts PJMs' decisions (Jørgensen, 2005a). This influence impacts human beliefs and may change the course of the project if the PJM misses the ability to reconsider the sources and credibility of the information provided (Jørgensen, 2005).

<u>Third family: Group and social bias</u>

This family of bias is related to sources of bias that influence the decisions of PJMs when they are among a group of people, or the impact of that group affects PJMs' decisions (Al-Ali, Emes & Leal, 2018; Virine & Trumper, 2008). Only one sub-group is placed under this source of bias, Social Bias.

1. <u>Social bias</u>

This source of bias refers to making critical decisions based on attitude towards the social relationship between decision-makers and other people from a particular level (Mohanani et al., 2018). Three sources of bias are placed under this sub-group: Self-efficacy, Bandwagon Effect and Cultural Bias.

- **Self-efficacy:**

This source of bias refers to the human mind's capability to manage risky results, and it is a personal belief in the ability to succeed in a specific situation. It is "the personal human beliefs regarding their capacity to organize certain events successfully that can impact achieving the desired objectives" (Yeşilyurt, Ulaş & Akan, 2016). This source of bias requires many emotional, social, and behavioural skills to be applied to the individual activity and achieve it effectively, which requires long experience, lessons learned, and education to reach that level of efficacy. Self-efficacy plays a significant role in the DM process. How problems are solved comes from the interaction between personality, behaviours, and environmental influences. Increasing self-efficacy leads to high risk by affecting the way decision-makers perceive threats or opportunities, where high self-efficacy underestimates threats and overestimates opportunities.

- **Bandwagon effect:**

Mohanani et al., (2018) defined the Bandwagon effect as people's propensity to align their opinions and decisions with the majority; thus, their perception of events is affected by many opinions that are not based on rational judgment and analysis. Fu and Sim (2013) defined it as "the tendency for social constituents to emulate the consensus among a critical mass of peers as their focal choice". The concept is associated with individuals believing in an opinion most people follow, although it might be wrong. The bandwagon effect is a psychological state that impacts humans' ability to make correct decisions (Rikkers, 2002).

For instance, project team members obey their supervisor's decision without looking for alternatives, and this also applies to PJMs when following upper management instructions without further analysis of the consequences of project activities. Although the Bandwagon effect might be helpful because the majority agree on particular decisions, it does not always mean it is correct (Fu & Sim, 2013). The bandwagon effect may be valid for specific situations. It is worth mentioning that people pursue this source of bias based on superficial reasons, not according to a rational analysis of the overall situation; thus, decisions will be influenced by sceptical and misleading information in some instances (Rikkers, 2002).

- **Cultural bias:**

This source of bias refers to people's propensity to make a judgment based on cultural differences (Pauleen et al., 2006). This concept is a double-edged sword: people may be evaluated negatively based on differences in behaviours; furthermore, cultural diversity can be embraced and enhance the DM process (Pauleen et al., 2006). PJMs should look deeply into other cultures' backgrounds, especially when working with team members from different cultural backgrounds in different countries or within the same work environment, including how team members perceive information, instructions, and guidance. Cultural bias is a cause of conflict that PJMs should handle carefully, so their judgments should be based on facts, not on differences in backgrounds (Pauleen et al., 2006). Judgment should also be based on the value of the information, not on the way information is perceived.

Fourth family: Effects and memory bias

This family refers to the bias that changes, deteriorate or promote particular memories (Al-Ali, Emes & Leal, 2018; Virine & Trumper, 2008). There is only one sub-group placed under this bias.

1. Memory bias

This source of bias impacts the ability of decision-makers to remember specific information or an experience. Two sources of bias are placed under this sub-group: hindsight and time-based bias.

- Hindsight:

Cunha et al., (2014) defined hindsight bias as the "Human tendency to be incapable of overhauling previous states of knowledge that changed later". Examples of hindsight vary; sometimes, decision-makers claim that they knew the opposite results would occur although they have selected their favourable options and then use that statement when the outcomes of their decisions are wrong. In other situations, decision-makers feel something about a confident decision like estimating the duration of X activity, so when the prediction comes within their expectation, they say: it was predicted.

- **Time-based bias**

Cunha et al., (2014) defined time-based bias as "a reduction of attention via short-term thinking and hyperbolic discounting error". This source of bias affects the quality of information due to that fact that this information is from the past hence can't be sued to make future decisions Fleischmann, M. et al (2014); example of time-based bias involve making a decision based on absolute technology or decide to process with particular vendors according to their past successful project within a prosper economic factors ignoring the factors that surround this era.

<u>Fifth bias family</u>

This study has established this family to include sources of bias that were not classified under any of the previous families. According to the literature, representativeness and information bias were investigated, but none of these studies placed these sources of bias.

1. Representativeness

Representativeness bias is "the impulse to judge the probability that X refers to Y by how similar X is to Y" (Cunha et al., 2014). It refers to the rule of thumb or the level of relationship between sample and population, and this point is associated with the DM process.

Human minds like to organize information easily by creating attributes and classifications for every situation encountered. In many cases, that approach could work correctly, but the issue emerges when the rating of that judgment is incorrect, and the human mind's realization of the fact is not based on correct information.

PJMs' inaccurate classification of specific details will inevitably lead to stereotyping, like rewarding a contract for large-scale companies with the highest price; However, small companies were offering a lower price with the same services and deliverables, they were eliminated because of its size. The PJM's mind tends to choose the higher bidder because they believe the quality will be higher, although both companies may provide the same results. Top management may also fall into this bias, and an experienced PJM may be assigned to manage the PM office due to their certificates and experience. Representative bias occurs when the human mind attempts to classify things such as a particular object, person, or process, leading to mistakes (Virine & Trumper, 2008a).

2. Information bias

This source of bias refers to the human tendency to request unhelpful and unrelated information during an uncertain event (Mohanani et al., 2018). Information is the basis for process inputs; without information, the project activities will run in a vacuum, but this information should be timely, accurate and relevant, or the outputs of the projects will fail. The higher the contribution of relevant information, the higher the likelihood of project success (Savun, 2008).

Previous research on cognitive bias in project management

Many studies have discussed the impact of bias on human behaviours (Podsakoff et al., 2003; Kiełczewski, Matel & Poskrobko, 2016; Behavioural Insights Team, 2017), whereas many others have focused on the impact of bias on DM from a psychological perspective (Tversky & Kahneman, 1978; Tversky & Kahneman, 1981; Armstrong & Fildes, 1984; Arnott, 2006; Johnson et al., 2013; Meissner & Wulf, 2016; Park, York & Boyle, 2017; Hersing, 2017). These studies focused on the bias that impacts human reactions under certain circumstances like uncertainty, fear, and pressure; however, a few studies have explored the impact of bias on PJMs' DM style and studies that investigated sources of bias in PM have covered a few aspects. Nevertheless, it was noticed that most of the studies were qualitative and analysed bias based on a quantitative approach.

Table 2.6 demonstrates the studies in CB in PM, the aim of each study, the methodology used, sources of bias and PM segment. Notably, a discussion of these studies' results, methodology, criticism, and conclusions will follow the table.

Table 2. 6: Previous studies in CB and PM

Paper Title/Year/Authors	Aim	Methodology	Sources of bias	PM segment
Cognitive bias in software engineering: A Systematic mapping study (Mohanani et al., 2018)	Gather a collective body of knowledge related to CB in software engineering projects	Quantitative systematic mapping process-secondary data	Interest, Stability Action-oriented Pattern recognition Perception, Memory decision, Social	Software engineering
Heuristics and bias in project management- (Virine & Trumper, 2008)	Explore a few sources of bias that affect PM	Qualitative-Case Study	Availability, Anchoring, Representativeness, Confirmation, ignoring rate frequencies, Illusion of control, Omissions, Optimism, Planning fallacy	General PM
Project management in light of cognitive bias: a public sector it organization case (Cunha et al., 2014)	Explore PJMs' awareness of sources of bias, and develop tools and techniques to avoid bias	Qualitative – interviews	Anchoring, Exposure effect, Pseudo-certainty effect, Certainty effect, Hindsight, Halo effect, Planning fallacy, Availability, Parkinson law.	IT sector
Investigating the awareness of decision-making heuristics and bias in the selection and definition of infrastructure Projects – (Al-Ali, Emes & Leal, 2018)	Exploring the impact of CB in infrastructure projects	Quantitative	Group and social bias, Effects and memory bias Perception and behavioural, Belief and probability estimation.	Infrastructure
Project management in behavioural perspective – cognitive bias in the formulation of the project's aim (Kiełczewski, Matel & Poskrobko, 2016)**.**	Confirm that bias exists when formulating project objectives	Qualitative – secondary data	Sunk cost effect, IKEA effect, priming effect, Anchoring, Focusing effect, Legend Effect, Isolation effect, Primacy effect, The asymmetric dominance effect, hedonism, Authority Effect, Searching For a dominant structure, Confirmation, Herd Instinct.	General PM
Project managers' overconfidence: how is risk reflected in anticipated project success? (Fabricius & Büttgen, 2015)	Investigate PJMs' overconfidence bias when assessing project risk	Quantitative	Overconfidence	General PM
Optimism bias within the project management context – (Prater, Kirytopoulos & Ma, 2017)	Investigate the impact of optimism bias on developing a schedule baseline for the project	A quantitative – systematic review of previous secondary research	Optimism	General PM
Responding to human bias in project control (Rutten et al., 2014)	Increase the awareness towards CB that cause humans to make irrational decisions	PM control cycle	Availability, Conservatism, Escalation of commitment, Groupthink, Illusion of control, Overconfidence, Recency, Selective perception, Sunk cost	General PM

Forecasting software damage rate from cognitive bias in software Requirements gathering and specification process (Chotisarn & Prompoon, 2013b)	"Investigating the impact of the human factor psychological side on software development projects"	Quantitative – Survey	Anchoring, Adjustment, Availability, Confirmation	Software development projects
Project management under uncertainty: the impact of Heuristics and bias (McCray, Purvis & McCray, 2002)	Define sources of bias that can affect the PJMs' decisions and find ways to mitigate bias	Qualitative, secondary data	Comparisons, Inaccurate information, Anchoring, bounded rationality, Gambler fallacy, average tendency, overconfidence, and Hindsight.	General PM
Systematic bias and culture In project failures (Shore, 2008)	Define sources of bias that causes project failure	Qualitative, secondary data-Cases study	Available data, Conservatism, Escalation of commitment, Groupthink, Illusion of control, Overconfidence, Recency, Selective perception, Sunk cost	General PM

Source: Author

CB is a science that is closer to human psychology and behaviours (Tversky & Kahneman, 1978); PM science is more concerned with methodologies, tools and techniques to complete project deliverables (Padalkar & Gopinath, 2016). The only factor that links both sciences is humankind, which is the entity that thinks, makes plans, performs and makes decisions (Parkin, 1996). During the past 20 years, a considerable amount of literature has been published on the impact of CB on PM, and volumes of descriptive published studies carried out in general PM disciplines without further investigation of a particular aspect.

Several attempts have been made to investigate CB within the PM context; for instance, Virine and Trumper (2008) explored the impact of limited sources of bias on the PJM's DM process. Kiełczewski, Matel and Poskrobko (2016) confirmed that bias exists while establishing the project objectives. Rutten et al., (2014) examined the overconfidence bias of PJMs when assessing project risks. McCray, Purvis and McCray (2002) defined sources of bias that can affect the PJM's DM process. Shore (2008) defined sources of bias that lead to project failure. The central theme of these studies was to define and introduce sources of bias.

Previous studies have reported the involvement of some sources of bias in actual cases (Virine & Trumper, 2008; McCray, Purvis & McCray, 2002); or explored one source of bias in PJMs' decisions (Fabricius & Büttgen, 2015; Prater, Kirytopoulos & Ma, 2017; Wright & Goodwin, 2002). Data from several sources have identified significant problems with these studies: (1) investigating general PM aspects without shedding light on particular domains (Virine & Trumper, 2008), (2) the lack of attention to PM process groups and knowledge areas that integrate the role of the PJM (Cunha et al., 2014), (3) examining few areas of CB, (Kiełczewski, Matel & Poskrobko, 2016), and (4) focusing on defining sources of bias without testing a hypothesis (Stacy & Macmillan, 1995).

In addition, limited research focuses on a specific industry, like the study by (Al-Ali, Emes & Leal, 2018), who strongly emphasized the impact of CB on the infrastructure of projects. That study defined all the sources of bias that impact project infrastructure and categorized each source of bias under one of four main families: (1) Group and social bias, (2) Effects and memory bias, (3) Perception and behavioural, and (4) BPEB. This taxonomy paved the way to explore sources of bias from a different perspective within the PM discipline by collecting all the sources of bias mentioned in previous studies and merging these sources of CBA under specific categories.

A fair amount of literature has been published on CBA in ITSD projects. For example, a study by Mohanani *et,al*. (2018), in which they investigated sources of bias in software engineering. The authors came from different countries like Finland, Australia, and New Zealand and agreed upon the significant sources of bias that affect such domains by mentioning 37 CB that were extracted from previous studies. However, some major limitations of their literature review are that the authors examined cases that were extracted from secondary data without testing hypotheses or linking bias to theories; most CB was investigated in isolation from one another; the study mainly focused on analysing only eight sources of bias; and, finally, it did not address the connection between CBA resources and the human behaviours in the DM context.

In contrast, Cunha *et,al.* (2014) investigated how software PJMs in IT software development in the government sector in Brazil make their decisions from a naturalistic perspective by focusing on agile development practices, stakeholder involvement, participatory DM, emotions and CBA. The research focused on the ability of PJMs to make rational decisions under uncertain conditions and provided a framework to guide PJMs through sources of bias and identify which mental status to avoid when making challenging decisions. However, the authors did not elaborate on CB by mentioning sources of bias or focusing on the PJMs' DM style.

Chotisarn and Prompoon (2013) investigated the impact of human psychological status on software development projects in China. This paper is linked to the current study's assumptions from different perspectives: the focus on the human mind, which is the central theme of that research, and investigating the source of bias in the ITSD industry. A survey instrument was used to collect data from IT PJMs. Their study makes a major contribution to the current study, as it provides a straightforward design survey instrument to collect data from respondents. The difference is that the number of sources of bias used to investigate the impact of the human factors on the projects (Chotisarn & Prompoon, 2013b) is less than what is intended in this thesis. Additionally, their study did not explore the DM process or the decision-naming style of the PJM; rather, the focus was on the damage rate caused by particular sources of bias.

Koskela and Howell (2002) emphasized the benefits of adopting theories like explaining behaviours and future predictions and a stable foundation for analysing and designing research. It was noticed that most of the authors they reviewed did not combine the theory of PM with CB, which is a significant drawback in previous studies. PM theory combines the essential elements of PM science like project constraints (scope, time, cost, quality, risk, resources, and stakeholder's satisfaction) and defines primary phases of the PM process like planning, executing, controlling, and finally, the stakeholder's satisfaction. Therefore, the current study considered these theories, designed the conceptual framework based on these fundamental elements, and expanded on this domain by comprehensively investigating more sources of CBA that PJMs may experience during projects and how these sources impact the DM style PJMs and linking that to project outcomes.

The research methodology for a few previous studies was based on secondary data from cases. For example, Mohanani et al., (2018) used a systematic mapping process to review all research investigating sources of CB in software engineering PM using a quantitative methodology. However, these studies did not establish a theory to examine particular phenomena (Saunders, & Lewis, 2009). The same approach was followed by (Prater, Kirytopoulos & Ma, 2017), who used a systematic quantitative literature review to examine one source of bias and the focus of the research and validated the impact of optimism bias compared to other studies.

Virine & Trumper (2008) published a paper describing sources of bias using a qualitative methodology to investigate secondary cases. They defined 14 sources of bias and explained these sources by giving examples and linking them to the decisions that PJMs could have made in the past to make an accurate judgment. However, no theories or questions were raised to solve a particular phenomenon in the study. The study makes a notable contribution to knowledge, and the lack of theories and research questions is a significant drawback. Shore (2008) adopted the same perspective by reviewing actual cases and linking these to sources of bias when a decision was made that led to project failure, where the author linked more than 10 cases of project failure to sources of bias.

It would be an enormous contribution if the cases were investigated before failure. As one of these cases was related to the Columbia Shuttle crash that caused the death of seven astronauts on February 1, 2003; the essence of that example shows the importance of research to practical life and how, if research results were raised earlier, before it became too late, people's lives could have been saved.

Cunha et al., (2014) investigated sources of CB in PM using a qualitative exploratory methodology (semi-structured interviews) and open-ended questions. The study interviewed seven PJMs in the ITSD public sector and enlisted the participation of another three PJMs to judge and assess the concept map outcomes.

The study used an open-ended question approach to collect respondents' data to express their opinions. Although semi-structured interviews are used to understand the relationship between two variables (Saunders& Lewis, 2009), a significant drawback is the number of respondents who participated in the study. Marshall et al., (2013) observed that the sample size for a qualitative approach might vary but with minimum limits of 20-30 respondents and 30-50 respondents in some cases, and that is what raises a debate about interviewing only seven respondents to explore the CB in IT projects conducted by (Cunha et al., 2014).

Catterall (2000) has another opinion about the validity of the questions: he emphasized that ten subject matter experts should validate the study questions before the semi-structured interviews are conducted, which adds another drawback to the research.

Chotisarn and Prompoon (2013); Fabricius and Büttgen (2015) followed a quantitative research methodology to investigate the impact of CB on PM: a questionnaire instrument was designed and sent to PJMs to respond. The collected data were analysed accordingly based on correlations and multiple regressions. The author agrees with that approach since the questionnaire approach is more relaxing for the respondents, as respondents are not under any interview pressure, which in the study's opinion, may cause biased answers.

These studies were promising and managed to relate the impact of PJMs' CB on decisions during the initiating and planning of different types of projects. However, the question is why these studies investigated only a few sources of bias, although many studies have revealed more than 37 sources of bias. Table 2.7 summarizes the number of sources of bias investigated by each study:

Table 2. 7: Number of sources of bias investigated in previous research.

Authors	**Number of sources of bias**
Mohanani et al., (2018)	Eight
Virine and Trumper (2008)	Nine
Cunha et al., (2014)	Nine
Al-Ali, Emes and Leal (2018)	Four
Kiełczewski, Matel and Poskrobko (2016)	Thirteen
Fabricius and Büttgen (2015)	One
Prater, Kirytopoulos and Ma(2017)	One
Rutten et al., (2014)	Nine
Chotisarn and Prompoon (2013)	Four
McCray, Purvis and McCray (2002)	Eight
Shore (2008)	Nine

2.3.3 Project manager behaviour

Background

Organizations tend to improve performance by focusing on individuals' and groups' behaviours. The concept of organization behaviours is meant to study people's behaviours inside an organization (Mullins, 2007). Organizations generally do not focus on the tip of the iceberg, as depicted in figure 2.5: the primary concern of the management is what lies underneath the surface that determines the overt direction of the organization.

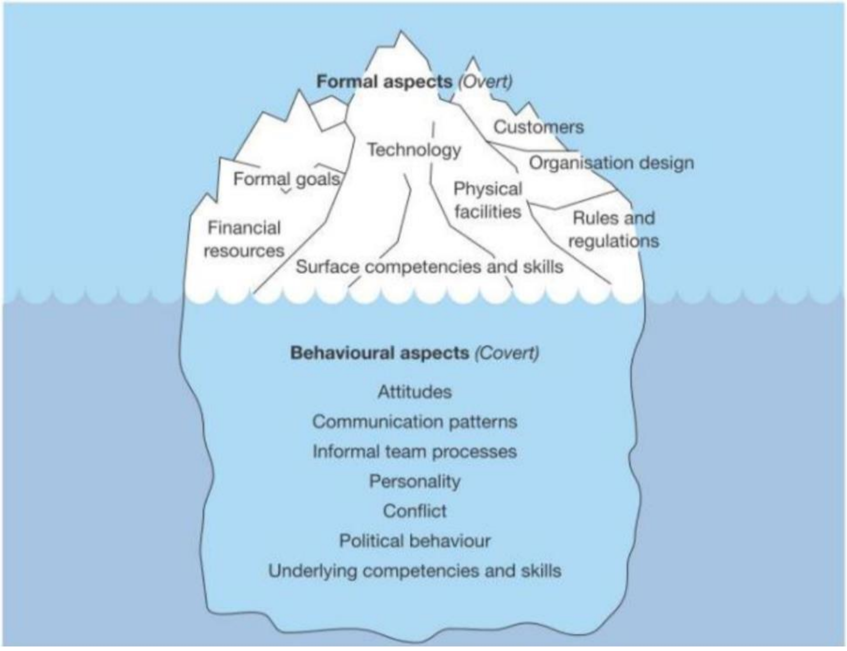


Figure 2. 4: The organizational iceberg
Source: Hellriegel, Jackson and Slocum Jr. (1998)

PJMs are humans who behave according to their ethnic origin, gender, experiences, culture, attitude, motivation, perception and character traits (Mullins, 2007). Their behaviour is based on their inner feelings and psychological state of mind, which control their reaction to uncertain events with limited time to think, or when a situation is at stake (Carnes, Creasy & Johnson, 2019). Therefore, PJMs must be aware of the factors surrounding projects and ensure that social, political, and cultural factors are under control (Wang, Jiang & Pretorius, 2016), as conflicts among people and organizations with different backgrounds will impact the project success.

Investigating the relationship between behaviours and PM has been a vibrant area of exploration for the past century and a half (Carnes, Creasy & Johnson, 2019). The relationship between behaviours and PM is stable, as both disciplines investigate similar phenomena that shape the management of organizations and projects (Carnes, Creasy & Johnson, 2019). The main phenomena investigated are conflict resolution (Xie, Song & Stringfellow, 1998; Wang, Jiang & Pretorius, 2016), leadership characteristics (Ouimet, 2010; Rauthmann, 2012; Pinto &

Patanakul, 2015), and communication (Ekrot, Rank & Gemünden, 2016; Edakkat Subhakaran & Dyaram, 2018).

PJMs should have certain competencies to manage and control projects; the first is *knowledge*, which is the PJM's qualifications and experiences working in the PM industry. The second one is *performance*, which is the ability of the PJM to produce project deliverables while applying PM practices and methodology. The third factor is *personality*, which indicates how PJMs behave when planning and delivering project activities. Personality is a combination of attitude, characteristics and leadership (Cunha et al., 2014). Competencies are characteristics that motivate PJMs to accomplish project objectives. It is an aspect of the human perception of social responsibility (Boyatzis, 1983).

Competencies are a set of behaviours that are essential to achieving project deliverables. PJM behaviour is a part of the competencies applied to perform critical tasks and is considered a significant indicator of project success (Lepsinger & Lucia, 1998). This study focuses on the impact of PJMs' CBA on the decisions made during the ITSD project.

Project managers' decision-related behaviours

As PJMs' behaviour is considered a factor substantially related to the DM process (Mullaly, 2014), the decisions made have the highest impact on project success or failure and determine the course of action of the project deliverables. These decisions reflect the influence on actions taken by PJMs (Mullaly, 2014). Decision-related behaviours are classified under three leading schools: the reductionist, the pluralist and the contextualist (Stingl & Geraldi, 2017). Each school class adopts a behavioural thinking paradigm that is explained next.

1. Reductionist school

This school follows realistic, positive and objective thinking and measures the deviation from ideal standard measurements (Stingl & Geraldi, 2017). This school asserts that decisions should be based on logical analysis and focuses on the PJM as optimism bias. This type of thinking school links DM to CBA and refers to the root causes of deviation as bias and errors. The primary empirical studies of the school explored optimism bias, resource allocation, quality gold plating and inefficient communication with stakeholders (Stingl & Geraldi, 2017). Furthermore, studies have moved forward to cover more sources of bias like self-efficacy and illusions of control. Previous literature on reductionist thinking discussed and investigated the relationship between project activities, failure, planning and PJM personality traits from research problems and CB and behaviour from a theoretical basis (Stingl & Geraldi, 2017).

2. Pluralist school

This school follows the ideal normative approach similar to a reductionist school but refers to the deviation to group thinking, not to individuals who cause conflicts (Stingl & Geraldi, 2017), and suggests that PJMs act according to their interests. This school explores emotions, groups, processes and stakeholders from the research problem perspective and conflict resolutions and negotiation techniques from a theoretical perspective (Stingl & Geraldi, 2017).

3. Contextualist school

This school of behavioural thinking focuses more on the process that leads to particular decisions than on the decisions (Stingl & Geraldi, 2017). The contextualist school adopts sense-making theory and focuses on management approaches that lead to effective decisions; the research problem focuses on conflicts, misunderstanding between stakeholders, values and future vision, and explores the cultural dimension and sensemaking from a theoretical perspective (Stingl & Geraldi, 2017).

The next section discussed NB and other behavioural traits:

1. NB is related to the reductionist school of theoretical thinking.
2. VB is associated with a reductionist theoretical basis.

2.3.4 Narcissistic behaviour

NB is a psychological state or personality disorder is characterized by high self-regard and a desire for personal aggrandizement (Pinto & Patanakul, 2015). The NB of PJMs has a critical impact on project process. Previous studies have indicated a direct relationship between project success and PJM behaviour and found a relationship between narcissism and optimism bias (Pinto & Patanakul, 2015).

Debates arise, and questions are asked about the ability of PJMs with NB to make rational decisions and the consequences of this behaviour as a psychological disorder for the DM process. The answer to that question has been answered by many studies (Pinto & Patanakul, 2015), which have investigated the impact of PJMs' NB on project success, and found that their behaviour leads to failure, according to the decisions made during the project life cycle. Ouimet (2010) found that narcissism has a risky impact on organizations, creates a toxic environment, decreases stakeholders' trust, and decreases trust within team members.

A narcissistic PJM shows five behavioural aspects when communicating with stakeholders; these behavioural aspects shape the character of a narcissistic leader, which consecutively affects the rationality of decisions. According to research by (Pinto & Patanakul, 2015; Ouimet, 2010), five narcissism aspects control leaders' reactions. These aspects are arrogance, interpersonally exploitative, lack of empathy, grandiosity, and antagonism. The study is linking PJMs' CBA, an internal psychological state that is the hidden part of the personality, and the narcissistic reaction towards constraints and decisions made during the ITSD project. The link is part of the framework that shapes the guidelines for PJMs and demonstrates the combination of internal and external reactions towards an uncertain situation that requires analysis and rational decisions to avoid project failure and steer the project wheel to success.

Although the literature has considered variables from different schools, no previous investigation of narcissistic PJM behaviour has been conducted. The only research that has examined NB considered project champions the focal point of the analysis, not PJMs. The research was carried out by Pinto and Patanakul (2015), who assumed that a project champion's role was as a motivator, visionary, manager of political organization issues, someone who took a risk-based on personal assumptions, and who was the main focal point between the top management and project.

The following section summarizes the narcissism aspects:

- **Arrogance:**

Pinto and Patanakul (2015) define arrogant behaviour as the leaders' disposition to amplify the importance of their personality and abilities compared to peers and subordinates, and it shows the behaviour of being better than everyone. This type of behaviour surfaces when organizations encounter an uncertain situation (Ouimet, 2010). However, an arrogant person might be right sometimes, and their behaviour may bring benefits to the organization, but it is not recommended at managerial and project team levels.

- **Interpersonally exploitative:**

This type of behaviour is defined as the leaders' disposition to exploit others to achieve self-benefits instead of the organization's interests (Pinto & Patanakul, 2015). This aspect represents extreme maladjustment and aggressive behaviours like forcing others to respect the other leaders (Reidy et al., 2008).

- **Lacking empathy:**

Pinto and Ptanakul (2015) defined lack of empathy as the tendency to ignore and neglect others' feelings and a lack of respect for their perceptions. This aspect decreases the leader's sense of other requirements and opinions and enforces narcissism to think about their interest-only, regardless of the project outcomes, making the work environment toxic and creating a cold relationship among stakeholders (Ouimet, 2010).

- **Grandiosity:**

This aspect of NB drives the leader to seek attention from others and is considered a pathological mental state that causes inconsistency in the project performance. PJMs with the grandiosity trait take high risks without conducting the necessary analysis of risk factors. This behaviour strongly relates to optimism bias, which implies people who think that only positive events will occur and ignore facts during risk identification (Pinto & Patanakul, 2015). More evidence shows the mutual relation between their behaviours and CB.

- **Antagonistic:**

Leaders characterized as having antagonistic behaviour show hostility towards other opinions during the DM process (Pinto & Patanakul, 2015); this aspect reveals a dark personality that does anything to gain self-benefits without considering others' or the organizational interests (Rauthmann, 2012).

2.3.5 Voice behaviour

The PJM VB is defined as "The ability to communicate ideas, thoughts, and concerns to the upper management to provide positive decisions and improve performance (Ekrot, Rank & Gemünden 2016). According to Ekrot, Rank and Gemünden (2016), PJMs' VB with the pure intention to improve the organizational performance is a positive gesture that impacts the quality of the DM process; hence, it improves the project processes and encourages innovative opinions. Edakkat Subhakaran and Dyaram (2018) asserted that VB has a significant positive impact on the DM process and is recognized as an early detection tool for problems.

VB aims to enhance decisions to criticize them; a dynamic and unstable project environment increases the necessity for innovative ideas, but these ideas should be directed to upper management without fear. Furthermore, the management should be open to employees and listen to their thoughts. Although it has not been analysed in PM research, VB is a part of psychological studies (Ekrot, Rank & Gemünden, 2016). To talk or keep silent is a decision that a PJM makes during the project life cycle, which is affected by internal mental perceptions like bias.

Previous literature has intently looked into VB and its impact on the performance of any organization, and most of these previous studies indicated that this behaviour has a positive impact on the performance of organizations and the success of their projects. One of these studies is by Rees, Alfes, and Gatenby (2013), in which the authors tested the relation between voice and engagement, voice and trust in senior management, trust in senior management and engagement, and voice and the employee-line manager relationship. The authors revealed in their results that employees who perceive themselves as speaking up with their opinions and suggestions are more inclined to be engaged with their work; they also highlighted the value of focusing on the employees' voices to boost their engagement. In other words, the study indicated that VB has mainly positive implications.

Another study that investigated VB is by Jinyun et al., (2014), in which they studied the voice efficacy model to explain the impact of self-efficacy, perceived team-servant leadership, and perceived organizational support on VB. The authors indicated in their results that VB is essential for enhancing employee performance and organizational effectiveness, thus, suggesting that an organization should encourage its employees to speak up.

The focus of the study is to link the VB variable with the CBA of PJMs and recognize the relation between these two variables. VB is divided into three aspects: communication, suggestions, and concerns. Each of these aspects is summarized in the next section:

- **Communication:**

The first aspect of VB is the PJMs' communication of ideas. Ekrot, Rank and Gemünden (2016) defined it as the extent to which the PJMs express their ideas to improve project performance. PJMs' innovative ideas with upper management positively impact the programme or portfolio (Edakkat Subhakaran & Dyaram, 2018), where downward communications motivate team members to accomplish project deliverables and be creative. (PMBOK, 2017, p.290) considers communication as one of the ten knowledge areas that require PJMs to prepare a clear plan for all channels of communication and define the channels and tools of communication, either internally with the project teams or externally with top management and stakeholders.

- **Suggestions:**

Ekrot, Rank and Gemünden (2016) define suggestions as PJMs' initiative to provide advice, corrective action plans, counselling, and demonstrations to resolve an issue. PJMs face two types of consequences regarding their suggestions: they may provide a suggestion that yields a positive impact on the DM process; however, the suggestion may adversely impact the decision made, which leaves them confused about taking that step. Management should encourage employees to speak their minds; listening to their opinions and ideas could solve conflicts or issues that need someone to look from a different angle (Edakkat Subhakaran & Dyaram, 2018).

- **Concerns**:

The last aspect of VB is concern. Ekrot, Rank and Gemünden (2016) defined it as the PJMs' ability to show their concerns to top management regarding adverse events. Hence, upper management should allow a space for employees to express their concerns about adverse events; accordingly, staff loyalty and commitment to their organizations will increase, and confidence in management's decisions will also increase, which creates a mutual interest between the management and the employees that fosters the relationship among team members and stakeholders and takes the organization towards innovation and successful implementation of projects. Listening to employees' concerns enables early detection of issues and problems and gives organizations the time to be proactive and ready for unpleasant events (Edakkat Subhakaran & Dyaram, 2018).

2.4 Chapter summary

The emirate of Dubai I thriving to position itself among the leading regions with the technology advancement, yet Dubai faces many challenges to achieve this endeavour. This chapter demonstrated the value of PJM and their contribution to the success of the projects, and the impact of the project decisions on project success, and emphasise the awareness of impact of project decision on the success of the project.

Therefore, theories related to this domain concentrate on PJMs' reasoning measures to reach a certain decision, which might be affected by their feelings, emotions, values, and beliefs; thus, theories have integrated the PJMs' ability their behaviours into the DM process. PJMs might resort to CBA when making decisions under uncertain events. CBA directly impacts PJMs' decisions under uncertain events; perception and behaviour bias and BPEB contain the main sources of bias that many empirical studies have investigated. In this essence, CBA causes the human mind to deviate from making rational decisions by creating shortcuts based on past human experiences.

PJMs' behaviours impact the DM process, and the behaviours might be suggestions or problem solving or harmful behaviours that negatively influence the project. Nevertheless, the link between CBA and such behaviours has not been explored efficiently. NB and VB play a moderating role to find the relation between PJMs' CBA and their DM style and how that affects the success of projects.

CHAPTER 3: CONCEPTUAL FRAMEWORK

The conceptual framework is a visual representation that serves as an analytical tool to show an arguable correlation between variables, keys, or factors, highlighting concepts and organising ideas. The conceptual framework demonstrates and links research key variables into a thematic view that makes a logical sense of the relationship between factors (Sekaran & Bougie, 2012; Saunders & Lewis 2009).

This chapter aims to demonstrate the theories that the study counts on (including CB theories, psychological and behavioural theories, and DM theories) to illustrate the relation between the various sources of bias and the moderating role of most critical PJM behaviours of NB and VB, and how these factors can impact the efficiency of the DM process in the ITSD PM discipline. It also presents the operational definitions of the study variables and a detailed explanation of the research hypotheses and development. It also defines the impact of independent variables on dependent variables and the impact of mediator variables on dependent variables.

3.1 Development of the conceptual framework

This study aims to assess the influence of CBA on the DM style of the PJM during ITSD projects in Dubai and the moderating role of NB and VB. It also examines the impact of the DM style of the PJM on project success, where these two variables are unidimensional. The study considered the psychological and behavioural attributes of the PJM and investigate the impact of CBA on the DM style of the PJM.

Hence, the PJM is the unit of analysis in the study, where the variables of interest are the PBB and BPEB. On the other hand, the narcissistic and VB of the PJM are also examined to determine the relationship between sources of bias, behaviour, and their impact on the DM style of the PJM during ITSD projects, which recalls one of the research's significant outputs, which is PJMs’ CBA and behaviour influence those project outcomes.

Study questions:

With a focus on ITSD projects in Dubai, the main questions that underpin the study were developed based as follow:

During a project, the PJM is affected by the fact that they have less information about a particular activity that should yield prospective results, called wishful thinking (Babad & Katz, 1991), which decreases the accuracy of decisions during the project’s phases and is part of the interested bias. Lack of information and lessons learned during the project and software design manifest the availability bias due to the tendency to remember particular keywords that trigger the PJM’s DM process (Mohanani et al., 2018), whilst fixation bias affects the concept of software design as the focus is directed to one aspect of the project, as asserted by (Mohanani, Ralph & Shreeve, 2014).

Personal preferences also play a role in making decisions affected by the mere exposure effect (Kwan, Yap & Chiu, 2015). Prieto, (2011) proved that the Semmelweis reflex impacts the selection of project objectives. Furthermore, framing bias affects decisions regarding loss or gain and when the situation is crucial and requires further analysis (Wright & Goodwin, 2002). In addition, Tversky and Kahneman (1978) linked the mental condition of the PJM when planning for deliverables; the planning fallacy (optimism) bias shows irrational decisions due to the high confidence of the PJMs like overestimation of team capabilities and presenting future results with high expectations (Yamini & Marathe, 2018). Quality assurance and testing are affected by confirmation bias. The less the experience, the higher the bias (Mohanani et al., 2018). Moreover, due to the emotional attachment of the PJM or team members to a confident decision, the IKEA bias affects the decisions made during the project.

Selective perception bias impacts how the PJM defines if the deliverables meet the plan's baseline, and the results are selected according to the PJM's perception of the results (Jørgensen & Sjoberg, 2000). PJMs tend to provide information in a particular style and order to impact the decisions of stakeholders, so their focus will be directed to the most critical, early or lately statements of the project update, which is defined according to Murphy, Hofacker and Mizerski (2006) as the primacy and recency effect. Irrational decisions made during planning can continue to impact the project execution; Chung and Cheng (2018) indicated that PJMs insist on carrying on in particular lost projects even though they are no longer making a profit like sunk cost bias. In addition, PJMs tend to erase particular information that impacts the project course if it does not agree with their thoughts due to the impact of omission bias; which represents a risk to the project's progression and success (Park, York & Boyle, 2017; Baron & Ritov, 2004).

PJMs tends to make decisions based on s specific reference point to make the estimation process easier, this trap affects the quality of decisions due to the presence of anchoring bias; where in other cases, PJMs keep to think that particular project team is beneficial for all projects regardless of the fact the competencies of the project team is diverse, and keep everything as is affect the project deliverables, this trap is referred to status-que (Geng, 2016); in other cases, the PJMs associate their mind with close awareness and previous knowledge of certain issues; where their conscious is completely absent and instead they select decision based on what is more familiar, this mental trap called the familiarity bias (Seiler *et al.*, 2008). Anchoring, status-que, and familiarity are related to the stability bias which is part of the BPEB. Furthermore, PJMs decisions are affected by the tendency to make early decision regardless of the emergence of new options and new information, this bias is related to the action-oriented bias (Mohanani *et al.*, 2018); PJMs fall under the trap of overconfidence when making decisions depending on the fact that positive results will happen because previous events yields unpleasant results (Fabricius & Büttgen, 2015); however, obsessive overconfidence gives the PJMs the feeling that the project activities are under control, where their perception to risk is decreased due to the reason that PJMs fill under the trap of illusion of control (Meissner & Wulf, 2017); in other cases, the PJMs believe that the next decision will bring positive results because previous incidents were negative, this hunch is gambling fallacy and is based on a game rather being based on rational information assessment (McCray, Purvis & McCray, 2002); in addition, the PJMs avoid to complex information and may accept the results of quality assurance of project deliverables without considering the complex aspects of the process and information related to these activities, this mental trap influence the decision-making process and called misrely information bias (Mohanani *et al.*, 2018); lastly, PJMs may follow information blindly without attending assessment the quality of these information and build their coming decisions based on misleading information bias (Jørgensen, 2005); thus, the first study question is:

Q1: What is the relation between the CBA and the DM style of the PJMs?

PJMs behaviour has an impact on the project activities and drive the course action of the project decisions (Carnes, Creasy & Johnson, 2019); this behaviour may create a toxic environment that determines the project progress toward personal interest instead of the organization objectives, this type of behaviour characterized by arrogance, interpersonally exploitative, lack of empathy toward project team, the feeling of grandiosity, and antagonistic (Pinto & Patanakul, 2015); these aspects shape the narcissistic behaviour which impact the decision that emerge during the project and at uncertain events (Ouimet, 2010); this study is will try to link CBA and DMS to the narcissistic behaviour, thus, the second study question is:

Q2*: *Does NB act as a moderator in the relation between CBA and the DM style of the PJMs?

According to Ekrot, Rank and Gemünden (2016), PJMs' VB with the pure intention to improve the organizational performance is a positive gesture that impacts the quality of the DM process; hence, it improves the project processes and encourages innovative opinions. Edakkat Subhakaran and Dyaram (2018) asserted that VB has a significant positive impact on the DM process and is recognized as an early detection tool for problems.

The voice efficacy model explains the impact of self-efficacy, perceived team-servant leadership, and perceived organizational support on VB. The authors indicated in their results that VB is essential for enhancing employee performance and organizational effectiveness, thus, suggesting that an organization should encourage its employees to speak up. which is affected by internal mental perceptions like bias; however, prompt reaction is associated the experiential DMS which may affect the quality of the decision; thus the study third question will reveal the relationship between the CBA and DMS, and their relationship to VB:

Q3: Does VB act as a moderator in the relation between CBA and the DM style of the PJMs?

A project's success rate grows with the decisions made during the project (McCray, Purvis, & McCray, 2002); unrealistic decisions increase the risk of project failure (Al-Ali, Emes & Leal, 2018). As a result, logical reasoning and proper information analysis have a substantial impact on project success (Kieczewski, Matel, & Poskrobko, 2016). Even if stakeholders dislike them, effective decision-making lead to project success (Culp & Smith, 2001), better team performance leads to increased project effectiveness, which leads to success (Culp & Smith, 2001), and the quality of performing activities a0nd decisions leads to project success (Culp & Smith, 2001; Ford & Bhargav, 2006; Tohidi, 2011), for example, demonstrates the impact of different decision-making styles on project successful outcomes. Thus we forward the following proposition:

Q4: Does the DM style of the PJMs influence the success of ITSD projects in Dubai?

Project managers' decision making a key success factor in projects (Chotisarn & Prompoon, 2013) and a major cause of failure in ITSD projects is the project managers cognitive biases (Stacy & Macmillan, 1995; Mohanani et al., 2018); the project manager's perception of information distorts reality and causes bias (Cunha et al., 2014). Cognitive bias appears during the execution of daily tasks that the project manager performs (Stacy & Macmillan, 1995). It was concluded by Mohanani et al., (2018) that bias related to the project manager's interest and favoured decisions have a high influence on the success of the project outcomes. The success of the ITSD project depends on the Project managers' decision making a key success factor in projects (Chotisarn & Prompoon, 2013) and a major cause of failure in ITSD projects is the project managers cognitive biases (Stacy & Macmillan, 1995; Mohanani et al., 2018); thus the study fifth question is:

Q5*: *Does the CB influence the ITSD project successful outcome?

According to the study questions and objectives, the study developed multiple hypotheses to examine the influence of CB on the DM style of the PJM. The study's conceptual framework was developed based on CB and DM processes using the CEST model and behaviour theories. Projects contain an interrelated set of processes that interact differently in situations of environmental turbulences, which is why many projects fail to accomplish their final outputs (Besteiro, de Souza Pinto & Novaski, 2015). These critical decisions affect the PJMs' behaviour that appears in the reaction towards specific issues during ITSD projects. PJMs' CB causes the brain to deviate from analytical and rational DM and forces it to make an irrational judgment.

On the other hand, constraints are elements that limit the ability of the PJM to complete the project outputs successfully. The PJM should investigate these constraints and monitor changes within the project to decrease the imbalanced constraints, as project turbulence is inevitable in the PM industry. Nevertheless, constraints are challenging to the PJMs and project teams, and frequent assessment and evaluation must be conducted to minimize the impact of uncertain events on projects.

Accordingly, the conceptual study framework proposes a relationship between the CB and the DM style of the PJMs during ITSD projects. These decisions may positively impact project outcomes, which means the project succeeded and met the stakeholders' requirements or ended up with negative consequences and failed to deliver the outcomes as agreed in the PM plan and is considered a failure.

Theories of CB state that bias plays an essential role in the DM process in projects and can determine a project's path toward success or failure (Virine & Trumper, 2008; Cunha et al., 2014; Al-Ali, Emes & Leal, 2018; Kiełczewski, Matel & Poskrobko, 2016; Fabricius & Büttgen, 2015; Hersing, 2017; Behavioural Insights Team, 2017; Stingl & Geraldi, 2017; Mohanani et al., 2018).

These studies identified more than 237 sources of bias and categorized them into many classifications. For instance, Al-Ali, Emes and Leal (2018) categorized sources of bias under four main families: 1) Group and social bias, 2) Effects and memory bias, 3) PBB, and 4) BPEB. In contrast, Mohanani et al., (2018), identified eight CBA groups: 1) Interest bias, 2) Stability bias, 3) Action-oriented bias, 4) Pattern recognition bias, 5) Perception bias, 6) Memory bias, 7) Decisional bias, and 8) Social bias. These families identified what traps PJMs might fall into while deciding under uncertainty and defined methods to avoid such sources of bias. Thus, this study looked into two families of bias: PBB and BPEB. However, the study won't analyse group and social bias due to the fact that this family concerns with the impact of group of people on decision making process within groups rather than on individual level; in this case the project manager as a unit of analysis is not considered (Al-Ali, Emes & Leal, 2018); furthermore, sources of bias related to that family are associated with the decision that a group make under certain circumstances like Bandwagon effect for instance (Mohanani et al., 2018); on the other hand, the study is not considering the effect and memory bias group due to the lack of previous literature within similar filed of research.

In quantitative research, generalization of the concept is a determinant of quality for this study; three models of generalization were developed by Firestone (1993) that provided a framework; these models are: first: statistical model which is the most common model for quantitative research due to the relationship between sample and population; second: analytic model which combine both quantitative and qualitative researches; third model: the transferability model which is related to the qualitative research (Polit & Beck, 2010). This study follow statistical model of generalization, which select the population that the study aims to generalize its findings upon; however; the results of the study could be different from one geographical place to another, as other factors can affect the findings like human factor, culture, and habits especially when it is related to decision-making; hence, the sociological background of the respondnates may have an effect on the responses which could impact decisions (Kalogeropoulos et al., 2020).

To achieve the study's objective, figure3.1 depicts the study framework according to literature and theories on CB, behaviour, DM style, and project outcomes. Figure 3.1 illustrates the independent variables, dependent variables, and moderators.

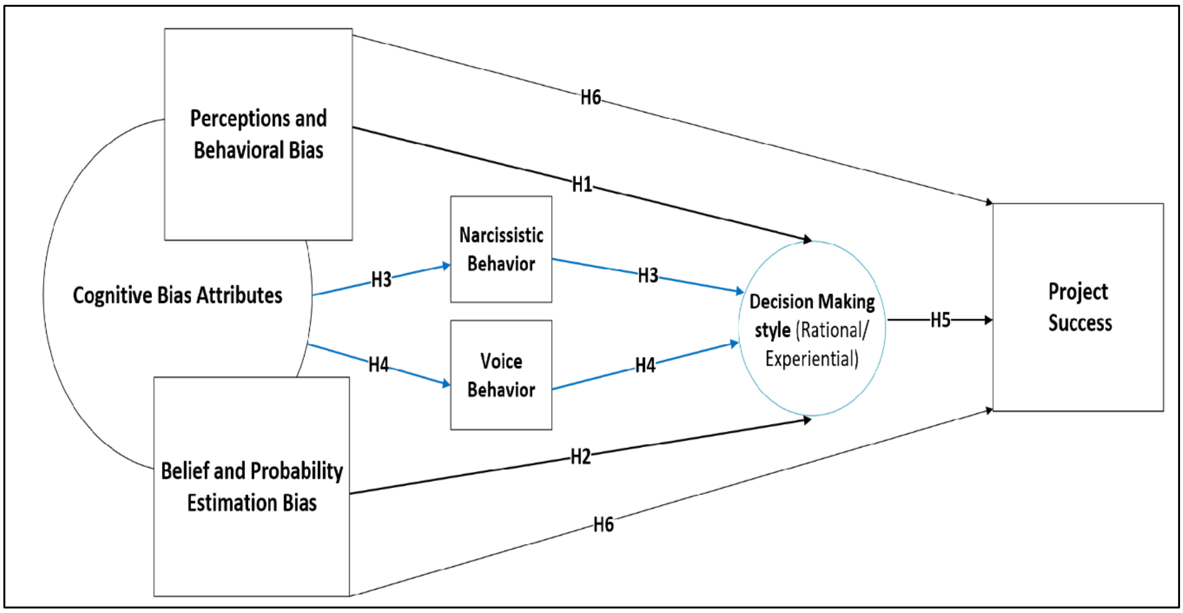


Figure 3. 1: Study conceptual framework

3.2 Independent variables (IDV): Cognitive bias attributes

CB categories are the primary independent variables of the study and consist of the variables depicted in figure 3.2:

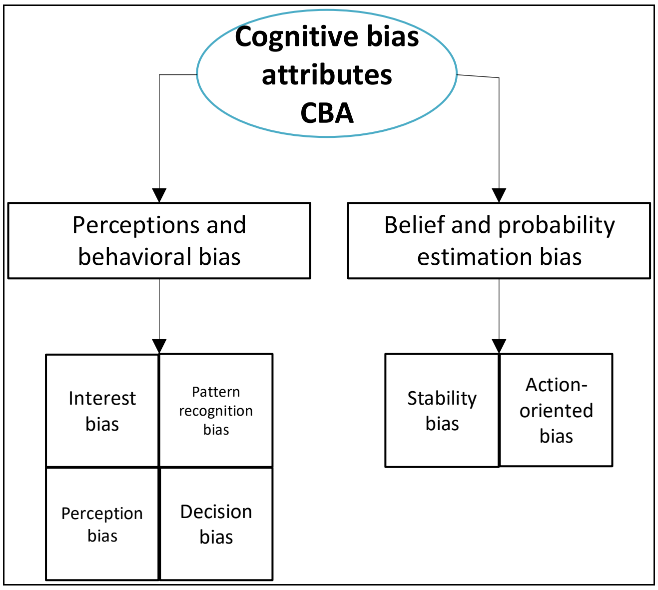


Figure 3. 2: Independent variables

The independent study variables show CBA as the primary independent variable (IDV) to achieve the study's objectives. Two categories are placed under the main IDV consisting of six sub-categories designed to investigate the impact of PJMs' CBA on project constraint decisions during ITSD projects in Dubai. Figure 3.2 is intended to achieve the study's first objective: to explore the influence of CBA on the DM style of the PJM during ITSD projects in Dubai; and the study's second objective: to examine the impact of CBA on project success of ITSD projects in Dubai.

3.3 Independent variables' (IDV)/moderator: Narcissistic and voice behaviour

PJMs' narcissistic and VB play a significant role in this study. The impact of CBA on the DM style of the PJM is tested through the moderating variables of narcissistic and VB; these variables are tested twice based on the rational approach and experiential approach to determine the impact of the DM style of the PJM and the relationship of PJM behaviour.

3.4 Study variables – theoretical definition

According to the literature, the study variables' theoretical definition is illustrated in the following few sections to explore the actual definition of study variables: how they were measured in previous research, which industries investigated these variables, and how they were measured.

Cognitive bias attributes categories

Table 3.1 illustrates the main CB categories, as mentioned in the literature:

Table 3. 1: CB categories

Item	CB categories	Subcategory	References
1	Perceptions and behavioural bias	- Interest bias - Pattern recognition bias - Perception bias - Decision bias	(Al-Ali, Emes and Leal (2018); Mohanani et al., 2018; Hersing (2017), Stingl & Geraldi 2017); Virine & Trumper 2008; Fabricius & Büttgen 2015).
2	BPEB	- Stability bias - Action-oriented bias	(Al-Ali, Emes & Leal 2018); Mohanani et al., 2018; Virine & Trumper 2008; Kiełczewski, Matel & Poskrobko 2016; (Prater, Kirytopoulos & Ma 2017).

1. **Perceptions and behavioural bias**: This bias family is related to judging based on personal perceptions of particular beliefs or observations. It affects the minds and emotions of the decision-makers, which impacts decisions in return (Al-Ali, Emes & Leal, 2018). According to the literature, four sub-groups of bias are placed under these categories, as defined in Table 3.2:

Table 3. 2: Perceptions and behavioural bias

Item	Bias sub-group	Definition
1	Interest bias	People tend to misinterpret analysis according to their personal preferences, thoughts, and sympathy to serve others or win an argument.
2	Pattern recognition bias	People propensity to pay attention to the information they are most familiar with.
3	Perception bias	People's propensity to prejudice the processing of new information.
4	Decision bias	This source of bias develops during the process of DM and affects the quality of decisions.

2. **Belief and probability estimation bias**: This bias family consists of two sub-categories, Stability bias and Action-oriented bias. The group refers to judging the strength of the decision according to the validity of the decision-makers' beliefs instead of considering what supports the decision (Al-Ali, Emes & Leal, 2018). Table 3.3 provides the definition of these sub-categories:

Table 3. 3: Belief and probability estimation bias

Item	Bias sub-group	Definition
1	Stability bias	People's propensity to keep pre-established options and ignore the presence of emerging and new information even if it is superior.
2	Action-oriented bias	People's propensity to make a premature decision without taking into consideration an alternative course of action or related information.

3.5 Study Hypotheses

According to the conceptual framework and to achieve the study objectives, the following hypotheses and sub-hypotheses are developed to test the study variables and investigate the influence of CBA on the DM style of the PJM during ITSD in Dubai.

Direct hypotheses

1. Direct cognitive bias attributes hypotheses

Sources of bias taxonomy are under particular families; two of the main families are presented next because they contain most sources of bias found in projects, the PBB and belief and probability estimation (Al-Ali, Emes & Leal, 2018). However, Mohanani et al., (2018), in their systematic mapping review, grouped sources of bias under seven categories; the intersection of these categories represents interest, pattern recognition, perception and decision bias under the behavioural perception bias. On the other hand, stability and action-oriented are placed under the BPEB. The impacts of sources of bias differ depending on the progress of the project; Table 3.4 depicts sources of bias during the project:

Table 3. 4: Source of bias classification according to project phases

Bias during ITSD projects	Sources of bias	
	Perception and behavioural bias	Belief and probability estimation bias

	- Wishful thinking - Availability - Fixation - Mere exposure effect - Semmelweis effect - Framing - Planning fallacy - Confirmation - IKEA - Mere exposure effect - Primacy and recency effect - Sunk cost. - Omission	- Anchoring - Familiarity - Overconfidence - Miserly information processing - Misleading information - Status quo - Illusion of control

Hypothesis 1: The relationship between perception and behavioural bias and the DM style of the PJM.

There is a direct relationship between perception and behavioural bias and the DM style of the PJM (experiential/rational) during IT software development projects.

During ITSD project, the PJM is affected by the fact that they have less information about a particular activity that should yield prospective results, called wishful thinking (Babad & Katz, 1991), which decreases the accuracy of decisions during the project's phases and is part of the interested bias. Lack of information and lessons learned during the project and software design manifest the availability bias due to the tendency to remember particular keywords that trigger the PJM's DM process (Mohanani et al., 2018), whilst fixation bias affects the concept of software design as the focus is directed to one aspect of the project, as asserted by (Mohanani, Ralph & Shreeve, 2014).

Personal preferences also play a role in making decisions affected by the mere exposure effect (Kwan, Yap & Chiu, 2015). Prieto, (2011) proved that the Semmelweis reflex impacts the selection of project objectives. Furthermore, framing bias affects decisions regarding loss or gain and when the situation is crucial and requires further analysis (Wright & Goodwin, 2002). In addition, Tversky and Kahneman (1978) linked the mental condition of the PJM when planning for deliverables; the planning fallacy (optimism) bias shows irrational decisions due to the high confidence of the PJMs like overestimation of team capabilities and presenting future results with high expectations (Yamini & Marathe, 2018).

PJMs suffer from the impact of interest bias on the DM style; for instance, quality assurance and testing are affected by confirmation bias. The less the experience, the higher the bias (Mohanani et al., 2018). Moreover, due to the emotional attachment of the PJM or team members to a confident decision, the IKEA bias affects the decisions made during the project. These decisions connected with the features or extra specifications they add to the software may not be required in the project scope (Shmueli, Pliskin & Fink, 2015).

Furthermore, selective perception bias impacts how the PJM defines if the deliverables meet the plan's baseline, and the results are selected according to the PJM's perception of the results (Jørgensen & Sjoberg, 2000). PJMs tend to provide information in a particular style and order to impact the decisions of stakeholders, so their focus is directed to the most critical, early or lately statements of the project update, which is defined according to Murphy, Hofacker and Mizerski (2006) as the primacy and recency effect. Irrational decisions made during planning can continue to impact the project execution; Chung and Cheng (2018) indicated that PJMs insist on carrying on in particular lost projects even though they are no longer making a profit. These investments affect the stakeholders' involvement and team allocation of other projects. In addition, PJMs tend to erase particular information that impacts the project course if it does not agree with their thoughts due to the impact of omission bias; which represents a risk to the project's progression and success (Park, York & Boyle, 2017; Baron & Ritov, 2004). The DM process is affected by the PJMs' information processing. Thus, PJMs decide what to do next. The PJMs' decisions go through two main approaches: experiential and rational (Monacis et al., 2016). These two approaches are defined in the CEST model and DM approaches, where rational thinking depends on a deep understanding and analysis of information, and the experiential approach depends on a quick and holistic DM process (Epstein et al., 1996). Accordingly, the first hypothesis states that:

H1: There is a relationship between perception and behavioural bias and the DM style of the PJM (experiential/rational) during IT software development projects.

Table 3. 5: CBA direct hypotheses

Hypothesis number	**Hypothesis**
Perceptions and behavioural bias hypotheses	
H1-1	There is a direct relationship between interest bias and the DM style of the PJM (experiential/rational) during IT software development projects.
H1-2	There is a direct relationship between pattern recognition bias and the DM style of the PJM (experiential/rational) during IT software development projects.
H1-3	There is a direct relationship between perception bias and the DM style of the PJM (experiential/rational) during IT software development projects.
H1-4	There is a direct relationship between decision bias and the DM style of the PJM (experiential/rational) during IT software development projects.

The first hypothesis explore the direct relationship between four sub-groups of the source of bias placed under the PBB: interest bias, pattern recognition bias, perception bias and decision bias (Al-Ali, Emes & Leal, 2018).

Hypothesis 2: the relationship between belief and probability estimation bias and the DM style of the PJM.

There is direct a relationship between belief and probability estimation bias and the DM style of the PJM (experiential/rational) during IT software development projects.

During ITSD project, the PJM makes inaccurate estimates based on anchoring bias, making decisions based on one reference point (Cunha et al., 2014). The PJM makes decisions based on familiarity bias based on experience a knowledge that does not fit the current situation and with different inputs (Seiler et al., 2008). Furthermore, the overconfidence of PJMs directly impacts the DM process and increases the negative consequences of the action on constraints (Fabricius & Büttgen, 2015; Zia, Sindhu & Hashmi, 2017). In addition, the personality traits of the PJM play a vital role in planning events, which might be subject to the PJM's gambling traits – that they make predictions based on risky gambling (McCray, Purvis & McCray, 2002; Virine & Trumper, 2008). The absence of important information about the project requirements affects the project's results. This source of bias refers to a miserly information bias that causes the PJM to deviate from estimating the right resources, stakeholders' requirements, and quality specifications. Finally, a lack of proper assessment of information leads to poor decisions that create undesired deliverables(Jørgensen, 2005a); this source of bias is called misleading information.

The PJM thinks everything is under control due to their exaggerated belief in their abilities. This illusion of control directly impacts constraints decisions that change the course of the project during the production of deliverables (Meissner & Wulf, 2016). On the other hand, PJMs prefer to select the most familiar options when encountering uncertain events that seem to cause the most negligible loss (Geng, 2016; Hessami & Resnjanskij, 2019). Furthermore, PJMs were found to hold on to their decisions even when new alternatives came through since familiar options' status quo had already been made (Hessami & Resnjanskij, 2019).

These sources of bias are placed under two groups: stability bias and action-oriented bias. These groups are part of the BPEB family (Al-Ali, Emes & Leal, 2018). Thus:

H2: There is direct a relationship between BPEB and the accuracy of project constraints decisions during IT software development projects.

Two sub-hypotheses are placed under the main hypothesis, as illustrated in Table 5.6.

Table 3. 6: Second CB direct hypotheses

Hypothesis number	**Hypothesis**
BPEB hypotheses	
H2-1	There is direct a relationship between Stability Bias and the DM style of the PJM (experiential/rational) during IT software development projects.

H2-2	There is direct a relationship between action-oriented bias and the DM style of the PJM (experiential/rational) during IT software development projects.

Hypothesis 3: NB as a moderator in the relationship between CBA and the DM style of the PJM.

NB moderates the relationship between CBA and the DM style of the PJM.

The PJM's personality traits affect the DM process (Pinto & Patanakul, 2015). Studies have found a relationship between project success and PJM behaviour (Pinto & Patanakul, 2015). A narcissistic PJM uses the available resources to direct the project towards their interests without considering the rationality of the situation and making efficient data analysis to reach the right decision (Ouimet, 2010). Both bias and narcissism are related to decisions, as both concepts are defined as a systematic deviation from sanity (Pinto & Patanakul, 2015). On the other hand, a narcissistic PJM has the power to impact the DM process, and has a powerful charisma that bends the project's progress towards their interest (Ouimet, 2010), and serves as a personal motive to lead the project to a certain point that does not match the project's objectives (Pinto & Patanakul, 2015). Rauthmann (2012) found that NB is part of the three dark triads that affect humans' mental state, which in return impacts the DM process. On the other hand, rational and experiential DM approaches interact with all types of behaviour (Epstein et al., 1996); hence, the impact of the DM style of the PJM is related to NB (Reidy et al., 2008) as narcissistic people tends to turn the situation to their interest, regardless of the consequences of the decision (Pinto & Patanakul, 2015). However, NB variable is unidimensional in this study.

Accordingly, the third hypothesis states that:

H3: NB moderates the relationship between CBA and the DM style of the PJM.

The third hypothesis measure the moderating role of NB.

Hypothesis 4: VB as a moderator in the relationship between CBA and the DM style of the PJM.

VB moderates the relationship between CBA and the DM style of the PJM.

While negative personality traits impact the DM process, the situation may also have a bright side to yield positive outputs. The positive characteristics of PJMs may be expressed by telling the truth and expressing their feelings to the management when there is a wrong decision or miscalculation of the current situation. The VB of the PJM positively impacts the project's success (Ekrot, Rank & Gemünden, 2016). PJM VB has a vital role in project success, as keeping things unrevealed and remaining silent causes damage to the project's progress, mainly when a lack of sufficient information significantly affects crucial decisions (Ekrot, Rank & Gemünden, 2016). Hence, the CEST model controls the DM process, linking information processing to rational and experiential approaches. In this case, the rational/experiential approaches are related to all types of behaviour, especially when making decisions and VB (Edakkat Subhakaran & Dyaram, 2018). Moreover, VB may slightly negatively impact the DM process when the decision is based on experience rather than rationality, which increases the risk of inaccurate judgment within the PM context (Nguyen, Chen & De Cremer, 2017). However, NB variable is unidimensional in this study.

Thus, the fourth hypothesis states that:

H4: VB moderates the relationship between CBA and the DM style of the PJM.

Hypothesis 5: The relationship between the DM style of the PJM and the project success.

The DM style of the PJM *influences ITSD project success.*

Differences in PJMs' behaviour create conflicts within the project stakeholders, leading to undesirable team performance, poor communication, and deviation from key performance indicators (Culp & Smith, 2001). A project's success rate increases depending on the decisions made during the project (McCray, Purvis & McCray, 2002); unrealistic decisions enhance the probability of project failure (Al-Ali, Emes & Leal, 2018). Thus, logical thinking and sufficient information analysis significantly affect the project's success (Kiełczewski, Matel & Poskrobko, 2016). Even if not liked by stakeholders, realistic decisions lead to project success (Culp & Smith, 2001), better team performance increases the effectiveness of a project that leads to success (Culp & Smith, 2001), and quality of performing activities and quality of decisions lead to project success (Ford & Bhargav, 2006). Accurate and realistic information enhances the DM process during IT projects (Eweje, Turner & Müller, 2012). Thus, the fifth hypothesis states that:

H5: The DM style of the PJM influences ITSD project sucess

Table 3. 7: Indirect CBA hypothesis project success

Hypothesis number	**Hypothesis**
H5	*The* DM style of the PJM *influences ITSD project success*

The fifth hypothesis measure the impact of constraints decisions; seven statements have been developed to measure the impact based on a literature review of project success and failure.

Hypothesis 6: The relationship between CBA and ITSD project success in Dubai.

There is direct a relationship between the CB and ITSD project success.

A major cause of failure in ITSD projects is the PJM's CB (Stacy & Macmillan, 1995; Mohanani et al., 2018); the PJM's perception of information distorts reality and causes bias (Cunha et al., 2014). CB appears during the execution of daily tasks that PJMs perform (Stacy & Macmillan, 1995. It was concluded by Mohanani et al., (2018) that bias related to the PJM's interest and favoured decisions have a high influence on the success of the project outcomes.

On the other hand, the success of the ITSD project depends on the PJM's method of handling conflicts and making unbiased decisions (Cunha et al., 2014); it is becoming a fact that the PJM is a key success factor in ITSD (Chotisarn & Prompoon, 2013).

The emphasis on the influence of PJM CB on project success is increasing due to the fact that 60% of PJM decisions related to project schedule and cost are biased (Cunha et al., 2014).

Chotisarn and Prompoon, (2013); Stacy and Macmillan (1995) illustrate that availability and confirmation bias influence the success of ITSD projects; whilst mere exposure effect bias influences the success of ITSD projects due to familiar options that the PJM selects during the project (Cunha et al., 2014). It is also suggested that the planning and sunk-cost fallacies impact the PJM's estimation efforts, leading to project failure (Kiełczewski, Matel & Poskrobko, 2016). In contrast, the PJM IKEA bias led to consuming more resources and ended in project failure (Kiełczewski, Matel & Poskrobko, 2016), furthermore, the primacy and recency effect confuses the PJM and push them to make decisions related to the different issue; these sources of bias classified under PBB; thus:

H6-1: There is direct a relationship between the perception and behavioural bias and ITSD project success.

On the other hand, Chotisarn and Prompoon (2013); Cunha et al., (2014) asserted the influence of anchoring bias on ITSD projects. In addition, the PJM's overconfidence in their decisions fails to raise awareness of early issue detection during the project (McCray, Purvis & McCray, 2002); and puts the project at risk (Fabricius & Büttgen, 2015). the PJM's tendency to frame decisions according to the presentation of the information without investigating the trustworthiness leads to a failure in deliverables (Hersing, 2017), where the status quo bias of the PJM halts the process of generating further alternatives, which could impact the success of the project (Hersing, 2017). These sources of bias are classified under BPEB; thus:

H61: There is a direct relationship between the belief and probability estimation bias *and ITSD project success.*

Table 3. 8: Direct relationship between CBA and ITSD project success

Hypothesis number	**Hypothesis**
H6-1	There is direct a relationship between the PBB and ITSD project success.
H6-2	There is direct a relationship between the belief and probability estimation bias and ITSD project success.

3.6 Chapter summary

This chapter summarized the study objectives and questions in a comprehensive diagram that shows the relationship between independent, dependent and moderator variables. Six hypotheses were formulated to answer the study questions. Thus, PJM CBA variables are independent, PJM narcissistic and VB are always moderators, and the DM style of the PJM using rational/experiential approaches is a dependent variable when testing hypotheses 1, 2, 3, and 4. On the other hand, the DM style of the PJM is treated as an independent variable when testing the impact on project success, as depicted in the fifth hypothesis.

The interaction of these variables is based on the CBA of the PJM, the narcissistic and VB.

According to the study variables, literature and conceptual framework, study hypotheses and sub-hypotheses were developed to measure and influence PJMs' CBA on project decisions during ITSD projects in Dubai.

CHAPTER 4: METHODOLOGY

The study process links multiple phases that integrate the study components into a cohesive whole; research methodology defines the strategy of applying the quantitative or qualitative method, population, and sampling selection techniques.

Chapter six is intended to provide a brief overview of the research background, demonstrate the justification for using a quantitative method to test the study hypotheses and explain the purpose of the epistemological, philosophical view and reason for adopting a positivism strategy.

This chapter provides the steps to conduct a pilot study and design the final questionnaire besides defining channels for collecting primary data, analysis and statistical treatment of results, and verification and validation of the primary data. The study considers the ethical part of the study and determines how to treat the collected data from respondents as confidential.

4.1 Research philosophy strategy

A research philosophy consists of assumptions on how to view the research context, highlighting the primary strategy and methods used in data collection and sampling. It constructs the relationship between knowledge and procedure; selecting a philosophy demonstrates the value of using one philosophy best fits the research context and questions. Considering that no research philosophy is more than another, the adopted philosophy depends on the nature of the research questions.

Generally, four philosophies are adopted in academic research: 1) positivism, 2) realism, 3) interpretivism, and 4) pragmatism. The particular overview of the study influences the selection of the philosophy; for instance, a study that focuses on the resources needed for a particular process flow is different from measuring the feelings and behaviour of the human resources used in that process. Table 4.1 demonstrates the differences between research philosophies and the characteristics of each philosophy.

Table 4. 1: Differences between research philosophies. Source: Saunders and Lewis (2009)

	Positivism	**Realism**	**Interpretivism**	**Pragmatism**
Ontology: *the researcher's view of the nature of reality or being*	External, objective and independent of social actors	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question
Epistemology: *the researcher's view regarding what constitutes acceptable knowledge*	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements	Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data
Axiology: *the researcher's view of the role of values in research*	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
Data collection techniques most often used	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple method designs, quantitative and qualitative

The study adopted a positivist epistemological philosophy to answer the study questions and depict the relationship of the independent and dependent variables that formulated the study hypotheses; this positivism philosophy is adopted to transform observed phenomena into data and facts that are credible, where the focus on causality and generalization reduces the phenomena to their simplest elements. Moreover, epistemology views what constitutes acceptable knowledge (Saunders & Lewis 2009).

The use of numerical and statistical data that demonstrate tables that show “Facts”, not “Feelings”, guides the study to adopt an epistemological philosophy, which also decreases the element of bias in the results (Saunders & Lewis 2009).

On the other hand, the study intends to explore the relationship among study variables instead of explaining the variables. Furthermore, using a positivist philosophy enables the study to treat actual data and use an objective approach that is not subjective to support the hypotheses.

Another significant value of using this philosophy is avoiding study bias towards research results, where all data are analysed using statistical software based on inputs from collected questionnaires.

The study looked into previous studies and constructed the study hypotheses based on theories in a similar industry. These hypotheses formulate the development of studies that can be examined in the future. Accordingly, the positivism strategy is implemented as the primary strategy to guide this study to answer the questions and demonstrate the relationship of study variables. Moreover, another aspect of using the positivism strategy is that the study cannot manipulate data, as the positivism strategy depends on statistical analysis derived from quantifiable data (Saunders & Lewis 2009).

4.2 Quantitative research method

Quantitative research investigates the relationship among research variables using systematic and quantifiable data from a particular sample linked to the research context. Different computerized treatments are used to analyse these data to interpret them into meaningful information that justifies the relationship among variables and presents scientific justifications for the test results based on figures (Saunders & Lewis 2009).

The primary purpose of quantitative research methods is to describe, test and explore particular phenomena that use an existentialist philosophical approach that constructs hypotheses according to the research objectives and the variables the research intends to assess (Saunders & Lewis 2009). Quantitative methods require the study to use a survey to collect data from a designated sample using a questionnaire distributed online. Unlike qualitative methods, quantitative methods exclude any interference from the researcher when collecting data to avoid bias; hence, the researcher did not observe or interview the respondents, and the questionnaire questions was answered without any comments or questioning (Saunders & Lewis 2009).

Intensive exploration of previous research that combines CB theories and PM for the last 15 years indicated that studies have mostly used qualitative research methods. Despite the scarcity of journals that examined the influence of CBA in PM, these studies examined limited sides of CB and did not investigate further. Nevertheless, none of the articles used quantitative methods to develop and test hypotheses to support the study problem, highlighting the limited quantitative research in CB and PM. Table 4.2 illustrates previous studies and provides a brief description of the methods used to examine CBA in PM:

Table 4. 2: Previous research methodologies in CB and PM

Item	Research Title	Year	Methods	Brief description	Citation
1	Cognitive bias in software engineering: a systematic mapping study	2016	Qualitative	Systematic mapping: the study uses the terminology of CB and PM to define sources of bias.	Mohanani R et al., (2018) “Cognitive bias in software engineering: a systematic mapping study,” (2018).
2	Heuristics and bias in project management	2008	Qualitative	Case study and comparison between sources of bias.	Virine, L., Trumper, M. and Virine, E. (2018) “Heuristics and Bias in Project Management,” 7(1)
3	Project management in light of cognitive bias: public sector IT organization case	2014	Qualitative	Semi-structured interviews based on opened-ended questions.	Cunha José Adson et al., (2014) “Project Management in Light of Cognitive Bias: A Public Sector It Organization Case,” 2014, P50.
4	Project management in behavioural perspective - cognitive bias in the formulation of the aim of the project	2016	Qualitative	Results are from secondary research only.	Kiełczewski, D., Matel, A. and Poskrobko, T. (2016) “Project Management in Behavioural Perspective – Cognitive Bias in the Formulation of the Aim of the Project,” 8(3), pp. 70–78.
5	Optimism bias within the project management context A systematic quantitative literature review	2016	Quantitative – no hypotheses	The study used quantitative techniques to search for phrases and keywords to search for several types of research in the CB area, and no hypotheses were developed to test.	Prater J, Kirytopoulos K and Ma T (2017) “Optimism Bias Within the Project Management Context: A Systematic Quantitative Literature Review,” 10(2), pp. 370–385.
6	Responding to human bias in project control	2014	Qualitative – no hypotheses	PMCC was used as a framework to apply CB to the project control cycle.	Rutten, W., Martin, H. and Janssens, G. (2014) “Responding to Human Bias in Project Control” (2014).
7	Investigating the awareness of decision-making heuristics and bias in the selection and definition of infrastructure projects	2018	Quantitative	An online survey sent to different positions in different countries and different PM industries. The participants were selected via LinkedIn.	Proceedings of the International Conference on Industrial Engineering and Operations Management Paris, France, July 26-27, 2018
8	PJMs’ overconfidence how is risk reflected in anticipated project success?	2015	Quantitative	Standardized, case-based survey.	Fabricius, G., and Büttgen Marion (2015) “Project Managers’ Overconfidence: How Is Risk Reflected in Anticipated Project Success?” 8(2), pp. 239–263.
9	Decision-making in software project management: a systematic literature review	2016	Qualitative	Systematic literature review, categorized papers from five search engines synthesized into a thematic map.	Cunha José Adson O.G, Moura, H. P. and Vasconcellos, F. J. S. (2016) “Decision-Making in Software Project Management: A Systematic Literature Review,” 100, pp. 947–954.

The study pursues a deductive approach to answer the study questions and test the hypotheses. The deductive approach demonstrates the relationship between variables, presents results in statistical and numerical values that can interpret the output of the study in figures that show the impact of one variable on the other, provides a solid foundation to reject or accept the hypotheses and provides a generalization of the human behaviour based on a sufficient selected sample (Saunders & Lewis 2009). The deductive approach is built based on scientific principles that can transfer theory to data and explain the relationship between variables; the deductive approach provides controls to ensure the validity of collected data and the generalizability of the conclusions (Saunders & Lewis 2009).

4.3 Study strategy

Different research strategies may be applied to exploratory, descriptive and explanatory research (Catterall, 2000). Considering that no strategy is superior, the essence of a strategy is its applicability to answer the study questions; these strategies may vary from experiment, survey, and case study to grounded theory.

The study used a survey strategy to achieve the study objectives, answer the study questions, and test the hypotheses. This is linked to the deductive approach, and it is broadly used for management and business science to answer questions like who, what, and where (Catterall, 2000).

A survey is a convenient tool to explore and describe study results and allows the study to collect data from an organised population and makes it easy to compare and gather quantitative data that can be analysed using statistical software packages like SPSS and AMOS. It provides an adequate explanation for the relationship between variables.

4.4 Sample

The sample is considered a leading primary data source to test the study hypotheses. This sample is selected from a population that represents the respondents. Yet, it is impossible to test all the respondents within the population, especially when the number of respondents is above 50 (Saunders & Lewis 2009). This justifies selecting a sampling technique that reduces the amount of data required to answer study questions.

Data can be collected from the entire population if the size is manageable and reachable, but this does not necessarily add value to the results. In this case, sampling provides a solution to collect data, considering factors like the possibility of collecting data from the entire population is impossible, cost, time, and research constraints. Studies indicate that sampling rather than including the entire population increases data accuracy (Saunders & Lewis 2009). The Dubai Chamber of Commerce was contacted via their website (http://www.dubaichamber.com) with a request to provide the total number of ITSD companies in Dubai; a confirmation email was received from an official email address (customercare@dubaichamber.com) on 21st March 2020. On 22nd March 2020, an email was received with the total number of ITSD companies in Dubai: 879, that may be indicator that each company has at least PJM and even more working in these companies.

The list contained the full company name, email address, phone numbers and location. The sample distribution is depicted in the below table 4.3:

Table 4. 3: ITSD companies in Dubai

Item	The zone that issued the trading licence in Dubai	Number of ITSD companies
1	Department of Economic Development	773
2	Dubai Airport Free Zone Authority	1
3	Dubai Development Authority	4
4	Dubai International Financial Centre	2
5	Dubai Multi Commodities Centre	18
6	Dubai Silicon Oasis	12
7	Dubai Technology and Media Free Zone Authority	9
8	Dubai World Central	5
9	e-Traders Licence	2
10	DMCC	1
11	Trakhees – Located Dubai	18
12	Others	34
Total companies in all authorities		**879**

Sampling strategy

Sampling is divided into a number of main techniques. The first is the probability, which indicates that selecting a specific sample can represent the entire population and achieve the study objectives, and this method is associated with the use of a questionnaire instrument. The second is judgmental sampling, which indicates that selecting some instances from the population will not achieve the study objectives. This study used a probability sample to achieve the study objectives. Figure 4.1 illustrates the stages of probability sampling:

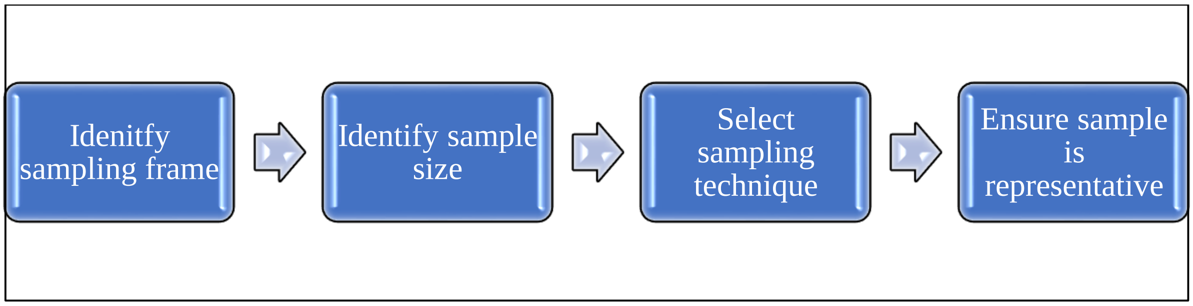


Figure 4. 1: Stages of probability sampling

Identify the sampling frame

Sample framing includes all populations in a list containing details of respondents, but it is difficult sometimes to include all samples, especially when access to databases is not permitted, and the process to approach respondents is complicated. To rectify the accuracy of this study, the sample is the PJMs working for ITSD companies that operate in Dubai. The source of this information is the Dubai Chamber of Commerce. This step is essential to minimize error in sampling and bias in sample selection and avoid low accuracy in the results. The PJMs who work for these companies received a link to a questionnaire to answer the study questions, and, based on their responses, the analysis of the results was performed. Regarding ethics, none of the respondents' names, positions, or contact information were not disclosed.

Identify sample size

Increasing the number of selected samples increases the likelihood of generalizing results (Catterall, 2000); selection of sample size is governed by certain conditions that compromise between the duration taken to collect data and cost; these factors are level of confidence, the margin of error that the study can tolerate, type of analysis and population size. Considering that the sample size should not be less than 50, it is also essential to sample level of confidence. Three factors determine the size of the sample: (1) level of accuracy which is related to sample error, (2) level of risk which is related to confidence level, and (3) variability which is related to the distribution of the attributes in the population (Israel, 1992); according to (Krejcie, R.V., & Morgan, 1970) table 4.4, no calculation is required to determine the sample size for a given population, for instance to determine the sample size for 50,000 population, the sample size is 381. Given this fact, the increasing number of population will no longer affect the sample size if the population exceed 100,000, thus sample size remain constantly relevant (Krejcie, R.V., & Morgan, 1970).

Table 4. 4: Level of sample confidence

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

However, the exact number of PJM can't be determined accurately. Project management institute-PMI determined the number of PJMs in UAE based on number of PJMs who passed PMP exam which is (13,100) according to their statical results [3]; however this result is unreliable due to the fact that many PJMs do not have PMP certificate, and others may have other credentials like PRINCE 2 or IPMA certificates; furthermore, PMI is no longer calculating the expired certificates; thus the exact population can't be determined. Thus any responses collected above 300 is sufficient to this study (Krejcie, R.V., & Morgan, 1970; Israel, 1992).

[3] https://www.pmi.org/certifications/certification-resources/registry

Select sampling technique

Five sampling techniques are used to obtain the representativeness of sampling, considering that types of questions determine the sampling technique; these techniques are simple random, systematic, stratified random, cluster and multi-stage.

The study used a simple random technique because the selection of respondents is based on a random basis, and all respondents have an even chance of being selected.

Ensure the sample is representative

The demographic questions selected for this study ensured that participants' ages, experience, and qualifications are mentioned and cover all aspects. The position of the PJM is mentioned to include all professionals who work in the PM field in ITSD companies in Dubai. From another perspective, the study looks forward to generalizing the results; thus, this technique is more suitable for sampling (Saunders & Lewis 2009). Three models were designed to generalize results in research; the statistical generalization model, the analytical generalization model, and transferability generalization model (Polit & Beck, 2010). The first model is associated with the quantitative model which is pursued by this study, where the other two models are associated with quantitative and quantitative together (analytic model), and qualitative methodology (the transferability model).

Population size	Sample size					
	Continuous data (margin of error=.03)			Categorical data (margin of error=.05)		
	alpha=.10 t=1.65	alpha=.05 t=1.96	alpha=.01 t=2.58	p=.50 t=1.65	p=.50 t=1.96	p=.50 t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

Figure 4. 2: Minimum sample size for a given population. Source: Bartlett II et al., (2001)

Due to the high number of ITSD companies in Dubai, the study uses the minimum sample size table depicted in figure 4.2. The expected total number of respondents is between 300 and 500, with a coefficient margin of error is 5% level of confidence.

4.5 Data collection method

A questionnaire instrument consists of demographical questions contains: age, gender, position, education, and years of experience used to collect data, and the body of the questionnaire consists of statements related to study variables.

The sample study of this study is the DM style of the PJM, which also include senior PJMs, programme managers and portfolio managers in ITSD companies in Dubai.

Data collection started after the study questionnaire's refinement and the pilot study's completion. The design of the questionnaire was completed through the Survey Monkey website. The data collection process started on 20th December 2020 and was completed on 20th February 2021.

The questionnaire was sent by email or private message on LinkedIn to all the companies and the respondents who work for these companies. These emails and messages included the study title, aim, link to the questionnaire, and pledge of information regarding confidentiality.

The message urged the staff in charge of managing the company email to send the link to the PJM to respond to the questions. But the response rate was low, as most companies did not cooperate; thus, the data collection process was completed on LinkedIn by looking for the company profiles and then sending an add request to the PJMs who work for these companies. This was one of the obstacles faced by the study, as most people did not respond to the messages and connection requests; hence, multiple reminders were sent to urge the respondents to respond and complete the questionnaire.

4.6 Measurements

This section provides the measurements for each variable according to literature; each of these variables is defined based on previous studies in the field of CB, the DM style, voice and NB, and the project outcomes.

On the other hand, this study used the Likert scale as the most applied psychometric tool in social science study (Joshi et al., 2015). A Likert scale is a set of items presented for a study that describes a particular situation to participants who are urged to answer these items according to their level of agreement. This study used a seven-point Likert scale to allow the respondents to select the exact point that describes their attitude towards particular items. This scale also performs better than the five-point one due to the variety of options, which increases the probability of meeting the respondents' reality (Joshi et al., 2015).

Cognitive bias attributes measurements

This section provides the operational definition and measurements for the two families of CBA attributes mentioned in the literature. Each category is depicted in a separate table. These families are:

1. Perceptions and behavioural bias consist multidimensional variables as follow:
- Interest bias variables.
- Pattern recognition bias variables.
- Perception bias variables.
- Decision bias variables.
2. Belief and probability estimation bias consist multidimensional variables as follow:
- Stability bias variables.
- Action-oriented bias variables.

Perceptions and behavioural bias

The development of first global variable -PBB- is based on the measurements that were adopted in literature; measurements under this variable assess interest bias which have three sources of bias: confirmation bias (You make decisions based on what corresponds to your beliefs), wishful-thinking (You underestimate the possibility of unpleasant results when you make a decision), and IKEA bias (You give higher value to the decisions you make) (Mohanani et al., 2018; Virine & Trumper, 2008; Hersing, 2017; Katz, 1991; Shmueli, Pliskin & Fink, 2015).

Pattern recognition bias is based on four sources of bias measurements, Availability (You make decisions based on information that is easy to recall), Fixation (You focus on one angle of the situation when making a judgment), Mere exposure effect (You make decisions based on routine and familiar processes, tools, and techniques), and Semmelweis reflex (Under uncertain events, you reject new information if it contradicts your beliefs) (Virine & Trumper, 2008; Cunha et al., 2014; Al-Ali, Emes & Leal, 2018; Fabricius & Büttgen, 2015; Rutten et al., 2014; Mohanani et al., 2018).

The third dimension is perception bias, which consist of three sources of bias: Framing (You might change your decision if the way information presented changes), Selective perception (You make a judgment based on your perception of information), Primacy and recency effect (Information presented at the beginning and end of a meeting determines your decision) (Hersing, 2017; Mohanani et al., 2018).

The fourth dimension is decision bias, which consist of three sources of bias, Sunk cost (You hold on to your past decisions even if this requires more resources in the future), Planning fallacy (You have the confidence to complete the project as planned), Omission bias (You might observe a potential problem in the project and do nothing rather than being part of that problem if it happened) (Mohanani et al., 2018; Tversky & Kahneman, 1978; Park, York & Boyle, 2017).

Each dimension and its definitions is depicted in table 4.5

Table 4. 5: Perceptions and behavioural bias definitions

Item	**Variable**	**Definition**	**Sources of bias definition**
1	Interest bias	Sources of bias cause deviations from logic according to the person's preferences, thoughts or emotions for other individuals or debates.	**Confirmation** bias: people tend to confirm preconceptions or hypotheses, independent of whether they are true or not, by placing weight on the current information. **Wishful thinking:** defined as predicting a more favourable outcome for a preferred decision based on what might be pleasing to imagine, rather than on evidence, rationality, or reality. **IKEA**: the propensity to increase the valuation of self-made decisions, ideas, thoughts, or objects.
2	Pattern recognition bias	Sources of bias lead the person to pay more attention to the information that they are familiar with.	**Availability**: the propensity to rely on easy to recall information, or how easy it is for the human brain to remember this information of experience. **Fixation**: is the tendency to focus on one side of the issue, sometimes due to self-imaginary barriers. **Mere exposure effect:** the tendency to develop preferences due to the human brain familiarity with particular objects. **Semmelweis reflex:** the tendency to reject new information that contradicts human beliefs and previous knowledge.

3	Perception bias	Sources of bias people propensity to prejudice the process of new information.	**Framing**: the tendency to react to information based on how it is presented. **Selective perception**: the tendency to perceive information from different people in a different way. **Primacy and recency effect**: the tendency to memorize the first and the last items of an event or object and forget details in between.
4	Decision bias	Sources of bias that decrease the quality of decisions during the DM process**.**	**Sunk cost** is the tendency to irrationally invest more resources in an investment that is already losing. **Planning fallacy**: the confidence that PJMs have to expect their project will be completed as planned. **Omission bias:** the human mind, when preferring omissions to action.

Belief and probability estimation bias

The development of second global variable -BPEB- is based on the measurements that were adopted in literature; measurements under this variable assess stability bias which consist of three

sources of bias, anchoring bias (You make your decision based on the initially received information), status quo (You prefer to stick to and defend the default option rather than reviewing other alternatives), and familiarity You make decisions based on previous experiences that have similar circumstances) (Virine & Trumper, 2008; Kiełczewski, Matel & Poskrobko, 2016; Hersing, 2017; Mohanani et al., 2018; Hersing, 2017).

The second dimension is action-oriented bias which consist of five sources of bias, Overconfidence (You assume that positive results will happen because you have sufficient skills and abilities), Illusions of control (You feel that you have the ability to control or influence project outcomes.), Gambler fallacy (You believe that your next decision will be wrong due to the several right decisions you previously made), Miserly information processing (You prefer to keep decisions simple and avoid complicated and rational analysis), and Misleading information (You follow provided information without attempting self-evaluation of this information) (Mohanani et al., 2018; Virine & Trumper, 2008; Fabricius & Büttgen, 2015; Meissner & Wulf, 2016; McCray, Purvis & McCray, 2002).

Table 4. 6: Belief and probability estimation definitions

Item	Variable	Definition	Sources of bias definition

1	Stability bias	Sources of bias that lead the person to preserve their opinion and perspectives about particular information regardless of the presence of better information.	**Anchoring**: the tendency to reform decisions and give high weight to initial perceived information. **Status quo:** the tendency to hold on to current behaviour not to change unless the motive to change is compelling. **Familiarity**: un-specified feelings of remembering where the human consciousness is utterly unable to recall previous confrontation.
2	Action-oriented bias	Sources of bias lead individuals to make immature decisions without further attention to more relevant details or alternative solutions.	**Overconfidence**: the tendency to overestimate a specific event or object's predictions and overestimate the individual abilities. **Illusions of control:** the tendency of decision-makers to systematically overestimate their influence on chance events. **Gambler fallacy:** mistakenly predicts and believes that positive events will occur according to the sequences of negative impact. **Miserly information processing**: the tendency to evade deep and complicated information processing. **Misleading information:** the tendency to listen to and follow information blindly without making any personal judgment and evaluation.

Narcissistic behaviour unidimensional variable measurements

This section provides the operational definition and measurements of NB aspects as mentioned in the literature. These aspects are depicted in table 4.7, which shows the definition NB and narcissistic behaviour characteristics (You always see yourself as important), (You may use others to achieve your personal benefits), these measurements as mentioned in literature are: (You do not care about others' feelings when making a decision under uncertain events), (You always look to be essential to and admired by others), and (When making decisions under uncertain events, you may be hostile towards others) (Pinto & Patanakul, 2015; Ouimet, 2010).

Table 4. 7: NB definitions

Item	Variable	Definition	Definition of NB traits
1	NB	A psychological state or personality disorder characterized by high self-regard and desire for personal aggrandizement.	**Arrogance**: the tendency to show exaggerated self-importance and abilities. **Interpersonally** exploitative: the tendency to use others to achieve personal benefits. **Lacking empathy**: the tendency to neglect others' perceptions and feelings. **Grandiosity**: the tendency to feel self-importance and entitlement and looking for admiration from others. **Antagonistic**: the tendency to reveal hostile behaviour against others when making a decision.

Voice behaviour unidimensional variable measurements

This section provides the operational definitions and measurements of NB as mentioned in the literature. These aspects are depicted in table 4.8, which shows the definition VB and its behavioural characteristics as follow: (You usually present ideas to make/support decisions that are important to the project), (You use initiative, and present proposals, recommendations, and hints to make/support decisions important to the project), and (You usually show your concerns to stakeholders regarding adverse events that impact project decisions) Ekrot, Rank & Gemünden, (2016).

Table 4. 8: VB definitions

Item	Variable	Definition	Definition of VB traits
1	VB	The ability to communicate ideas, thoughts, and concerns with the upper management to provide positive decisions and improve project performance.	**Discretionary communication** of ideas: the extent to present ideas to solve a particular issue. **Suggestions**: the initiative to present proposals, recommendations, advice, counselling, and hints to solve a particular issue. **Concerns**: the initiative to show worries to the upper management regarding adverse events.

The decision-making style of the project manager measurements

The rational-experiential inventory (REI) is used to measure the PJMs' DM style. This scale is derived from CEST (Epstein et al., 1996), and measure the PJMs' DM style during IT software development projects. Table 4.9 illustrates these measurements:

Table 4. 9: Measurement of constraints decisions

Item	Variable	Measurements	References
1	**Experiential:**	1- I like to rely on my intuitive impressions and trust in my hunches. 2- Using my feelings usually works well for me in figuring out problems in my life. 3- I do not have a very good sense of intuition. 4- I trust my initial feelings about people. 5- I would not want to depend on anyone who described themselves as intuitive. 6- Intuition can be a beneficial way to solve problems. 7- I often go by my instincts when deciding on a course of action. 8- I do not think it is a good idea to rely on one's intuition for important decisions. 9- I do not like situations in which I have to rely on intuition. 10- I tend to use my heart as a guide for my actions. 11- I think it is foolish to make crucial decisions based on feelings. 12- I generally do not depend on my feelings to help me make decisions. 13- I suspect my hunches are inaccurate as often as they are accurate. 14- My snap judgments are probably not as good as most people's.	(Epstein et al., 1996 ;Schutte et al., 2010; Björklund and Bäckström, 2008; Harper, 2016 ;Reyna and Ortiz, 2016; ;Leybourne and Sadler-Smith, 2006; ;Monacis et al., 2016).
2	**Rational:**	15- I do not like to have to do much thinking. 16- I have a logical mind. 17- I am much better at figuring things out logically than most people. 18- Reasoning things out carefully is not one of my strong points. 19- Thinking hard and for a long time about something gives me little satisfaction. 20- I do not reason well under pressure. 21- Knowing the answer without having to understand the reasoning behind it is good enough for me. 22- Using logic usually works well for me in figuring out problems in my life.	

		23- Learning new ways to think would be very appealing to me. 24- I am not very good at solving problems that require careful logical analysis. 25- I enjoy solving problems that require complex thinking. 26- I try to avoid situations that require thinking in depth about something. 27- I am not that good at figuring out complicated problems. 28- I enjoy intellectual challenges. 29- I am not a very analytical thinker. 30- I prefer complex to simple problems. 31- I have no problem thinking things through clearly. 32- I usually have clear, explainable reasons for my decisions	

Project success measurements

The last part of this chapter intends to measure project outcomes; Table 4.10 illustrates measurements for project outcomes:

Table 4. 10: Project success measurements

Item	Measurement	Measurement of project success	References
1	**Project success**	1. You always achieve the project objectives. 2. You always meet the project technical specifications. 3. You consistently achieve a high level of satisfaction concerning the project outcomes among internal stakeholders. 4. You consistently achieve a high level of satisfaction concerning the project outcomes with clients. 5. You always achieve projects outcomes within scope, time, and cost. 6. You always complete projects with minimal issues, troubleshooting and rework. 7. Your projects directly benefit the end-users and increase efficiency and effectiveness.	(Ozdemir Gundor and Gozlu, 2016); Haron, Gui and Lenny, 2014); (Hairul Nizam Md Nasir and Sahibuddin, 2015).

4.7 Pilot study

It is recommended to refine and revise the questionnaire before sending it to the respondents; this step allows the study to evaluate the validity of the questions. A pilot study is an effective tool to help the researcher redesign the questionnaire instrument and limit possible errors (Sekaran & Bougie, 2012). The preliminary analysis of the pilot study results gives an indication of the success of the survey instrument (Sekaran & Bougie, 2012).

Furthermore, subject matters experts provided their input to the study to increase the validity of the study questionnaire instrument (Sekaran & Bougie, 2012). They were selected based on the below criteria:

1. Years of experience in PM.

2. Hold one of the significant certificates in PM like PMP, PRINCE and Scrum or an academic qualification like a PhD.
3. Should have made a contribution to the PM field like research, books, and articles.

Ten subject matters experts (Catterall, 2000) were selected from different backgrounds. They have extensive experience in PM and a proven track in this domain, like publishing books and articles or working as experts for ITSD companies. Subject matter experts were approached through LinkedIn to assess the questions' clarity and provide their feedback. They found the questionnaire to be clear overall, and most of them asked for a copy of the results and considered it an interesting subject. Most of the comments were regarding the length of the questionnaire; thus, the number of questions was decreased from 60 to 50; that process was carried out by eliminating similar questions and merging some other questions. Moreover, the subject matter experts restructured a few statements to make them clearer for the respondents.

4.8 Demographic variables

Considering the study's primary location is Dubai, United Arab Emirates, and the ITSD industry is tested, PJMs from other industries like construction, manufacturing and infrastructures are out of the study scope. Accordingly, two divisions are tested: the demographical and work-related factors. Based on PM and CBA literature, the following demographic factors are measured.

Demographic factors

Table 4.11 illustrates the study demographic variables which targeted to analyse the study descriptive variables of the respondents, this variable determines the age, education level, years of experience in PM, certificates, and gender.

Table 4. 11: Demographic factors

Item	Factors	Categories					Reference
1	Age	22-30	30-40	40-50	50-60	60 above	(Al-Ali, Emes & Leal, 2018)
2	Education Level	Bachelor	Master	PhD	Others (please mention)		
3	Years of Experience in PM	1-5	5-10	10-15	15-20	20 above	
4	Position (please mention)						
5	PM Professional Certificate	PMP	Agile	Scrum	Prince 2	Others (please mention)	
6	No. of successful projects	1-5	5-10	10-15	15-20	20 above	
7	Gender	Male			Female		

4.9 Data analysis techniques

The source of the data collection process is divided into two main streams. **First**: is the theoretical stream, based on previous studies related to the current study's variables and domain; the sources of these data are books, journal articles, conference papers, government reports, and the internet. **Second**: is the practical stream, based on a descriptive and analytical model to test the study hypotheses; the source of this data is a questionnaire instrument. Data analysis is divided into two main schemes: preliminary data analysis and hypotheses testing (Forza, 2002); these two schemes are explained next.

Preliminary data analysis

Data analysis requires the use of specific software, tools, and methods to analyse, understand and interpret data gathered from questionnaires. The descriptive analysis demonstrates demographic data in figures, frequencies and charts that make the data convenient to understand in terms of the respondents' characteristics like age, position, experience, and qualifications, and sometimes uses gender.

The descriptive analysis consists of two major components: central tendency measure and spread measure. Central tendency measures are associated with the variables. **Mean** is the average of study variables, **Median** is the middle figure of all ranked data, and **Mode** measures the highest repeated value of the variables. On the other hand, the spread of values around the mean is different; in this case, the standard deviation is used to measure to which extent values are distributed around the mean, where the variance is associated with each observation distance from the mean. Table 4.12 illustrates types of descriptive analysis, description and relevance, according to Forza (2002):

Table 4. 12: Descriptive analysis

Type of analysis	**Description**	**Relevance**
Frequencies and percentages	Summarize the number of occurrences for multiple categories.	Retrieved from nominal variables.
The arithmetic measure of central tendencies	Mean, median, mode and characteristics of central tendencies.	Demonstrate central tendencies' values in a meaningful way.
Measure of dispersion	Spread variables that include range, standard deviation, variance, and interquartile range.	Indicates the variability that exists in a set of observations.
Measure of shape	These measures describe the distribution (or pattern) of the data within a dataset	Illustrate the sort of departure from a normal distribution.

Testing hypotheses

Usually, significance tests are divided into streams: parametric and non-parametric tests (Forza, 2002). Moreover, the parametric test is more powerful since data are retrieved from interval and rations measurements, where the possibility model is known. To complete the hypotheses test, Statistical Package for Social Sciences (SPSS) is used to analyse collected data, where the following statistical methods used:

1. Cronbach's alpha (α) to test study reliability.

2. Simple linear regression analysis to study hypotheses with (F) test statistics from the ANOVA table (analysis of variance).
3. Multiple regressions analysis.
4. T-test to show the significance of both estimated regressions and their coefficient to analyse the impact of cause-and-effect factors of the independent variables on dependent variables.
5. Pearson correlation: to define the positive/negative relationship between variables.
6. Chi-squared (x^2): which tests the equality of distribution.
7. Relative importance is calculated based on the following formula, where there are three levels of importance: high, medium, and low; the range is depicted below in table 4.13:

$$\textbf{Level of Importance} = \frac{\textbf{Upper limit of responses – the lower limit of responses}}{\textbf{Number of levels}}$$

Table 4. 13: Level of importance

Mean Range	Level
Up to 3	Low
Between 3 -5	Mid
Greater than 5	High

4.10 Validation and verification

Validity is defined as to what extent a concept is accurately measured in a quantitative study (Heale & Twycross, 2015). Validity measures if the collection tools measure what they are intended for, and they are useless if they do not do so. Three significant validity categories are available to measure study validity: content validity, construct validity and criterion validity, as described in table 4.14:

Table 4. 14: Major types of validity

Types of validity	Description
Content validity	The extent to which the questionnaire study instrument precisely measures all aspects of the construct.
Construct validity	The extent to which the questionnaire instrument measures the intended construct.
Criterion validity	The extent to which a study instrument is related to other instruments that measure the same variable.

Content validity

This type of validity ensures that the questionnaire instrument adequately covers contents concerning variables and covers the entire domain it is designed to measure. One primary method used in that category is face validity, where experts review the instrument within the same or a similar field, and the study asks for their opinion and feedback regarding the questionnaire instrument. Content validity is whether or not the content of the observed variables (i.e., questions of a questionnaire) is accurate to measure the latent concept that a certain study is trying to measure (Muijs, 2004). It also refers to the sufficiency of the measurement questions in truly measuring the research questions (Cooper & Schindler 2006).

According to the types of validation types, it is evident that some types cannot validate the study questionnaire instrument; for instance, the predictive validity is irrelevant as the study intends to measure current phenomena, not future predictions.

To achieve the validity of the study instrument, the author decided to follow the content validity approach through two primary processes: a comprehensive review of the literature and expert opinion.

Construct validity

This type refers to whether the study can depend on test result scores for the study object (Heale & Twycross, 2015); construct validity assess the ability of the study instrument to measure the study variables (Cooper & Schindler 2006).

Criterion validity

Criterion validity is achieved through correlation, which measures the extent to which different questionnaires measure the same variables, and it can be measured in three different ways indicates that a questionnaire should have a high correlation with the ultimate criteria.

4.11 Ethical consideration of the study

The study gives appropriate ethical consideration to the population and sample of the study. The study intends to collect primary data to solve certain phenomena; thus, the study should avoid causing embarrassment or harm to the participants and avoid disclosing confidential information.

Permission to access the respondents’ data is at the organisation's discretion. On the other hand, without exploiting the data, these data are treated as anonymous: no names, ages, titles, contact details, or any other information related to the organization or respondents are not disclosed under any means before further approval of the respondent or organization.

The study requested data from the Dubai Chamber of Commerce and Industry by email and confirmed that all information, contact details, emails and names related to ITSD companies in Dubai would be kept confidential.

4.12 Chapter summary

This chapter presented a comprehensive overview of the study methodology. The study provided an introduction to the study background, defined the quantitative method, provided justification for pursuing this method, explained the positivist epistemological strategy, defined the study sample and sampling strategy, defined data collection tools, and provided a brief overview of preliminary data analysis and testing hypotheses, and methods to ensure the validity and reliability of the study instrument. Moreover, this chapter provided insights into the key measurements and definitions of the variables. The study took into consideration the ethical aspects of academic study and ensured the confidentiality of the collected data.

CHAPTER 5: STUDY DATA ANALYSIS AND FINDINGS

This chapter focuses on the analysis of data collected from the study population. It aims to evaluate and assess the responses based on numerical analysis from SPSS and AMOS. This software is used to organize and analyse data to check the reliability of Cronbach's alpha, KMO and Bartlett's tests in the addition testing validity of the results using factor analysis of EFA and CFA. This chapter presents the data preparation process like response rate, replacing missing values, outliers test, testing the model significance and adequacy fit for analysis. In addition, it provides insight into the results of the demographic variables to explain the respondents' answers and how far they have affected the study results.

This chapter demonstrates the testing of the study hypotheses. It assesses the relationship between the PJM's CBA and their DM style and the impact on project success. Furthermore, this chapter demonstrates the moderating role of NB and VB when making decisions during ITSD projects. This chapter tests the study hypotheses and measures the positive or negative relationships. Regression analysis is carried out using IBM SPSS software, Reach; the significance level was chosen to be 0.05 (i.e., 95% confidence interval) since it is the most acceptable level in management study.

5.1 Survey data and response rate

The primary data of this study are collected from respondents working as ITSD PJMs in Dubai in the United Arab Emirates (UAE). The survey instrument in Appendix A is different from the survey used in the pilot study due to feedback and revision from subject matter experts in the academic and practical domain, after which some statements were merged with other statements due to their similarity. Thus, the number of statements decreased from 64 to 50, excluding the demographic variables.

All companies PJMs from 879 companies were approached to respond to the survey, 467 responses were received. This is a response rate of 53% of the total respondents targeted in this study. Accordingly, in this study, the responses received from the 467 participants are used to perform the needed assessments and test the study hypotheses.

5.2 Data filtering

Out of the 467 responses, five were removed because of respondents' non-consent, and 62 responses were removed because the respondents were not a PJM; this resulted in 400 responses that both gave consent and were from PJMs within the ITSD industry in Dubai.

5.3 Checking and replacing missing values

According to Hair et al., (2010), missing data are values not available for a subject and can occur when the respondent fails to answer one or more questions in the survey. The authors suggested four steps for treating a missing value: *first*: determine the type of missing data – can they be ignored or not? If they cannot be ignored, then the researcher examines the pattern of the missing data and decides whether to ignore or remedy the missing data; using the rule of thumb, missing data under 10% for a single case can be ignored unless it occurs in non-random fashion; for example, a set of related questions is not answered". *Second*: "the number of cases with no missing value is sufficient for performing the statistical analysis in case the study goes with eliminating the missing values option. The *third* step is diagnosing the randomness of the missing data using statistical tests such as the missing completely at random (MCAR) test, and the *final* step is selecting the data imputation method.

Upon reviewing the 400 cases with missing values, any cases with more than 10% missing answers were marked for examination. This resulted in 19 cases with missing data percentages from 78% to 13%. Appendix E presents the remaining 381 responses with random missing variables for each item. From the table, it can be noticed that the missing data for each item range from 6% to 23.2%, and the percentage of missing data increases for the last section of the questionnaire, which indicates that respondents did not complete the questionnaire due to its length and not because they intentionally chose to skip a question.

Using IBM SPSS, a MCAR test was performed. MCAR test values were Chi-Square = 163.151, DF = 169 and Sig.= 0.612. These values indicate an insignificant difference between the pattern of the data and the pattern anticipated for random missing data. Thus, it is adequate to use any remedy to treat the study's missing data (Hair et al., 2010). In this case, the random missing value remedy is used, which depends on incorporating the missing values into the analysis, using the missing value analysis model in the SPSS, which depends on the maximum likelihood approach and uses the EM method, which works on two stages to estimate the best value of the missing value.

5.4 Test of outliers

Outliers are the extreme values in a data set (Black, 2010) or a value well below or well above the other scores (Pallant, 2016). Outliers can cause a significant distortion in the statistical analysis and affect EFA, CFA, correlation, and regression. Outliers can result from errors from data entry, not defining missing values, unintended sampling, and true non-normal distribution. Accordingly, spending time treating the outliers results in more reliable results (Pallant, 2016). According to Hair et al., (2010), there are three methods for examining outliers: univariate detection, bivariate detection and multivariate detection tests. Multivariate detection is selected in this study since there are multivariate tests, and a univariate outlier test do not provide an adequate solution. A multivariate outlier can be defined as variables with extreme values regarding other variables (Garson, 2012).

The outliers were checked based on the *Mahalanobis* distance test. The test was performed using IBM SPSS; the value of the *Mahalanobis* distance was found and then compared to a chi-square distribution; any values less than 0.001 is considered an outlier and then eliminated in the current analysis. Ten outliers were found and removed. The *Mahalanobis* distance ranged between 63.355 and 0.004, and the probabilities from the chi-square distribution ranged between 1 and 0.0000. The complete data are presented in Appendix E.

5.5 Pilot study analysis

The validity and reliability of the study tools were verified using an exploratory sample from the study population and outside its sample, consisting of 30 selected in a simple random way from PJMs and different groups according to gender, age, years of education, experience, and other demographic variables.

The internal consistency between each question (paragraph) and the axis to which it belongs was examined to measure the paragraph's consistency with the axis to which it belongs. The results were as follows:

First: Measuring the internal consistency between the measurements of the interest bias.

Table 5. 1: Correlations - Interest bias items

Items		1	2	3	INT_MEAN
INT1	Pearson Correlation	1			.702
	Sig. (2-tailed)	.000			.000
INT2	Pearson Correlation	.213	1		.734
	Sig. (2-tailed)	.000			.000
INT3	Pearson Correlation	.315	.239	1	.687
	Sig. (2-tailed)	.000	.000	.000	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.1 shows that the correlation coefficients between the measurements of interest bias ranged between 0.213 and 0.315. All of them are statistically significant at the 0.01 level. Additionally, the correlation coefficients between the measurements of interest bias and the total average of interest bias mean ranged between 0.687 and 0.734. All of them are statistically significant at the 0.01 level.

Second: Measuring the internal consistency between the measurements of pattern recognition bias. Table 5.2 shows the results of the correlation coefficients between the measurements of the pattern recognition bias and the total average of mean.

Table 5. 2: Correlations - Pattern recognition bias items

	Items	1	2	3	4	PAT_MEAN
PAT1	Pearson Correlation	1				0.663**
	Sig. (2-tailed)	0.000				0.000
PAT2	Pearson Correlation	0.372**	1			0.816**
	Sig. (2-tailed)	0.000				0.000
PAT3	Pearson Correlation	0.246**	0.422**	1		0.664**
	Sig. (2-tailed)	0.000	0.000			0.000
PAT4	Pearson Correlation	0.261**	0.473**	0.275**	1	0.702**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.2 shows that the correlation coefficients between the measurements of pattern recognition bias ranged between 0.261 and 0.473. All of them are statistically significant at the 0.01 level. Additionally, the correlation coefficients between the measurements of pattern recognition bias with the total average ranged between 0.663 and 0.816. All of them are statistically significant at the 0.01 level.

Third: Measuring the internal consistency between the measurements of perception bias.

Table 5.3 shows the results of the correlation coefficients between the measurements of perception bias and the total average.

Table 5. 3: Correlations - Perception bias items

	Items	1	2	3	PERE_MEAN
PERCE1	Pearson Correlation	1			.619**
	Sig. (2-tailed)	.000			.000
PERCE2	Pearson Correlation	.176**	1		.735**
	Sig. (2-tailed)	.001			.000
PERCE3	Pearson Correlation	.201**	.326**	1	.743**
	Sig. (2-tailed)	.000	.000	0.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).

The previous table shows that the correlation coefficients between the measurements of perception bias ranged between 0.176 and 0.326. All of them are statistically significant at the

0.01 level. Additionally, the correlation coefficients between the measurements of perception bias and the total average ranged between 0.619 and 0.743. All of them are statistically significant at the 0.01 level.

Fourth: Measuring the internal consistency between the measurements of decision bias.

Table 5.4 shows the results of the correlation coefficients between the measurements of decision bias with the total average.

Table 5. 4: Correlations - Decision bias items

Items		1	2	3	DECI_MEAN
DECI1	Pearson Correlation	1			0.796**
	Sig. (2-tailed)	0.000			0.000
DEC2	Pearson Correlation	0.357**	1		0.747**
	Sig. (2-tailed)	0.000			0.000
DECI3	Pearson Correlation	0.501**	0.343**	1	0.781**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.4 shows that the correlation coefficients between the measurements of decision bias ranged between 0.343 and 0.501. All of them are statistically significant at the 0.01 level. Additionally, the correlation coefficients between the measurements of decision bias and the total average ranged between 0.747 and 0.796. All of them are statistically significant at the 0.01 level.

Fifth: Measuring the internal consistency between the paragraphs of the fifth axis, stability bias.

Table 5.5 shows the results of the correlation coefficients between the measurements of stability bias with the total average.

Table 5. 5: Correlations - Stability bias items

Items		1	2	3	STAB_MEAN
STAB1	Pearson Correlation	1			0.829**

	Sig. (2-tailed)	0.000			0.000
STAB2	Pearson Correlation	0.429**	1		0.750**
	Sig. (2-tailed)	0.000	0.000		0.000
STAB3	Pearson Correlation	0.330**	0.207**	1	0.635**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.5 shows that the correlation coefficients between the measurements of stability bias ranged between 0.207 and 0.429. All of them are statistically significant at the 0.01 level. Additionally, the correlation coefficients between the measurements of the stability bias and the total average ranged between 0.750 and 0.829. All of them are statistically significant at the 0.01 level.

Sixth: Measuring the internal consistency between the measurements action-oriented bias.

Table 5. 6: Correlations - Action-oriented bias items

Items		1	2	3	4	5	ACTOR_MEAN
ACTOR1	Pearson Correlation	1					.620**
	Sig. (2-tailed)	.000					.000
ACTOR2	Pearson Correlation	.333**	1				.415**
	Sig. (2-tailed)	.000	.000				.000
ACTOR3	Pearson Correlation	.179**	.145*	1			.648**
	Sig. (2-tailed)	.000	.044				.000
ACTOR4	Pearson Correlation	.282**	.156**	.284**	1		.715**
	Sig. (2-tailed)	.000	.002	.000			.000
ACTOR5	Pearson Correlation	.220**	.144*	.440**	.323**	1	.680**
	Sig. (2-tailed)	.000	.046	.000	.000	.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

table 5.6 shows that the correlation coefficients between the measurements of action-oriented bias ranged between 0.144 and 0.440. All of them are statistically significant at the 0.01 level or at the 0.05 level. Additionally, the correlation coefficients between the measurements of action-oriented bias and the total average ranged between 0.415 and 0.715. All of them are statistically significant at the 0.01 level.

Seventh: Measuring the internal consistency between the measurements the NB.

Table 5.7 shows the results of the correlation coefficients between the measurements of NB and the total average.

Table 5. 7: Correlations - NB items

Items		1	2	3	4	5	NARCISS_MEAN
Narciss1	Pearson Correlation	1					.647**
	Sig. (2-tailed)	.000					.000
Narciss2	Pearson Correlation	.268**	1				.603**
	Sig. (2-tailed)	.000					.000
Narciss3	Pearson Correlation	.192*	.103*	1			.509**
	Sig. (2-tailed)	.043	.045				.000
Narciss4	Pearson Correlation	.462**	.291**	.129*	1		.723**
	Sig. (2-tailed)	.000	.000	.012			.000
Narciss5	Pearson Correlation	.274**	.172**	.295**	.369**	1	.664**
	Sig. (2-tailed)	.000	.001	.000	.000	.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 5.7 shows that the correlation coefficients between the measurements of NB ranged between 0.103 and 0.462. All of them are statistically significant at the 0.01 level or at the 0.05 level. Additionally, the correlation coefficients between the measurements of NB and the total average ranged between 0.509 and 0.723. All of them are statistically significant at the 0.01 level.

Eighth: Measuring internal consistency in VB. The following table shows the basic output of the axis.

Table 5. 8: Correlations- VB items

Items		1	2	3	V0IVE_MEAN
Voice1	Pearson Correlation	1			.787**
	Sig. (2-tailed)	.000			.000
Voice2	Pearson Correlation	.689**	1		.854**
	Sig. (2-tailed)	.000			.000
Voice3	Pearson Correlation	.347**	.480**	1	.803**
	Sig. (2-tailed)	.000	.000	.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5. 9: Correlations- DM style (Experiential)

Items		1	2	3	4	5	6	7	EXP Mean
Experiential 1	Pearson Correlation	1							.676**
	Sig. (2-tailed)	.000							.000
Experiential 2	Pearson Correlation	.584**	1						.682**
	Sig. (2-tailed)	.000							.000
Experiential 3	Pearson Correlation	.319**	.411**	1					.551**
	Sig. (2-tailed)	.000	.000	.000					.000
Experiential 4	Pearson Correlation	.300**	.236**	.243**	1				.687**
	Sig. (2-tailed)	.000	.000	.000					.000
Experiential 7	Pearson Correlation	.179**	.214**	.193*	.455**	1			.576**
	Sig. (2-tailed)	.000	.000	.049	.000	.280**	.000		.000
Experiential 10	Pearson Correlation	.476**	.456**	.233**	.425**	.376**	1		.723**
	Sig. (2-tailed)	.109*	.000	.000	.000	.000	.000		.000
Experiential 12	Pearson Correlation	.034	.170*	.107*	.417**	.349**		1	.540**
	Sig. (2-tailed)	.000	.043	.038	.000	.000	.000	.000	.000

** Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 5.9 shows that the correlation coefficients between the measurements of DM style (Experiential) ranged between 0.347 and 0.689. All of them are statistically significant at the 0.01 level. Additionally, the correlation coefficients between the measurements of DM style (Experiential) and the total average ranged between 0.787 and 0.854. All of them are statistically significant at the 0.01 level.

Ninth: Measuring the internal consistency between the measurements of DM style (rational).

The total output from the previous table shows that the correlation coefficients between DM style (rational) measurements ranged between 0.179 and 0.584. All of them are statistically significant at the 0.01 level or at the 0.05 level. Additionally, the correlation coefficients between the measurements of DM style (rational) and the total average ranged between 0.540 and 0.723. All of them are statistically significant at the 0.01 level.

Tenth: Measuring the internal consistency between the measurements DM style (rational). Table 5.10 shows the results of the correlation coefficients between the measurements of DM style (rational). with the total average.

Table 5. 10: Correlations- DM style (Rational)

Items		1	2	3	4	5	6	7	8	RATIONAL_MEAN
Rational5	Pearson Correlation	1								0.484**
	Sig. (2-tailed)	.000								0.000
Rational6	Pearson Correlation	.246*	1							0.494**
	Sig. (2-tailed)	.000								0.026
Rational8	Pearson Correlation	.192*	.119*	1						0.535**
	Sig. (2-tailed)	.000	.033							0.000
Rational9	Pearson Correlation	.117*	.154*	.208**	1					0.423**
	Sig. (2-tailed)	.046	.002	.000						0.043
Rational11	Pearson Correlation	.133*	.161*	.287**	.196*	1				0.653**
	Sig. (2-tailed)	.009	.002	.000	.047					0.000
Rational13	Pearson Correlation	.108*	.128*	.403**	.175*	.432**	1			0.516**
	Sig. (2-tailed)	.035	.047	.000	.043	.000				0.000
Rational 14	Pearson Correlation	0.130*	0.134*	0.160**	0.113*	.537**	.429**	1		0.546**
	Sig. (2-tailed)	0.011	0.043	0.002	0.042	0.000	.000			0.000
Rational15	Pearson Correlation	0.207**	0.118*	0.225**	0.121*	0.357**	0.236**	0.375**	1	.619**
	Sig. (2-tailed)	0.000	0.021	0.000	0.046	0.000	0.000	0.375**	0.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The previous table shows that the correlation coefficients between DM style (rational) measurements ranged between 0.108 and 0.537. All of them are statistically significant at the 0.01 level or at the 0.05 level. Also, the correlation coefficients between DM style (rational) measurements and the total average ranged between 0.423 and 0.653, all of which are statistically significant at the 0.01 level.

Eleventh: Measuring the internal consistency between the measurements of project outcomes. Table 5.11 shows the results of the correlation coefficients between the stat measurements elements of project success with the total average.

Table 5. 11: Correlations-Project sucess

Items		1	2	3	4	5	6	7	OUTCOME_MEAN

Outcome1	Pearson Correlation	1							.722**
	Sig. (2-tailed)	.000							.000
Outcome2	Pearson Correlation	.628**	1						.809**
	Sig. (2-tailed)	.000	.000						.000
Outcome3	Pearson Correlation	.485**	.638**	1					.767**
	Sig. (2-tailed)	.000	.000	.000					.000
Outcome4	Pearson Correlation	.490**	.594**	.716**	1				.749**
	Sig. (2-tailed)	.000	.000	.000					.000
Outcome5	Pearson Correlation	.561**	.531**	.465**	.484**	1			.781**
	Sig. (2-tailed)	.000	.000	.000	.000				.000
Outcome6	Pearson Correlation	.248**	.392**	.309**	.269**	.447**	1		.643**
	Sig. (2-tailed)	.000	.000	.000	.000	.000			.000
Outcome7	Pearson Correlation	.312**	.407**	.450**	.420**	.425**	.381**	1	.641**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).

The previous table shows that project success measurements correlations and mean is 0.248 and 0.716. All of them are statistically significant at the 0.01 level. Furthermore, the outcome mean ranged between 0.641 and 0.809, all of which are statistically significant at the 0.01 level or 0.05 level.

Ten measurements were deleted from the axes of the study tool according to the analysis so that the study tool consisted of 41 questions (paragraphs) distributed over 11 axes, and the internal consistency was confirmed after modification to the paragraphs of the questionnaire in its final form to extract the degree of correlation of each measurements with the variable to which it belongs, and the following table 5.12 show correlations of interest bias with total mean:

Table 5. 12: Correlations- Interest bias items with total mean

Items		INT_MEAN
INT1	Pearson Correlation	.702**
	Sig. (2-tailed)	.000
INT2	Pearson Correlation	.734**
	Sig. (2-tailed)	.000
INT3	Pearson Correlation	.687**
	Sig. (2-tailed)	.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.12 shows that the correlation coefficients between the measurements of interest bias with the total average ranged between 0.687 and 0.734; they are high, and all are statistically significant at the 0.01 level.

Table 5. 13: Correlations- Pattern recognition bias items with total mean

Items		PAT_MEAN
PAT1	Pearson Correlation	.663**
	Sig. (2-tailed)	.000

PAT2	Pearson Correlation	.816**
	Sig. (2-tailed)	.000
PAT3	Pearson Correlation	.664**
	Sig. (2-tailed)	.000
PAT4	Pearson Correlation	.702**
	Sig. (2-tailed)	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.13 shows that the correlation coefficients between the measurements of pattern recognition bias with the total average o ranged between 0.663 and 0.816; they are high, and all are statistically significant at the 0.01 level.

Table 5. 14: Correlations- Perception bias items with total mean

Items		PERCE_MEAN
PERCE2	Pearson Correlation	.817**
	Sig. (2-tailed)	.000
PERCE3	Pearson Correlation	.812**
	Sig. (2-tailed)	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.14 shows that the relationship is 0.812 and 0.817; it is high and statistically significant at the 0.01 level.

Table 5. 15: Correlations- Decision bias items with total mean

Items		DECI_MEAN
DECI1	Pearson Correlation	.796**
	Sig. (2-tailed)	.000
DEC2	Pearson Correlation	.747**
	Sig. (2-tailed)	.000
DECI3	Pearson Correlation	.781**
	Sig. (2-tailed)	.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.15 shows that the correlation coefficients between the measurements of decision bias with the total average ranged between 0.747 and 0.796; they are high, and all are statistically significant at the 0.01 level.

Table 5. 16: Correlations- Stability bias items with total mean

Items		STAB_MEAN
STAB1	Pearson Correlation	.829**
	Sig. (2-tailed)	.000
STAB2	Pearson Correlation	.750**
	Sig. (2-tailed)	.000
STAB3	Pearson Correlation	.635**
	Sig. (2-tailed)	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.16 shows the correlation of stability bias, 0.635 and 0.829. And it is high, at the 0.01 level.

Table 5. 17: Correlations- Action-oriented bias items with total mean

Items		ACTOR_MEAN
ACTOR3	Pearson Correlation	.739**
	Sig. (2-tailed)	.000
ACTOR4	Pearson Correlation	.752**
	Sig. (2-tailed)	.000
ACTOR5	Pearson Correlation	.763**
	Sig. (2-tailed)	.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.17 shows that the correlation coefficients between the measurements of action-oriented bias with the total average ranged between 0.739 and 0.763. They are high and all are statistically significant at the 0.01 level.

Table 5. 18: Correlations- NB items with total mean

Items		NARCISS_MEAN
Narciss1	Pearson Correlation	.700**
	Sig. (2-tailed)	.000
Narciss2	Pearson Correlation	.647**
	Sig. (2-tailed)	.000
Narciss4	Pearson Correlation	.773**
	Sig. (2-tailed)	.000
Narciss5	Pearson Correlation	.647**
	Sig. (2-tailed)	.000

**Correlation is significant at the 0.01 level (2-tailed).

Table 5.18 shows that connection between NB measurements ranged between 0.647 and 0.773. Looking at these results, they are high correlation and all of them are statistically significant at the 0.01 level.

Table 5. 19: Correlations- VB items with total mean

Items		V0ICE_MEAN
Voice1	Pearson Correlation	.787**
	Sig. (2-tailed)	.000
Voice2	Pearson Correlation	.854**
	Sig. (2-tailed)	.000
Voice3	Pearson Correlation	.803**
	Sig. (2-tailed)	.000

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.19 shows that the correlation coefficients between the measurements of VB with the total average ranged between 0.787 and 0.854. These results are high, and all of them are statistically significant at the 0.01 level.

Table 5. 20: Correlations- DM style (Experiential) with total mean

Items		EXPERIENTIAL_MEAN
Experiential1	Pearson Correlation	.764**
	Sig. (2-tailed)	.000
Experiential2	Pearson Correlation	.773**
	Sig. (2-tailed)	.000
Experiential3	Pearson Correlation	.632**
	Sig. (2-tailed)	.000

Experiential4	Pearson Correlation	.617**
	Sig. (2-tailed)	.000
Experiential10	Pearson Correlation	.729**
	Sig. (2-tailed)	.000

**Correlation is significant at the 0.01 level (2-tailed).

Table 5.20 shows that the correlation coefficients between the measurements of DM style (rational) with the total average ranged between 0.617 and 0.773. These results are high, and all of them are statistically significant at the 0.01 level.

Table 5. 21: Correlations- DM style (Rational) with total mean

Items		RATIONAL_MEAN
Rational11	Pearson Correlation	.776**
	Sig. (2-tailed)	.000
Rational13	Pearson Correlation	.636**
	Sig. (2-tailed)	.000
Rational14	Pearson Correlation	.743**
	Sig. (2-tailed)	.000
Rational15	Pearson Correlation	.766**
	Sig. (2-tailed)	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.21 shows that the correlation coefficients between project success measurements with the total average ranged between 0.636 and 0.776. These results are high, and all of them are statistically significant at the 0.01 level.

Table 5. 22: Correlations-Project success with total mean

Items		OUTCOME_MEAN
Outcome1	Pearson Correlation	.722**
	Sig. (2-tailed)	.000
Outcome2	Pearson Correlation	.809**
	Sig. (2-tailed)	.000
Outcome3	Pearson Correlation	.767**
	Sig. (2-tailed)	.000
Outcome4	Pearson Correlation	.749**
	Sig. (2-tailed)	.000
Outcome5	Pearson Correlation	.781**
	Sig. (2-tailed)	.000
Outcome6	Pearson Correlation	.643**
	Sig. (2-tailed)	.000
Outcome7	Pearson Correlation	.641**
	Sig. (2-tailed)	.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.22 shows that the correlation coefficients between project success measurements with the total average ranged between 0.641 and 0.809. These results are high, and all of them are statistically significant at the 0.01 level.

Referring to the previous tables, we note that all measurements of the study tools are directly correlated with the total average with the study variables to which they are developed and have statistical significance, which indicates that the scale has high validity and that it contributes to the total score of the variables to which it belongs. The results of corelations show a strong relationship between the study variables.

the validity of the study tool is verified, and it is valid to apply to the original study sample to achieve the study's objectives and answer its questions.

5.6 Validity and reliability

An essential step in any study is to confirm that the scales used to measure the study variables measure the intended construct and do that correctly (U. Sekaran; R. Bougie, 2012). In this section, the goodness of measurement scales was tested by determining the reliability and validity of the measures (Sekaran & Bougie, 2013). According to Cronbach and Meeh (1966), as cited in (Harrington 2009 pp. 265-285), construct validity refers to an inspection of a measure of construct measured directly, while reliability is "a test of how consistently a measuring instrument measures whatever concept it is a measure. In other words, validity is concerned with whether we measure the right concept and reliability with stability and consistency of measurement" (Sekaran & Bougie, 2013). Validity is defined as how well an instrument developed measures the particular concept it is intended to measure (Sekaran & Bougie, 2013).

5.7 Reliability

Reliability is the extent to which a questionnaire, test, observation, or any measurement procedure produces the same results on repeated trials. In short, it is the stability or consistency of scores over time or across rates (Bolarinwa, 2015). To measure a construct efficiently through a set of items, the items must demonstrate a high level of homogeneity. Internal consistency is the primary measure of reliability, and it shows the degree to which a group of items measures a particular construct. Cronbach's alpha is the most common test to measure internal consistency; values higher than 0.6 are considered acceptable (Garson, 2012; Harrington, 2009).

As shown in table 5.23, all Cronbach's alpha values are higher than 0.6, except for interest bias and perception bias, where Cronbach's alpha values were almost 0.5. However, according to Pallant (2016), mean inter-correlation between the items is used when we have a small number of items, and, since interest bias and perception bias have three and two items, respectively, the mean for inert correlation was calculated. The results were 0.277 and 0.326, respectively. As recommended by Briggs and Cheek (1986) as cited in Pallant (2003), the value of the mean inter-correlation is 0.2 to 0.4; accordingly, it can be concluded that internal consistency is achieved for the study variables. However, both values were removed from further analysis due to the low values.

Cronbach's alpha coefficient and the split-half coefficient between the paragraphs of each axis of the study tool were used to verify the stability of the study tool. The following table 5.23 illustrates this:

Table 5. 23: Internal consistency Cronbach's alpha and half-split coefficient

Factor	Code	Item	No. of items	Cronbach's Alpha (α)	Half- split
Pattern recognition bias	PAT 1	You make decisions based on information that is easy to recall	4	0.678	0.700
	PAT 2	You focus on a particular angle of the situation when making a judgment			
	PAT 3	You make decisions based on routine and familiar processes, tools, and techniques			
	PAT 4	Under uncertain events, you reject new information if it contradicts your beliefs			
Decision bias	DECI 1	You hold on to your past decisions even if you know that expected results will not be achieved and cost cannot be recovered	3	0.664	0.695
	DECI 2	You always tend to be over-optimistic about the outcome of planned activities			
	DECI 3	In high-stakes decisions, you prefer not to take action even if you know that taking action leads to an objectively better outcome			
Stability bias	STAB 1	You make your decision based on the initially received information	3	0.739	0.726
	STAB 2	You prefer to stick to and defend the default option rather than reviewing other alternatives			
	STAB 3	You make decisions based on previous experiences that have similar circumstances			
Action-oriented bias	ACTOR3	You believe that your next decision will be wrong due to the several right decisions you previously made	3	0.607	0.658
	ACTOR4	You prefer to keep decisions simple and avoid complicated and rational analysis			
	ACTOR5	You follow provided information without attempting self-evaluation of this information			

NB	Narciss1	You always see yourself as important	4	0.634	0.620
	Narciss2	You may use others to achieve your personal benefits			
	Narciss4	You always look to be essential and admired by others			
	Narciss5	When making decisions under uncertain events, you may be hostile towards others			
VB	Voice1	You usually present ideas to make/support decisions that are important to the project	3	0.725	0.641
	Voice2	You take the initiative to provide proposals, recommendations, and hints to make/support decisions that are important to the project			
	Voice3	You usually show your concerns to stakeholders regarding the adverse and negative events that impact the decisions related to the project			
Experiential	Experiential 1	When I make project-related decisions, I like to rely on my intuitive impressions and trust in my hunches to solve problems	5	0.745	0.660
	Experiential 2	Using my feelings usually works well for me in figuring out problems in the project			
	Experiential 3	I trust my initial feelings about people			
	Experiential 4	When I make project-related decisions, I do not like to have to do much thinking			
	Experiential 10	When I make project-related decisions, I tend to use my heart as a guide for my decisions			
Rational	Rational 11	When I make project-related decisions, I enjoy solving problems that require complex thinking	4	0.680	0.682
	Rational 13	I usually have clear, explainable reasons for my decisions			
	Rational 14	I have a logical mind and enjoy intellectual challenges			
	Rational 15	I prefer complex and straightforward problems			
Success	success 1	You always achieve the project objectives	7	0.844	0.759
	Success 2	You always meet the project technical specifications			
	Success 3	You always achieve a high level of satisfaction concerning the project outcomes among internal stakeholders			
	Success 4	You always achieve a high level of satisfaction concerning the project outcomes with clients			
	Success 5	You consistently achieve projects outcomes within scope, time, and cost			
	Success 6	You always complete projects with minimal issues, troubleshooting and rework			
	Success 7	Your projects are directly benefiting the end-users and increase efficiency and effectiveness			

Results from table 5.23 shows that the stability coefficients of Cronbach's alpha ranged between 0.500 and 0.44, as well as the stability coefficient of the half-segmentation, which ranged between 0.500 and 0.759, and considering that there are relatively few paragraphs in each axis, such coefficients are considered acceptable for the stability of such a study. People always want to know what is an acceptable alpha. Cronbach, (1951); Hundleby and Nunnally (1968) offered a rule of thumb of 0.7. More recently, one tends to see 0.8 cited as a minimum alpha. Keep in mind that alpha is heavily dependent on the number of items composing the scale. Even if using items with poor internal consistency, a reliable scale can be obtained if the scale is long enough. For example, ten items with an average inter-item correlation of only .2 produces a scale with a reliability of .714. Similarly, if the average correlation among five variables is .5, the alpha coefficient is 0.833. But, if the number of variables is 10 (with the same average correlation), the alpha coefficient is 0.909.

Based on table 5.23, the PBB sub variables (Interest bias and perception bias) is equal to 0.500 which considered low; however the author conducted the test to include all sub-variables as depicted in the table 5.23; Cronbach-alpha for the model is equal 0.806 which is considered great (Haier et al. 1998) and removed values below 0.6.

5.8 KMO and Bartlett's test

Before applying EFA and CFA tests it is recommended to run: first (1) Kaiser-Meyer-Olkin Measure of Sampling Adequacy which is performed to measure the adequacy of that variables, where values that are closed to 1.0 the more reliable the scale, which gives an indicator that factor analysis can be performed. However, values less than 0.5 gives an indicator that the scale is unreliable and factor analysis cannot be performed (Haier et al. 1998; Field 2005; Mathur & Dhulla, 2014; Broen, et al. 2015; Hadi, & Sentosa, I., 2016; Napitupulu, & Jati, 2017).

second (2) Bartlett's Test of Sphericity was performed to examine occurrence of correlation for variable; this test is constructed based on the assumption that the correlation matrix is an identity matrix. The tests indicates that the scale is reliable when the significance value is small; thus the factor analysis can be completed (Haier et al. 1998; Field 2005; Mathur & Dhulla, 2014; Broen, et al. 2015; Hadi, & Sentosa, I., 2016; Napitupulu, & Jati, 2017).

Tables 5.24 and 5.25 shows the results of KMO and Bartletts tests for the study model and the stud variables respectively. KMO results show values higher than 0.5 and close to 1.0, however; Perception bias and Stability bias values are closed to 0.5, regardless of these values the scale is reliable and factor analysis tests are adequate to be performed since they are higher than 0.5 according to table 5.33 (Haier et al. 1998; Field 2005).

Results of Bartlett test for the study model is (*p* value=0.000) which is indicate a high significance and suggest that the scale is reliable, and the original correlation matrix is an identity matrix (Haier et al. 2010). The values of study variables show (*p* value=0.001) which is less than .005. which is also gives an indication about the reliability of the scales used in this study.

Table 5. 24: KMO and Bartlett's test – study model

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.866
Bartlett's Test of Sphericity	Approx. Chi-Square	5478.785
	df	861
	Sig.	.000

Table 5. 25: KMO and Bartlett's test – study variables

Item	**KMO**	**Bartlett's**	**df**	**Sig**
Perception and behavioral bias	.845	990.838	78	<.001
Interest Bias	.601	70.225	3	<.001
Pattern recognition bias	.700	237.207	6	<.001
Perception bias	.580	63.637	3	<.001
Decision bias	.640	177.022	3	<.001
Belief and Probability estimation bias	.793	569.808	28	<.001
Stability bias	.591	122.684	3	<.001
Action-oriented bias	.655	220.962	10	<.001
Experiential DM	.763	679.160	28	<.001
Rational DM	.701	491.927	36	<.001
Success	848	1127.704	21	<.001

Table 5. 26: KMO values – Kaiser (1974)

Indicator	**Range**
Not acceptable	less than 0.5
Good	between 0.5-0.7

Great	between .07-0.8
Superb	above 0.8

Based on the results of KMO and Bartlett's test of sphericity indicates that the scales used in this study are reliable and factor analysis is appropriate.

Common method variance

Common method variance is variance due to the measurement instrument rather than the construct. The self-administrated questionnaire may casue the issue of common method variance; in order to eliminate this concern, Podsakoff and Organ (1986) suggested a number of remedial approaches, one of which is Harman’s one-factor test. In this test, all the questionnaire items are entered into an un-rotated EFA test, and if no single factor emerges from the analysis and no one single factor is responsible for more than 50% of the variance, then the issue of CMV is eliminated.

All the study items (used in the analysis) were entered into EFA analysis, and the total variance explained produced 13 factors. The highest variance explained by one factor was 16.468% <50%. Accordingly, CMV is not an issue.

5.9 Validity

As mentioned earlier, validity tests how well an instrument measures the variable it is supposed to measure (Sekaran; & Bougie, 2012). This measure is considered an essential research criterion (Bryman & Bell, 2015). Several varieties of validity have been described by studies, including face validity, content validity and construct validity (Bolarinwa, 2015).

Face validity includes experts reviewing the scale items in the questionnaire and approving that the scale is a valid measure of the concept (Bolarinwa, 2015). Content validity can be defined as assessing whether the items used to describe specific concepts represent the content and the definition of the construct of interest (Bryman & Bell, 2015; Bolarinwa, 2015).

Construct validity can be defined as "how well the results obtained from using the measure fit the theories around which the test is designed" (Sekaran & Bougie, 2013, p.160). It refers to how well an instrument measures the trait or theoretical construct it is supposed to measure (Bolarinwa, 2015). One of the methods to measure construct validity is through factor analysis. Factorial validity is considered the empirical extension of content validity because factorial validity validates the content of the research constructs by using the statistical method called factor analysis. There are two main techniques of factor analysis: (EFA) and CFA. For pre-established scales, it is more appropriate to use CFA.

SEM typically refers to models investigating causal relationships between latent variables (Holtzman & Vezzu, 2011). Performing SEM provides a good fit for data and verifies that all items fit within the construct; to validate the data, CFA is used to verify that items are loadings. The data should be checked for several things to ensure that the author have collected appropriate data for testing the hypothesis. In addition to ensuring that each factor is represented by a sufficient number of items, called overdetermination, data should be collected from at least two different sources considering that the variable-to-factor ratio is important (Holtzman & Vezzu, 2011).

It is critical to have at least three items assigned to each factor; otherwise, a factor is generally weak and unstable. However, it is often acceptable for a model to contain at most one such factor (Holtzman & Vezzu, 2011).

According to a common rule, ten people should participate per variable in a model. Thus, in order to run a CFA on 20 items, data from at least 200 respondents must be collected; Once it is guaranteed that model and sample size assumptions have been met, the data should be checked for missing data, outliers, multivariate normality, and collinearity (Holtzman & Vezzu, 2011).

Evaluating model fit is very important in CFA as it provides evidence to confirm the model; v arios results will be obtained from this analysis to estimate the model parameters and assess model fit (Holtzman & Vezzu, 2011).

Structural equation modelling (SEM)

Structural equation modelling (SEM) is a designation for a variety of methods that scientists use in both experimental and observational study across the sciences. It is used more in the social and behavioural sciences.

SEM involves the construction of a model, an informative representation of some observable or theoretical phenomenon. This model assumes that the different aspects of the phenomenon are related to each other by a structure. This structure is a system of equations but is usually modelled on paper or a computer with arrows and symbols (also known as path notation). The structure includes statistical and often causal relationships between variables and error terms and can include multiple equations. Equations (or an equation) in SEM are mathematical and statistical properties incorporated into the model and its structural properties and then estimated using statistical algorithms (usually based on matrix algebra and generalized linear models) using experimental or observational data.

Criticisms of SEM methods point to problems with mathematical formulation, the tendency to accept models without demonstrating external validity, and the philosophical bias inherent in the criterion (Tarka, 2018).

Although there are not always clear boundaries as to what SEM is and what it is not (Curran, 2003), it generally includes path models and scaling models. It always uses statistical models and computer software to explore structural links between baseline variables and actual variables taken from the observed data (Tabri & Elliott, 2012).

The SEM toolkit includes confirmation factor analysis, complex confirmatory analysis, path analysis, multi-cluster, longitudinal, partial least squares path, latent growth, and hierarchical or multilevel (Tabri & Elliott, 2012; (Kline, 2016). SEM in the social sciences is usually justified because it is a method for identifying latent variables that are believed to exist but cannot be directly observed in reality (Bollen, 1989).

Researchers using SEM use software programs (such as Mplus, lavaan (in R), LISREL, SPSS and Stata) to estimate the strength and sign of the modulus of each modelled arrow and to provide diagnostic clues that indicate indicators or components of the model that may produce inconsistencies between the model and the data (Kaplan, 2000; Salkind, 2007).

An astounding advantage of SEM is that all of these measurements and tests occur simultaneously in a single statistical estimation procedure, where errors throughout the model are calculated using all the information from the model. This means that errors are more accurate than if the researcher had to calculate each part of the model separately (MacCallum & Austin, 2000).

5.9.1 Factor analysis

Factor analysis help the researcher identify the variances in the collected data and identify the factors that include most of the variance., especially when there is a large number of variables in the study (Punch, 2005). Factor analysis includes two major analyses: EFA and CFA.

1. Exploratory factor analysis (EFA)

EFA analysis is used to locate the number of latent variables which is obtained from the items of measurements; it verifies if the measurements used in the study reflect the conceptual framework; in addition, EFA analysis remove the least significance measurements to increase level or accuracy of the collected data (Field, 2009; Hair, Black & Babin, 2010). EFA provides a clear understanding of the components analysis results (Field, 2009; Hair, Black & Babin, 2010). Using rotation technique increase the differences between loading items and factors which provides a clear image of the results (Bryman & Cramer, 2011). The analysis takes into consideration the variables that are responsible of the variation; using SPSS analysis tool, the redundances variables are eliminated.

Perception and behavioural bias EFA

This study adopted the scales to measure the PBB as mentioned in (Mohanani et al., 2018); Virine & Trumper, 2008; Hersing, 2017; Babad & Katz, 1991; Shmueli, Pliskin & Fink, 2015) which is based on 12 items illustrated in table 5-27 where the total variance explained:

Table 5. 27: EFA for PBB

Component	Initial Eigenvalue			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.763	31.360	31.360	3.763	31.360	31.360
2	1.210	10.083	41.443	1.210	10.083	41.443
3	1.015	8.462	49.905	1.015	8.462	49.905
4	.883	7.357	57.262			
5	.844	7.033	64.296			
6	.814	6.782	71.077			
7	.733	6.112	77.189			
8	.722	6.019	83.208			
9	.575	4.791	87.998			
10	.539	4.491	92.490			
11	.484	4.036	96.526			
12	.417	3.474	100.000			

Table 5.27 shows that three items that Eigen value greater then (1) and responsible of the variance by 49.905%.

Figure 5.1 shows the graphical scree plot for PBB, where the slope starts to decline after the third scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

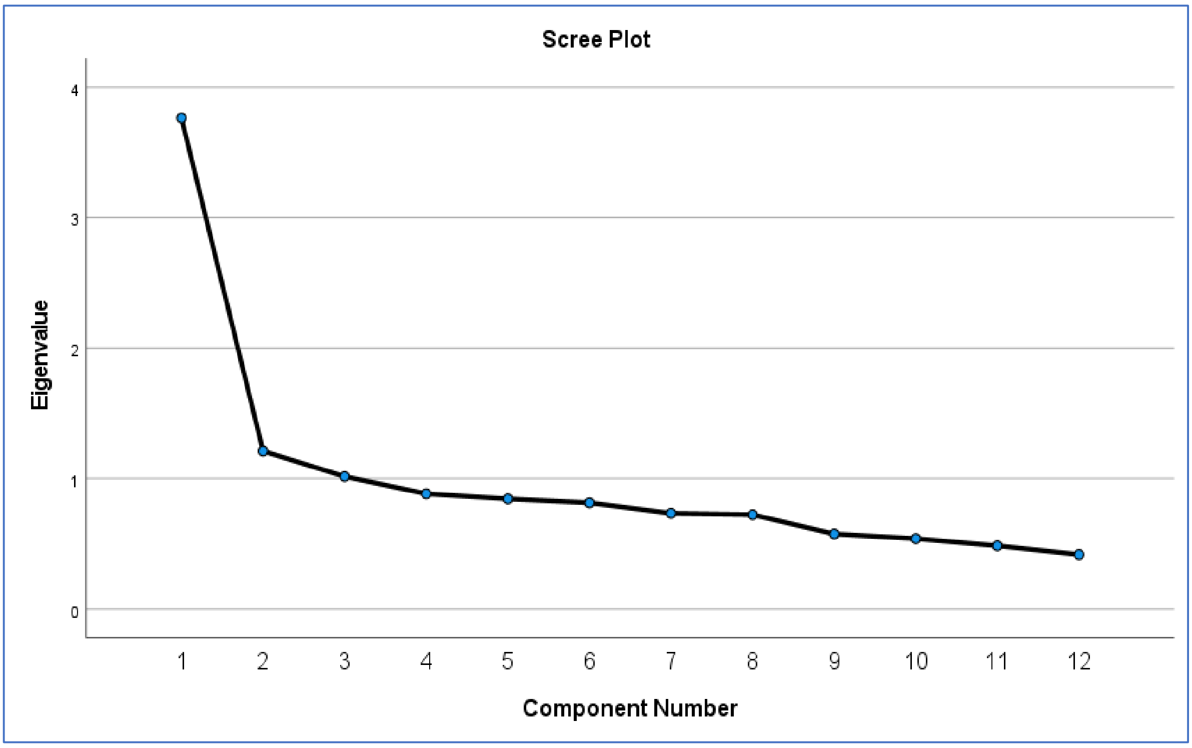


Figure 5. 1: PBB scree plot

Table 5.28 shows the components matrix of PBB, this table shows that all items are loading with value higher than 0.45 except the seventh scale where the value is 0.367.

Table 5. 28: Components matrix for PBB

	Component Matrix [a]
	1
INT1	.474
INT2	.557
INT3	.485
PAT1	.567
PAT2	.661
PAT4	.671
PERCE1	.367
PERCE2	.527

PERCE3	.540
DECI1	.621
DECI2	.576
DECI3	.600
Extraction Method: Principal Component Analysis.	
a. 3 components extracted.	

Beliefs and probability estimation bias EFA

This study adopted the scales to measure the BPEB as mentioned in (Virine & Trumper, 2008; Kiełczewski, Matel & Poskrobko, 2016; Hersing, 2017; Mohanani et al., 2018; Hersing, 2017) which is based on 8 items illustrated in table 5.29 where the total variance explained:

Table 5. 29: EFA for BPEB

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.871	35.887	35.887	2.871	35.887	35.887
2	1.301	16.267	52.154	1.301	16.267	52.154
3	.853	10.662	62.816			
4	.747	9.340	72.156			
5	.653	8.156	80.312			
6	.576	7.196	87.508			
7	.559	6.990	94.498			
8	.440	5.502	100.000			

Table 5.29 shows that two items that Eigen value greater then (1) and responsible of the variance by 52.154%.

Figure 5.2 shows the graphical scree plot for PBB, where the slope starts to decline after the second scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

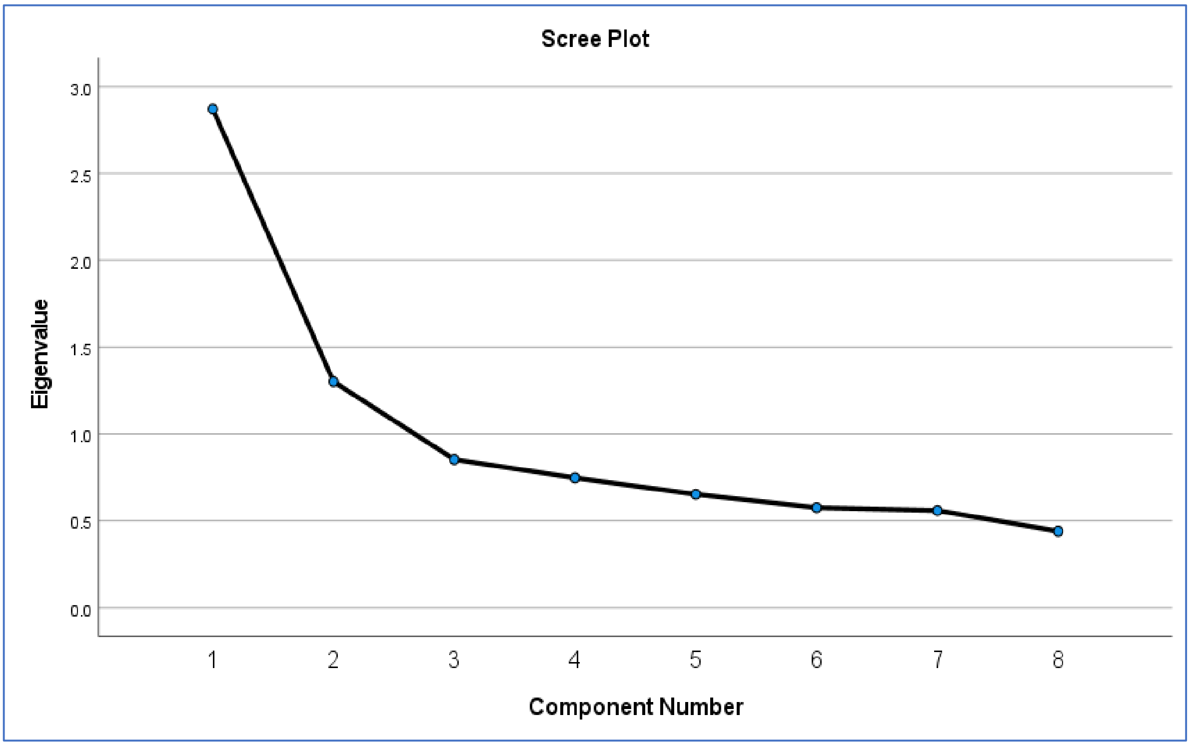


Figure 5. 2: BPEB scree plot

Table 5.30 shows the components matrix of BPEB, this table shows that all items are loading with value higher than 0.45 except the fifth scale where the value is 0.345.

Table 5. 30: Components matrix for BPEB

	Component
	1
STAB1	.646
STAB2	.751
STAB3	.495
ACTOR1	.575
ACTOR2	.345
ACTOR3	.629
ACTOR4	.601
ACTOR5	.663
Extraction Method: Principal Component Analysis.	
a. 2 components extracted.	

EFA for narcissistic behaviour

This study adopted the scales to measure the NB as mentioned in Pinto and Patanakul, 2015; Ouimet, 2010).which is based on 5 items illustrated in table 5-31 where the total variance explained:

Table 5. 31: EFA for NB

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.699	42.480	42.480	1.699	42.480	42.480
2	.961	24.014	66.494			
3	.772	19.298	85.792			
4	.568	14.208	100.000			

Table 5.31 shows that one items that has Eigen value greater then (1) and responsible of the variance by 42.480%.

Figure 5.3 shows the graphical scree plot for NB, where the slope starts to decline after the first scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

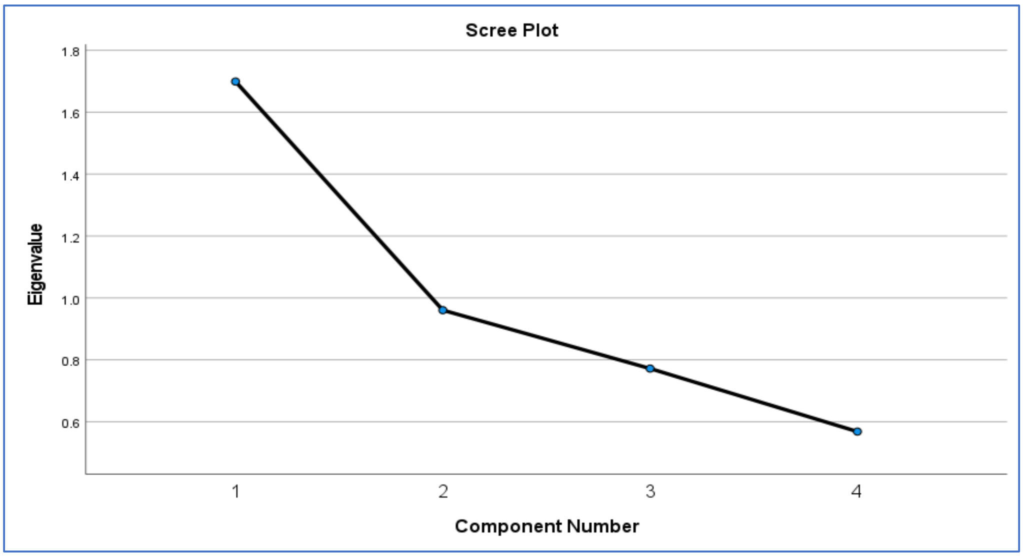


Figure 5. 3: NB scree plot

Table 5.32 shows the components matrix of BPEB, this table shows that all items are loading with value higher than 0.45.

Table 5. 32: Components matrix for NB

Component Matrix [a]	
	Component
	1
Narciss2	.567
Narciss3	.534
Narciss4	.729
Narciss5	.749
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

EFA for voice behaviour

This study adopted the scales to measure the VB as mentioned in (Ekrot, Rank & Gemünden, 2016).which is based on 3 items illustrated in table 5-33 where the total variance explained:

Table 5. 33: EFA for VB

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.024	67.483	67.483	2.024	67.483	67.483
2	.683	22.773	90.257			
3	.292	9.743	100.000			
Extraction Method: Principal Component Analysis.						

Table 5.33 shows that one items that has Eigen value greater then (1) and responsible of the variance by 67.483%.

Figure 5.4 shows the graphical scree plot for VB, where the slope starts to decline after the first scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

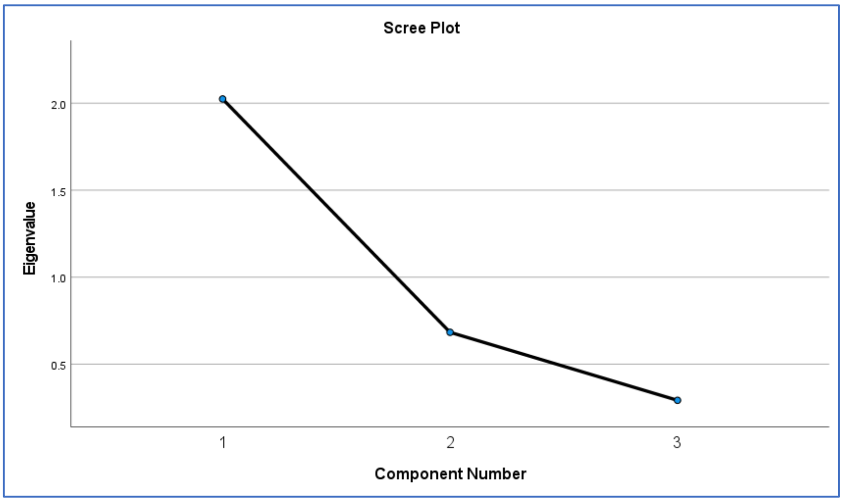


Figure 5. 4: VB scree plot

Table 5.32 shows the components matrix of VB, this table shows that all items are loading with value higher than 0.45.

Table 5. 34: Components matrix for VB

Component Matrix [a]	
	Component
	1
Voice1	.845
Voice2	.900
Voice3	.708
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

EFA for experiential decision-making style

This study adopted the scales to measure the experiential decision-making style as mentioned in (Epstein et al., 1996 ;Schutte et al., 2010; Björklund & Bäckström, 2008; Harper, 2016 ;Reyna & Ortiz, 2016; ;Leybourne & Sadler-Smith, 2006; ;Monacis et al., 2016).which is based on 6 items illustrated in table 5-35 where the total variance explained:

Table 5. 35: EFA for experiential DM

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

1	2.499	41.655	41.655	2.499	41.655	41.655
2	1.138	18.972	60.627	1.138	18.972	60.627
3	.760	12.672	73.299			
4	.655	10.917	84.216			
5	.502	8.363	92.578			
6	.445	7.422	100.000			

Table 5.35 shows that two items that has Eigen value greater then (1) and responsible of the variance by 60.627%.

Figure 5.5 shows the graphical scree plot for experiential decision-making style, where the slope starts to decline after the second scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

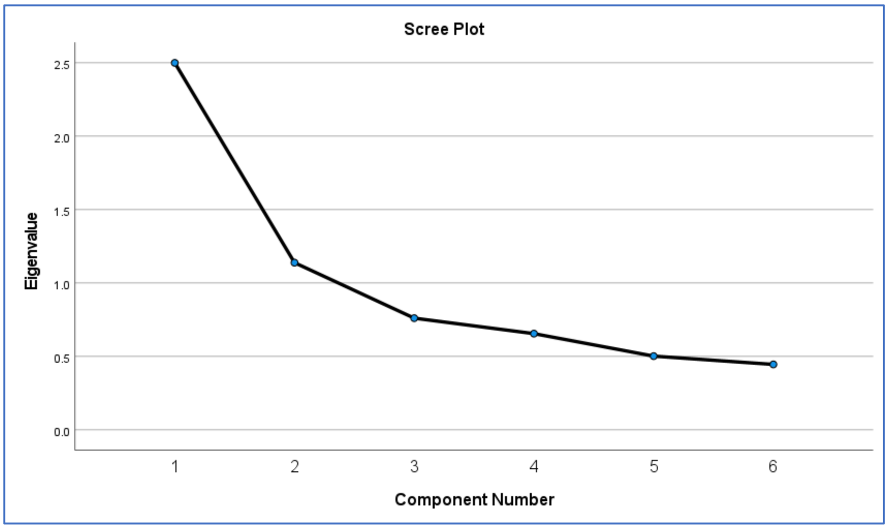


Figure 5. 5: scree plot for experiential decision-making style

Table 5.36 shows the components matrix of experiential decision-making style, this table shows that all items are loading with value higher than 0.45.

Table 5. 36: Components matrix for experiential decision-making style

	Component
	1
Experiential1	.606
Experiential3	.453
Experiential4	.770
Experiential7	.629

Experiential10	.743
Experiential12	.621
Extraction Method: Principal Component Analysis.	
a. 2 components extracted.	

EFA for rational decision-making style

This study adopted the scales to measure the rational decision-making style as mentioned in (Epstein et al., 1996 ;Schutte et al., 2010; Björklund & Bäckström, 2008; Harper, 2016 ;Reyna & Ortiz, 2016; ;Leybourne & Sadler-Smith, 2006; ;Monacis et al., 2016).which is based on 7 items illustrated in table 5-37: where the total variance explained:

Table 5. 37: EFA for rational decision-making style

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.508	35.824	35.824	2.508	35.824	35.824
2	1.205	17.217	53.041	1.205	17.217	53.041
3	.928	13.263	66.305			
4	.770	11.005	77.310			
5	.686	9.804	87.113			
6	.485	6.930	94.043			
7	.417	5.957	100.000			

Table 5.37 shows that two items that has Eigen value greater then (1) and responsible of the variance by 53.041%.

Figure 5.6 shows the graphical scree plot for rational decision-making style, where the slope starts to decline after the second scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

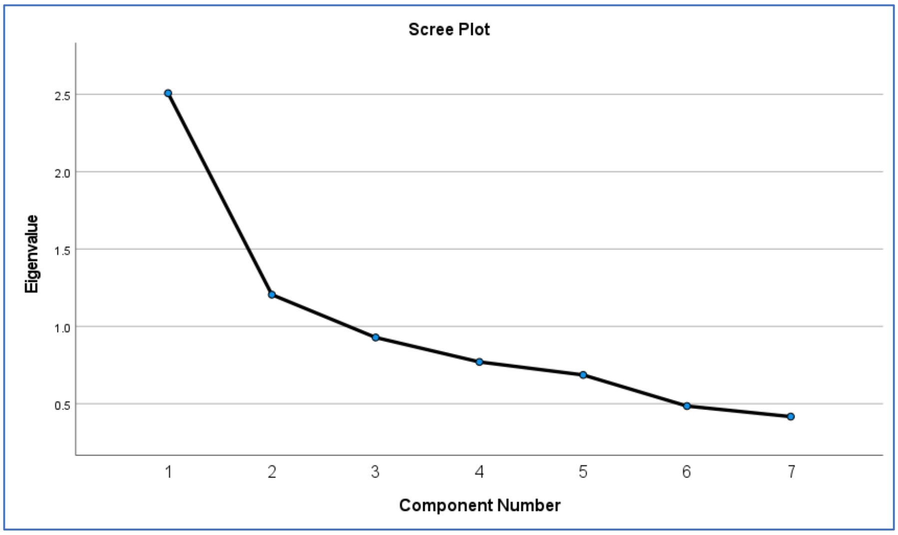


Figure 5. 6: scree plot for rational decision-making style

Table 5.38 shows the components matrix of rational decision-making style, this table shows that all items are loading with value higher than 0.45 except two values 0.375 and 0.224.

Table 5. 38: Components matrix for rational decision-making style

Component Matrix [a]	
	Component
	1
Rational5	.375
Rational6	.224
Rational8	.563
Rational11	.771
Rational13	.698
Rational14	.726
Rational15	.626
Extraction Method: Principal Component Analysis.	
a. 2 components extracted.	

EFA for project success

This study adopted the scales to measure the project success style as mentioned in (Ozdemir Gundor & Gozlu, 2016; Haron, Gui & Lenny, 2014; (Hairul Nizam Md Nasir & Sahibuddin, 2015).which is based on 7 items illustrated in table 5-39: where the total variance explained:

Table 5. 39: EFA for project success

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.805	54.357	54.357	3.805	54.357	54.357
2	.904	12.919	67.276			
3	.716	10.224	77.501			
4	.559	7.987	85.488			
5	.437	6.249	91.737			
6	.308	4.402	96.140			
7	.270	3.860	100.000			
Extraction Method: Principal Component Analysis.						

Table 5.39 shows that one item that has Eigen value greater then (1) and responsible of the variance by 54.357%.

Figure 5.7 shows the graphical scree plot for project success, where the slope starts to decline after the first scale where values below (1) connect with slight differences and shows Eigen values below (1) (Morgan et al.2004).

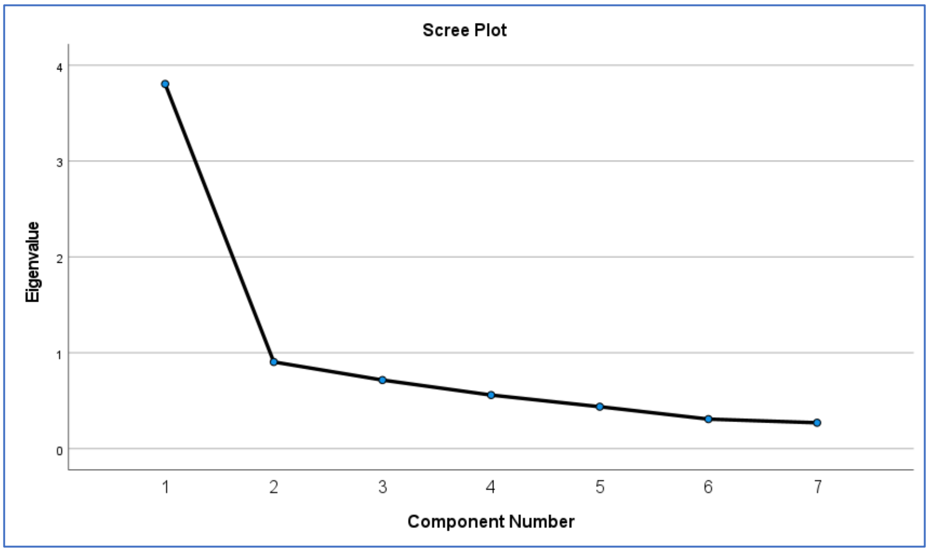


Figure 5. 7: scree plot for project success

Table 5.40 shows the components matrix of project success, this table shows that all items are loading with value higher than 0.45.

Table 5. 40: Components matrix for project success

Component Matrix [a]	
	Component
	1
Outcome1	.736
Outcome2	.830
Outcome3	.808
Outcome4	.791
Outcome5	.760
Outcome6	.554
Outcome7	.641
Extraction Method: Principal Component Analysis.	
a. 1 components extracted.	

2. Assessing confirmatory factor analysis CFA FIT statistics

When running CFA, many different fit statistics helps determine whether the model provides an adequate fit for the data. Therefore, it is often preferred to evaluate model fit based on other fit statistics (Holtzman & Vezzu, 2011). The chi-square test indicates the amount of difference between expected and observed covariance matrices. A chi-square value close to zero and a chi-square p-value greater than 0.05 indicate that there is little difference between the expected and observed covariance matrices, which is one indicator of good fit.

The Comparative Fit Index (CFI) assesses the enhancement of a proposed model over an independence model where the observed variables are uncorrelated. CFI values range from zero to one, with a larger value indicating a better model fit. Acceptable model fit is indicated by a CFI value of 0.90 or greater. The ratio of each parameter estimate to its standard error is distributed as a t-statistic and is significant at the 0.05 level if the value exceeds 1.96 and at the 0.01 level if the value exceeds 2.56. Since datasets used for CFAs are typically large and the t-distribution approaches the z-distribution for large samples, critical values from the z-distribution (1.96 and 2.56) can be used. For a good-fitting model, most or all parameter estimates should be significant. If a parameter estimate is not significant, dropping the corresponding item from the model should be considered. Additionally, correlations between the factors should be checked to see how the factors relate to each other. If correlations are sufficiently high, consolidating the corresponding factors into a single factor should be considered (Holtzman & Vezzu, 2011).

CFA for PBB

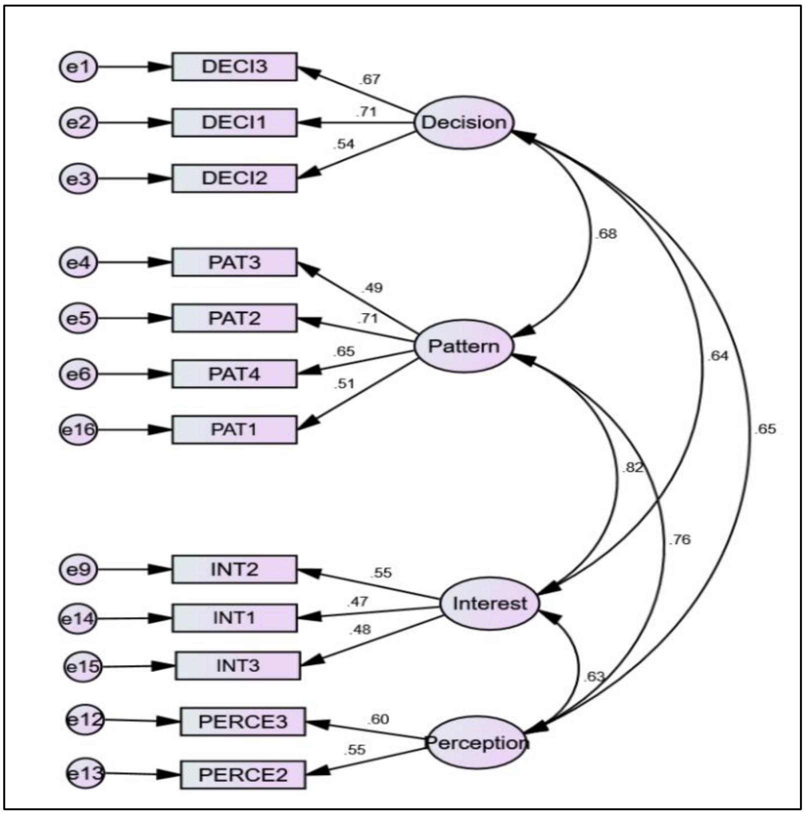


Figure 5. 8: CFA for perception and behavioural bias dimensions

Figure 5.8 presents the path diagram for the PBB variable dimensions (i.e., Interest Bias, Pattern recognition bias, Perception bias and Decision bias and the standardized factor loading for each item in addition to the correlations among dimensions. The observed items show a loading between 0.48 and 0.71. Although Hair et al., (2010) recommend a standardized factor loading higher than 0.5, Harrington (2009) stated that any standardized loadings below 0.30 are not interpreted; however, loading 0.45 and above is considered fair. The following table 5.41

presents the standardized factor loading with its significance. All the items loading are significant.

Table 5. 41: Regression weight for PBB dimensions

Item		Dimension	Estimate	S.E.	C.R.	P	Label
DECI3	<---	Decision	1.000				Sig.
DECI1	<---	Decision	1.104	.116	9.483	***	Sig.
DECI2	<---	Decision	.896	.110	8.177	***	Sig.
PAT3	<---	Pattern	1.000				Sig.
PAT2	<---	Pattern	1.764	.215	8.197	***	Sig.
PAT4	<---	Pattern	1.384	.175	7.898	***	Sig.
INT2	<---	Interest	1.371	.220	6.245	***	Sig.
PERCE3	<---	Perception	1.000				Sig.
PERCE2	<---	Perception	.924	.138	6.709	***	Sig.
INT1	<---	Interest	1.000				Sig.
INT3	<---	Interest	.918	.158	5.826	***	Sig.
PAT1	<---	Pattern	1.128	.163	6.924	***	Sig.

The model fit statistics for the PBB variable dimensions are CMIN ($p<0.001$) =127.195; CMIN/DF=2.65 <5; TLI =0.88; CFI=0.912; GFI= 0.947 and RMSEA=0.066. These results indicate that the initial model provides an adequate fit to the data (Hair et al., 2010).

CFA for BPEB

CFA was performed for Belief and probability bias dimensions. First, all the items are included in the analysis as per the original scale. However, any loading less than 0.3 was removed (Hair et al., 2010). Accordingly, two items from the action-oriented scale, “You assume that positive results will happen because you have sufficient planning skills and abilities” and “You feel that you have the ability to control or influence project outcomes”, and one item from stability, “You make decisions based on previous experiences that have similar circumstances”, were removed.

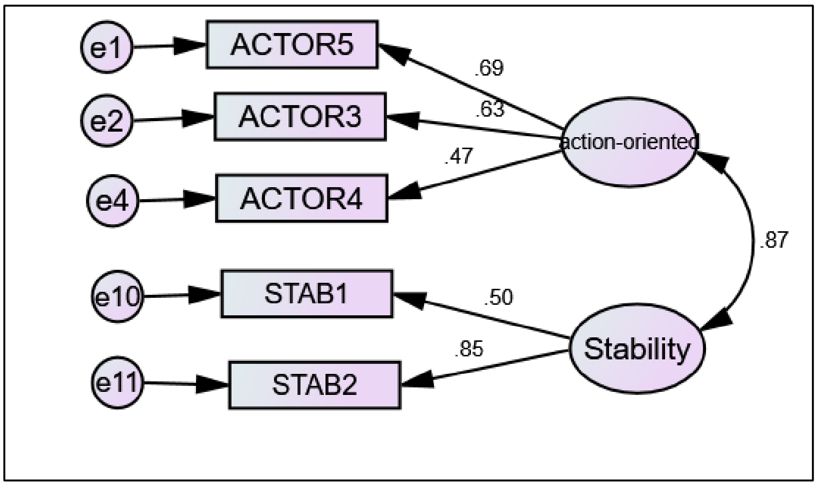


Figure 5. 9: CFA for belief and probability bias

Figure 5.9 presents the path diagram for BPEB variable dimensions (i.e., Stability bias and Action-oriented bias) and the standardized factor loading for each item and the correlations among dimensions. The observed items show a loading between 0.47 and 0.85. Although Hair et al., (2010) recommend a standardized factor loading higher than 0.5, Harrington (2009) stated that standardized loadings below 0.30 are not interpreted; however, a loading of 0.45 and above is considered fair. The following table 5.42 presents the standardized factor loading with its significance. All the items loading are significant.

Table 5. 42: Regression weight for BPEB

Item		dimension	Estimate	S.E.	C.R.	P	Label
ACTOR5	<---	Action-oriented	1.000				
ACTOR3	<---	Action-oriented	.899	.095	9.421	***	
ACTOR4	<---	Action-oriented	.815	.109	7.490	***	
STAB1	<---	Stability	1.000				
STAB2	<---	Stability	1.502	.201	7.475	***	

The model fit statistics for the PBB variable dimensions are: CMIN/DF=0.352 <5; TLI =1; CFI=0.99; GFI= 0.99 and RMSEA=0.000. These results indicate that the initial model adequately fits the data (Hair et al., 2010).

CFA for narcissistic behaviour

CFA was performed for NB: first, all the items were included in the analysis as per the original scale, and any loading less than 0.3 was removed (Hair et al., 2010). Accordingly, one item, “You do not care about other feelings when deciding uncertain events”, was removed.

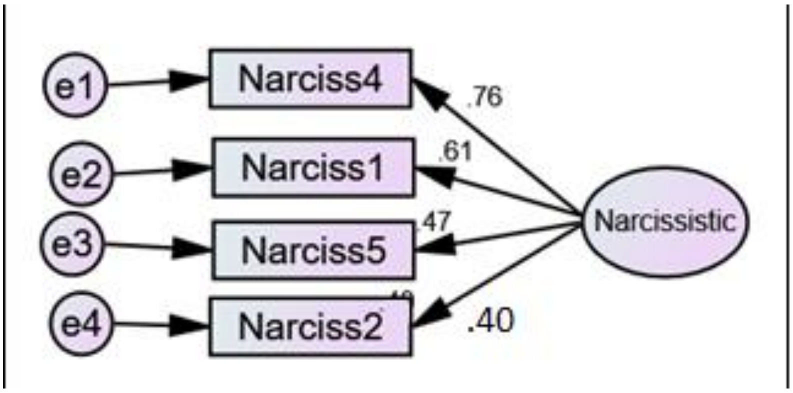


Figure 5. 10: CFA for NB

Figure 5.10 presents the path diagram for NB and the standardized factor loading for each item, and the correlations among dimensions. The observed items show a loading between 0.46 and 0.76. Although Hair et al., (2010) recommend a standardized factor loading higher than 0.5, Harrington (2009) stated that any standardized loadings below 0.30 are not interpreted; however, loadings of 0.45 and above are considered fair. The following table 5.43 presents the standardized factor loading with its significance. All the items loading are significant.

Table 5. 43: Regression weights for NB

Item		dimension	Estimate	S.E.	C.R.	P	Label
Narciss4	<---	NB	1.000				
Narciss1	<---	NB	.685	.095	7.176	***	
Narciss5	<---	NB	.573	.088	6.505	***	
Narciss2	<---	NB	.572	.092	5.760	***	

The model fit statistics for NB are CMIN/DF=0.494 <5; TLI =1; CFI=0.99; GFI= 0.99 and RMSEA=0.000. These results indicate that the initial model adequately fits the data (Hair et al., 2010).

CFA for voice behaviour

CFA was performed for VB: first, all the items were included in the analysis as per the original scale, and any loading less than 0.3 was removed (Hair et al., 2010). Accordingly, no items were removed. Figure 5.11 illustrates the CFA path diagram.

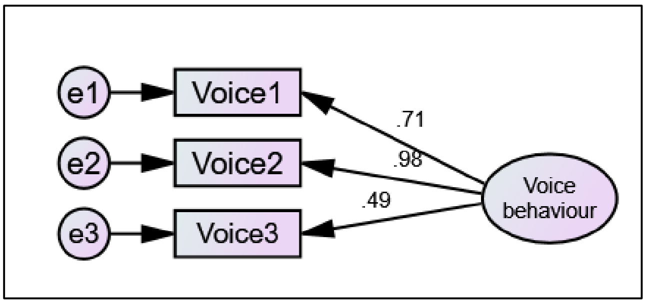


Figure 5. 11: CFA for VB

Figure 5.11 presents the path diagram for VB and the standardized factor loading for each item. The observed items show a loading between 0.49 and 0.98. Although Hair et al., (2010) recommend a standardized factor loading higher than 0.5, Harrington (2009) stated that any standardized loadings below 0.30 are not interpreted; however, loadings of 0.45 and above are considered fair. The following table 5.44 presents the standardized factor loading with its significance. All the items loading are significant.

Table 5. 44: Regression weights for VB

Item		dimension	Estimate	S.E.	C.R.	P	Label
Voice1	<---	VB	1.000				
Voice2	<---	VB	1.372	.147	9.322	***	
Voice3	<---	VB	.966	.103	9.351	***	

The model fit statistic for the VB variable dimensions was not calculated since the degree of freedom is zero due to three items to measure the construct (Hair et al., 2010).

CFA for the decision-making style of the project manager

Initially, this construct was unidimensional. Furthermore, there are two experiential and rational themes. The unidimensional option contains many low loading items and ends up eliminating all the rational items. Two models were tested in the CFA to examine the model fit for the two options (i.e., unidimensional and two-dimensions models). In the two-dimensions options, the loading for a few items was less than 0.45; as a result, two dimensions were produced, and the model fit was adopted.

The following items were eliminated from the experiential scale: “When I make project-related decisions, I do not like to have to do much thinking”, “Knowing the answer without having to understand the reasoning behind it is good enough for me”, “When I make project-related decisions, I am not that good at figuring out complicated problems”. And the following items were eliminated from the rational scale: “I am much better at figuring things out logically than most people”, “Thinking hard and for a long time about something gives me little satisfaction”, “Learning new ways to think would be very appealing to me”, “I do not think it is a good idea to rely on one’s intuition for important decisions”.

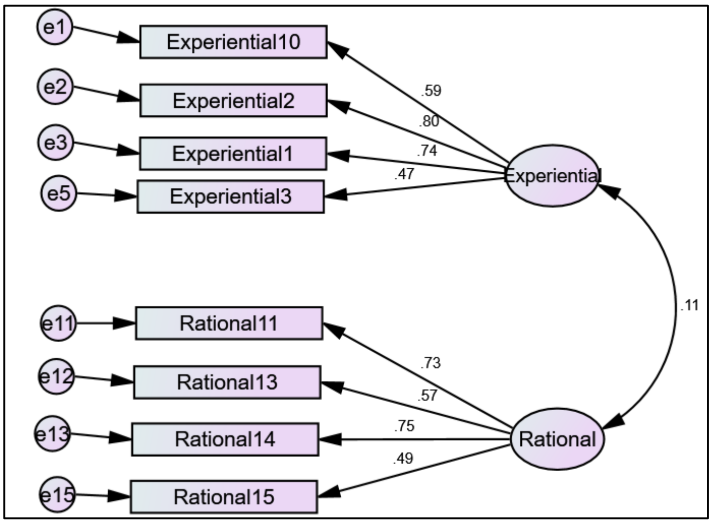


Figure 5. 12: CFA for PJMs’ DM style

Figure 5.12 presents the path diagram for VB and the standardized factor loading for each item. The observed items show a loading between 0.47 and 0. 8. Although Hair et al., (2010) recommend a standardized factor loading higher than 0.5, Harrington (2009) stated that any standardized loadings below 0.30 are not interpreted; however, loadings of 0.45 and above are considered fair. The following table 5.45 presents the standardized factor loading with its significance. All the items loading are significant.

Table 5. 45: Regression weights for DM style

Item		dimension	Estimate	S.E.	C.R.	P	Label
Experiential10	<---	Experiential	1.000				
Experiential2	<---	Experiential	1.471	.168	8.776	***	
Experiential1	<---	Experiential	1.313	.150	8.747	***	
Experiential3	<---	Experiential	.838	.129	6.502	***	
Rational11	<---	Rational	1.000				
Rational13	<---	Rational	.569	.071	7.981	***	
Rational14	<---	Rational	.758	.084	8.985	***	
Rational15	<---	Rational	.904	.129	6.983	***	

The model fit statistics for project constraints decisions are: CMIN/DF=1.541 <5; TLI =0.962; CFI=0.981; and RMSEA=0.038. These results indicate that the initial model adequately fits the data (Hair et al., 2010).

CFA for project success

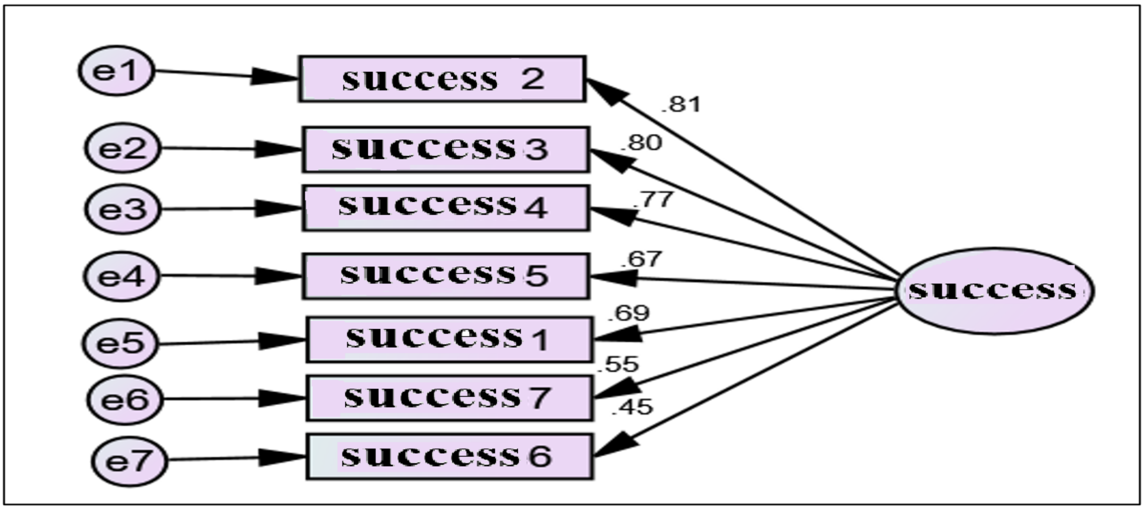


Figure 5. 13: CFA for project success

Figure 5.13 presents the path diagram for project success and the standardized factor loading for each item. The observed items show a loading between 0.45 and 0. 81. Although Hair et al., (2010) recommend a standardized factor loading higher than 0.5, Harrington (2009) stated that any standardized loadings below 0.30 are not interpreted; however, loadings of 0.45 and above are considered fair. The following table 5.46 presents the standardized factor loading with its significance. All the items loading are significant.

Table 5. 46: Regression weights for project success

Item		dimension	Estimate	S.E.	C.R.	P	Label
Outcome2	<---	Success	1.000				
Outcome3	<---	Success	.904	.063	14.429	***	
Outcome4	<---	Success	.882	.063	13.949	***	
Outcome5	<---	Success	.993	.084	11.815	***	
Outcome1	<---	Success	.893	.074	12.070	***	
Outcome7	<---	Success	.577	.062	9.326	***	
Outcome6	<---	Success	.777	.103	7.528	***	

The model fit statistic for project success is CMIN/DF=4.227 <5; TLI =0.933; CFI=0.931; and RMSEA=0.08. These results indicate that the initial model adequately fits the data (Hair et al., 2010).

CFA for study model

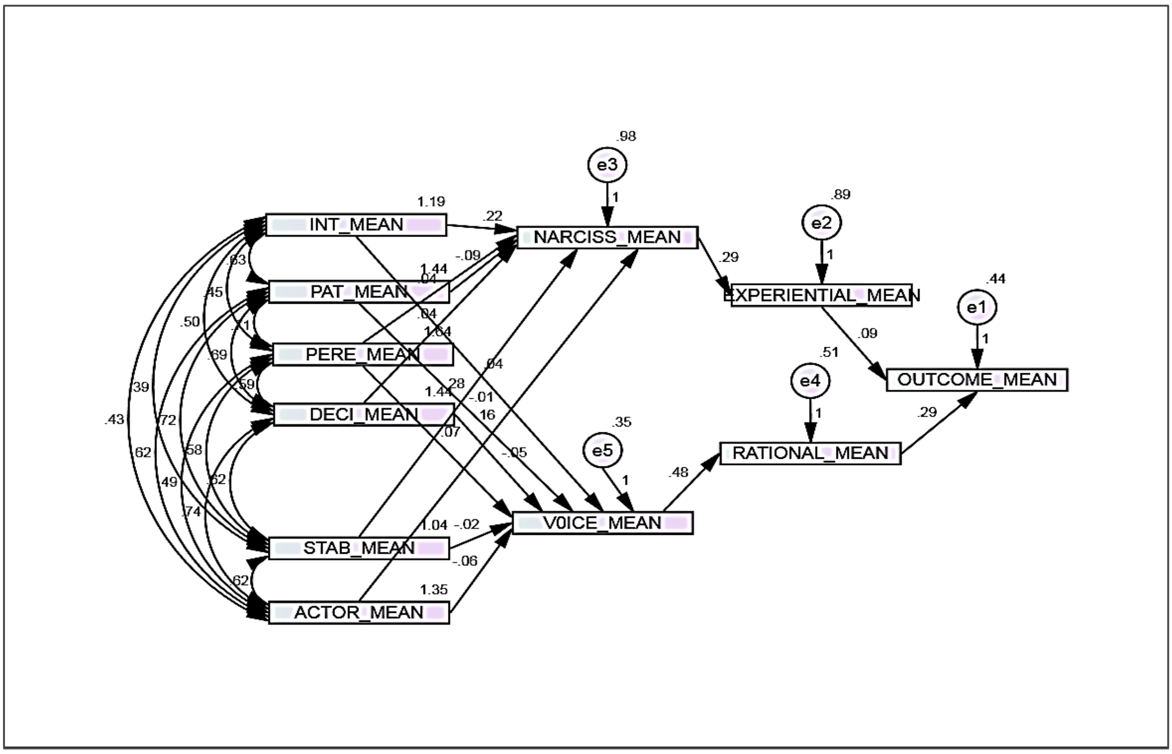


Figure 5. 14: CFA for study model

Table 5. 47: Regression weights: (Group number 1 – default model)

			Estimate	S.E.	C.R.	P	Label	
Experiential	<---	Interest	.155	.047	3.282	.001	Sig.	H1-1
Experiential	<---	Pattern	.045	.050	.902	.367		H1-2
Experiential	<---	Perception	.054	.040	1.345	.179		H1-3

			Estimate	S.E.	C.R.	P	Label	
Experiential	<---	Decision	.000	.047	-.003	.998		H1-4
Experiential	<---	Stability	.213	.059	3.625	***	Sig.	H2-1
Experiential	<---	Action	.161	.048	3.361	***	Sig.	H2-2
Rational	<---	Interest	-.016	.042	-.389	.697		
Rational	<---	Pattern	-.012	.045	-.261	.794		
Rational	<---	Perception	.090	.036	2.508	.012	Sig.	
Rational	<---	Decision	.034	.042	.812	.417		
Rational	<---	Stability	-.030	.053	-.566	.571		
Rational	<---	Action	-.082	.043	-1.924	.054		
success	<---	Experiential	.093	.034	2.725	.006	Sig.	H5
success	<---	Rational	.286	.044	6.512	***	Sig.	H5

The model fit statistics for path analysis are: CMIN/DF=3.19 <5; TLI =0.912; CFI=0.983; GFI= 0.987 and RMSEA=0.078. These results indicate that the model adequately fits the data (Hair et al., 2010).

Table 5.48 provides a summary of all items loading and adequate fit for data results:

Table 5. 48: CFA items loading

Dimensions	Items loading	Adequate fit to data
PBB	significant	Fit
BPEB	significant	Fit
NB	significant	Fit
VB	significant	Fit
DM style	significant	Fit
Project success	significant	Fit
The study model	significant	Fit

Summated variables

According to Hair et al., (2010), a summated scale represents the study variables and moves on with statistical tests. A summated scale can be created by averaging (or summation of) significant loaded items for each variable or using the factored score. Following Hair et al., (2010), a comparison between the summated variables methods summated scale (using average) is followed in this study since it reduces measurement error, represents multiple facets of the variable, and can be easily replicated for future study.

5.10 Descriptive statistics

Demographics

The demographic characteristics of this study cover the 381 valid responses. The demographic data frequencies and percentages are reported using charts, particularly pie charts and column charts. Those techniques are used for reforming and reducing data to make them more manageable (Black, 2010). The demographics of this study cover the following dimensions: Age, Gender, Education Level, Number of Years of Experience in PM, Professional Certificates in PM, Number of Successful Projects, and Current Position.

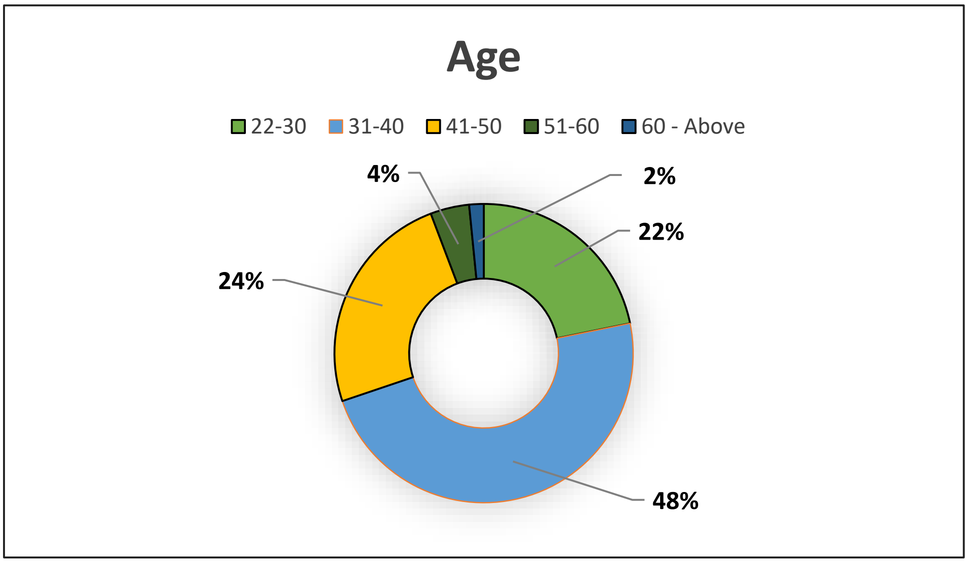


Figure 5. 15:

Respondents' age

The pie chart in figure 5.15 shows the respondents' age categories as follows: 83 respondents (22%) are in the age category 22-30 years, 183 respondents (48%) are in the age category 31-40 years, 93 respondents (24%) are in the age category 41-50 years, 16 respondents (4%) are in the age category 51-60 years and six respondents (2%) are in the age category 61 years and above.

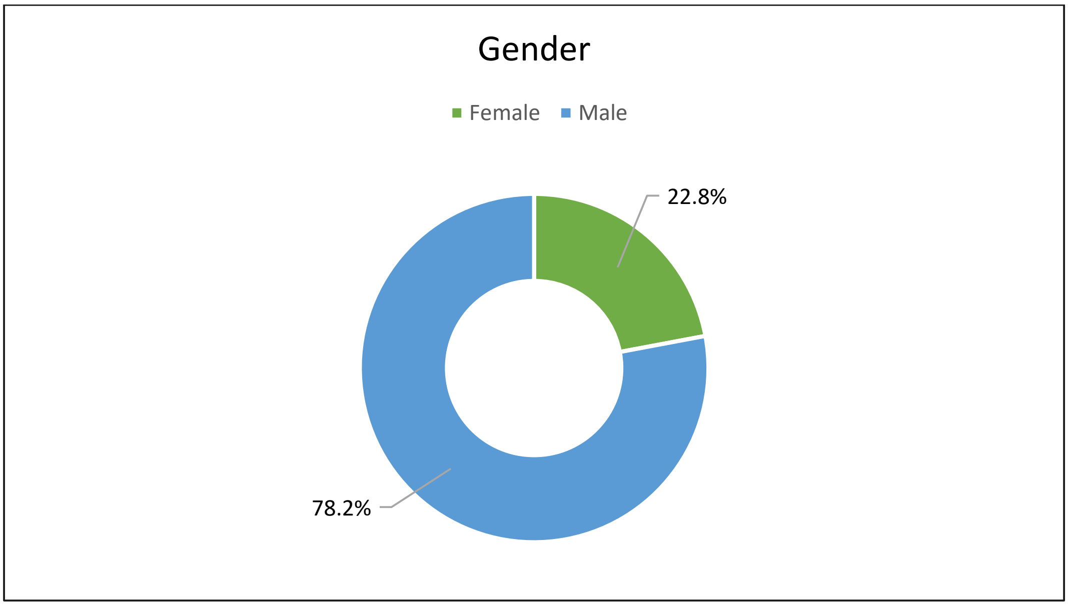


Figure 5. 16: Respondents' gender

The results of the gender statistics in figure 5.16 raised the flag again concerning bias towards hiring male PJMs over female PJMs. The pie chart in figure 5.9 shows the respondents' gender, where 84 respondents (22%) are female, and 297 respondents (78%) are male. The difference is vast and transparent between the number of male and female PJMs in the industry; stereotyping is also a source of bias against women, as stated by Pinto, Patanakul and Pinto (2017), who found that male PJMs have a more substantial opportunities to get hired over female PJMs, despite their competency and skills.

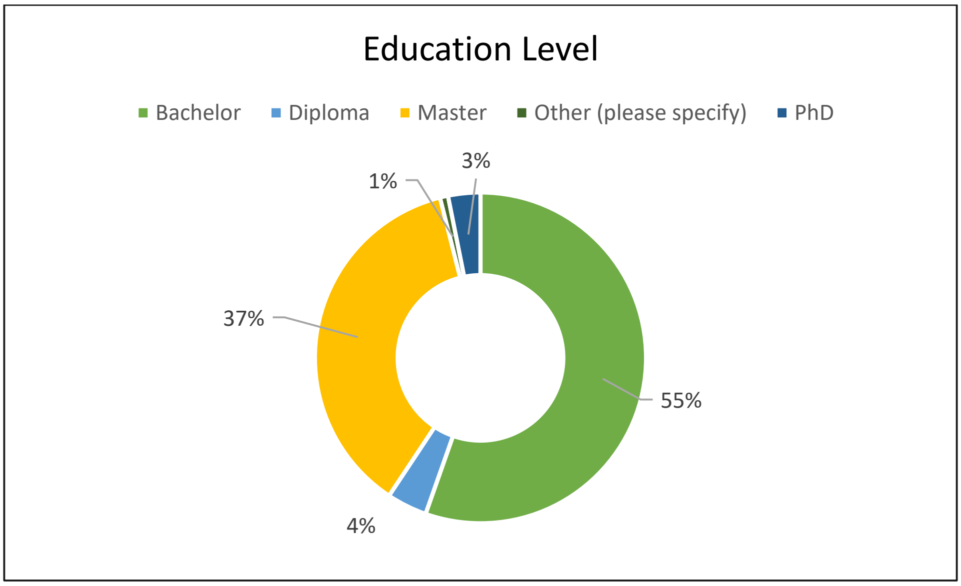


Figure 5. 17: Respondents' education level

The pie chart in figure 5.17 shows the respondents' education level: 211 respondents (55%) have a bachelor's degree, 15 respondents (4%) have a diploma, 140 respondents (37%) have a master's degree, 12 respondents (3%) have a PhD, and three respondents' (1%) education level was not within the choices – one respondent holds two master's degrees, and two respondents hold a post-graduate diploma. These statistics show the importance of education, providing PJMs with the soft skills to manage and lead projects (Pant & Baroudi, 2008), where human skills are essential.

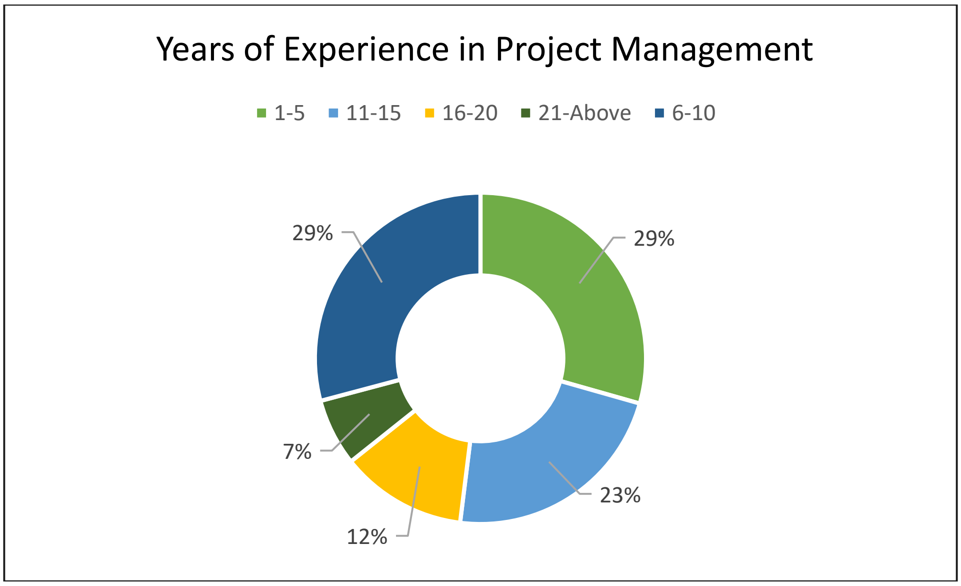


Figure 5. 18: Respondent's years of experience in PM

From the pie chart shown in figure 5.18 it is showing that 110 respondents (29%) have 1-5 years of experience, 86 respondents (29%) have 6-10 years of experience, and 87 respondents (23%) have 11-15 years of experience, 27 respondents (7%) have 21 and above years of experience, and 50 respondents (12%) have 16-20 years of experience. The PJMs' experience plays a valuable role when managing projects (Taylor, 2016); experience is considered one of the most significant factors for a successful project, including skills, motivations and self-organization.

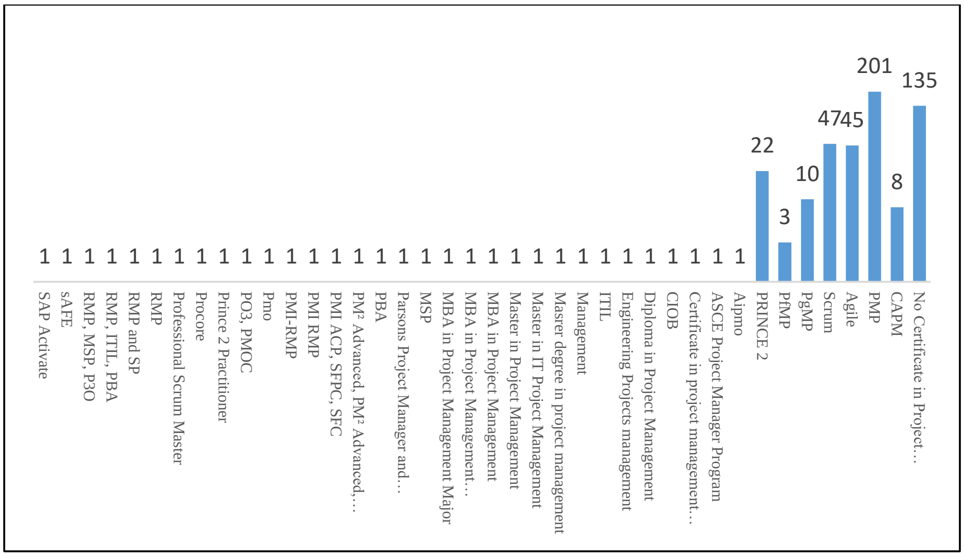


Figure 5. 19: Frequencies for PJMs' professional certificates in PM

From the bar chart presented in figure 5.19, it can be concluded that 135 respondents do not have any professional certification in PM, 201 respondents are PMP certified, 47 respondents are Scrum certified, 45 respondents are Agile certified, and 22 respondents are PRINCE2 certified. The rest of the respondents are classified under other certifications such as PfMP, PgMP, RMP, and SP.

The complete list of the certifications is presented in figure 5.19. Despite the value of PM certificates like PMP and PRINCE 2, the demographic variables show that 135 respondents do not have professional certificates in PM, whilst 315 respondents are certified. Therefore, these certificates demonstrate an excellent methodology to plan, execute and manage projects, but

Stevenson and Systems (2011) asserted that PMP/PRINCE2 certificates are ranked 15 among all the factors that lead to successful projects, which is a paradox between what recruiters require from a PJM as a proof of knowledge in PM and what is implemented on the ground.

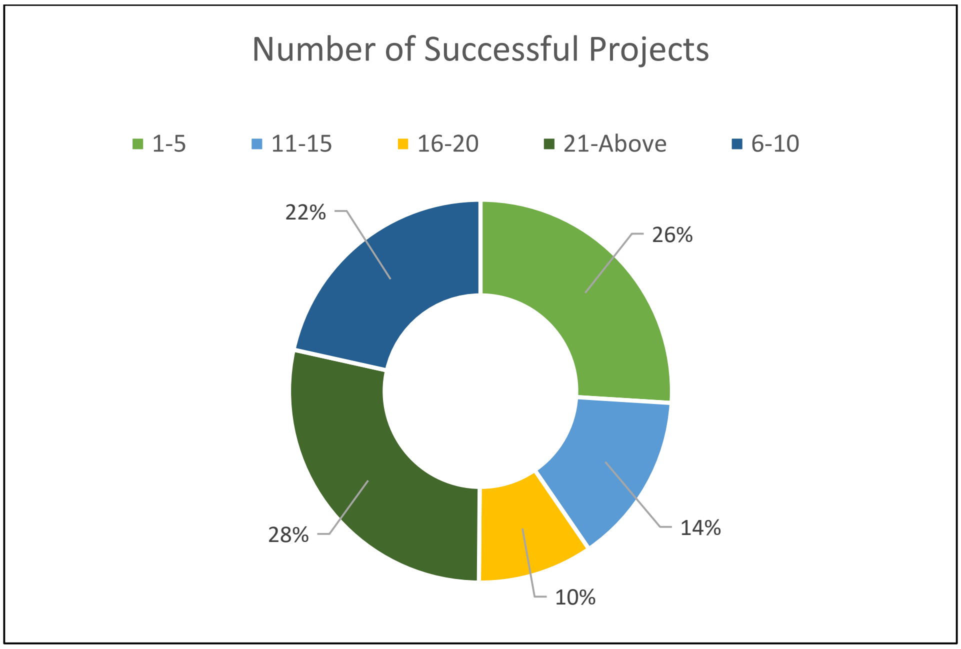


Figure 5. 20: Respondents' number of successful projects

From the pie chart shown in figure 5.20, it is clear that 108 respondents (28%) have completed a minimum of 21 successful projects, 99 respondents (26%) have completed 1-5 successful projects, 82 respondents (22%) have completed 6-10 successful projects, 55 respondents (14%) have completed 11-15 successful projects, and 37 respondents (10%) have completed 16-20 successful projects. This pie chart shows the number of successful projects but does not show the results of unsuccessful projects due to the formation of the question and the aim of the survey. Nevertheless, a Standish CHAOS group report in 2021 showed that only 31% of projects are considered successful according to the triple constraints (scope, time, and cost).

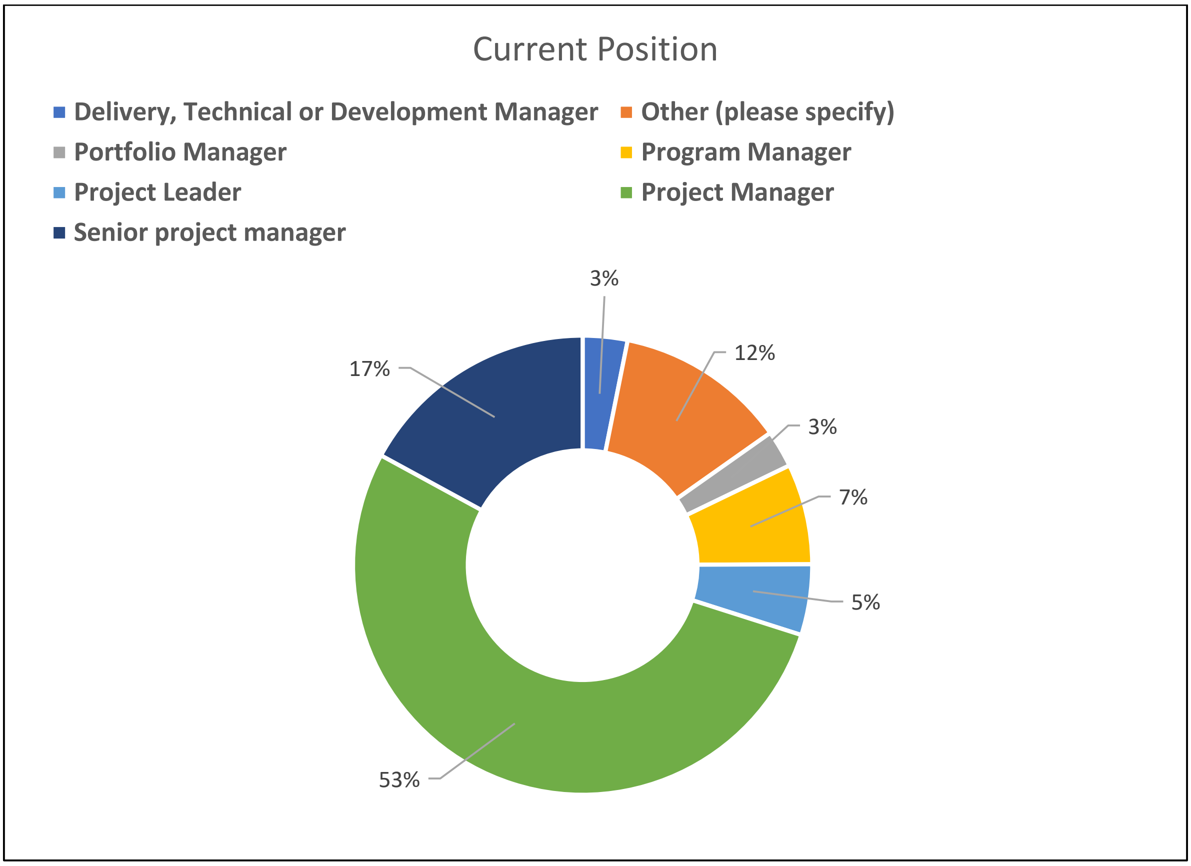


Figure 5. 21: Respondents' positions

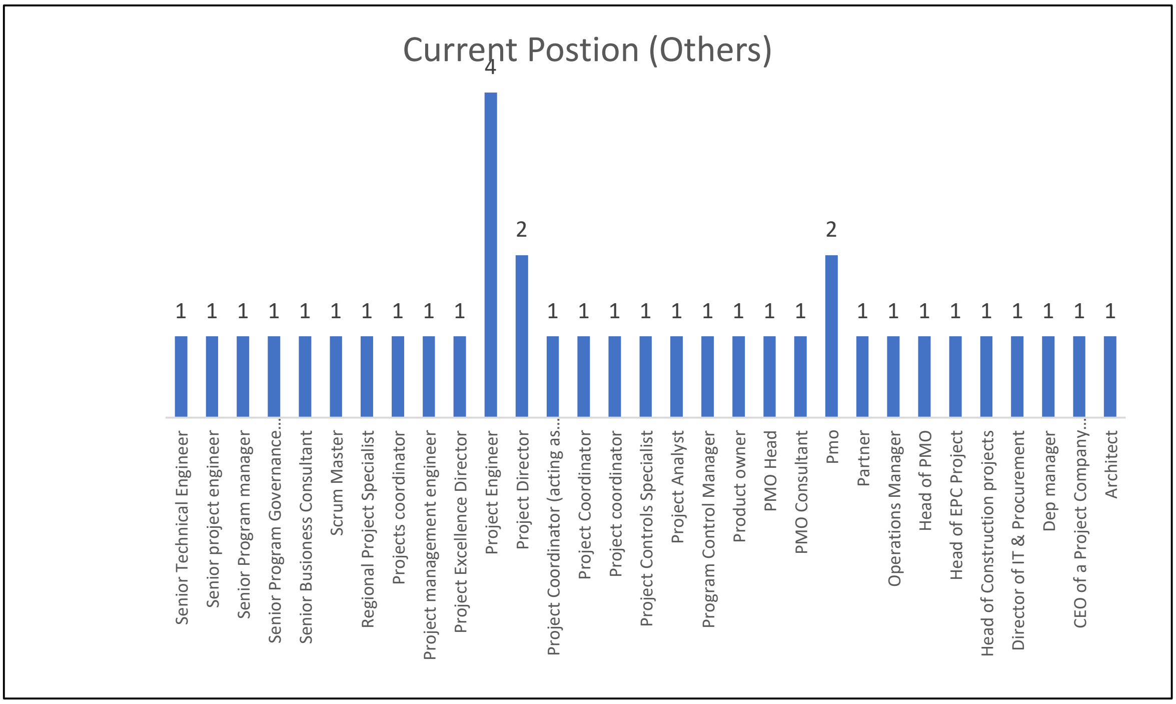


Figure 5. 22: Respondents' current position (others)

From the bar chart presented in figure 5.22, it can be concluded that 202 respondents (53%) are working as PJMs, 65 respondents (17%) are senior PJMs, 27 respondents (7%) are programme managers, 19 respondents (5%) are project leaders, ten respondents (3%) are portfolio managers, and 12 respondents (3%) are delivery, technical or development managers. The rest of the respondents work in several other positions, as furnished in figure 5.15.

Study variables

To describe respondents' perception towards each item in the questionnaire, the mean and the standard deviation were calculated for the sample and skewness and kurtosis.

The mean is a measure of the central tendency that provides information about the centre of the middle part of the group (Black, 2010); it also offers a general picture of the data (Sekaran & Bougie, 2013). It provides an overall picture of the respondent’s perception toward each item, dimension, and variable.

The standard deviation measures variability that describes the data's dispersion (Black, 2010). A small standard deviation value indicates that the value is closely clustered about the mean, while a considerable standard deviation value indicates the opposite. Together with measures of the central tendency and variability measure, it is possible to describe the study data fully.

To overview the study variables, the mean and the standard deviation of the study items and the study summated variables were calculated. Additionally, to classify the mean score of the study items and summated variables, a classification criterion was established according to the following equation:

“Range= (Max score of the scale – Min score of the scale) / The number of the scale points”

Accordingly, range = 7-1 /7 = 0.857; table 5.49 presents the means score ranges and the mean level.

Table 5. 49: Mean score range and levels. Source: Sekaran (2012)

Mean score range		Mean level
1.00	1.86	Very low

1.87	2.71	Low
2.72	3.57	Slightly low
3.58	4.43	Moderate
4.44	5.29	slightly high
5.30	6.14	High
6.15	7.00	Very high

Skewness and kurtosis are measures of shape that also provide information regarding the data normality. Skewness "describes distribution as asymmetrical or lacks symmetry" (Black, 2010, p. 77), and kurtosis "describes the amount of peakiness of a distribution" (Black, 2010, p. 78). Skewness and kurtosis have accepted limits to consider a data set as normally distributed; according to Garson (2009), the accepted range of values for the two measures is between -2 and +2. Tables 5.50 and 5.52 present the items and the summated variables' mean, mean classification, standard deviation, skewness, and kurtosis.

Table 5. 50: Mean and standard deviation for the study items

Coding	Mean	Standard deviation	Mean level	Min	Max	Skewness	Kurtosis
Interest bias							
INT1	5.168	1.4938	Slightly high	1.0	7.0	-1.073	.514
INT2	3.631	1.7602	Moderate	1.0	7.0	.233	-1.271
INT3	5.408	1.3577	High	1.0	7.0	-1.316	1.400
Pattern recognition bias							
PAT1	4.453	1.6854	slightly high	1.0	7.0	-.449	-.954
PAT2	3.637	1.8832	Moderate	1.0	7.0	.311	-1.287
PAT3	5.034	1.5386	Slightly high	1.0	7.0	-.969	.117
PAT4	2.912	1.6208	Slightly low	1.0	7.0	.812	-.445
Perception bias							
PERCE2	4.784	1.5852	Slightly high	1.0	7.0	-.853	-.354
PERCE3	4.776	1.5682	Slightly high	1.0	7.0	-.739	-.365
Decision bias							
DECI1	2.561	1.5432	Low	1.0	7.0	1.308	.927
DECI2	4.193	1.6307	Moderate	1.0	7.0	-.326	-.897
DECI3	2.745	1.4797	Slightly low	1.0	7.0	1.057	.463
Stability Bias							
STAB1	3.644	1.5660	Moderate	1.0	7.0	.194	-.949
STAB2	2.553	1.3878	Low	1.0	7.0	1.276	1.123
STAB3	5.396	1.1392	High	1.0	7.0	-1.473	3.009
Action-oriented bias							
ACTOR3	2.568	1.4373	Low	1.0	7.0	1.169	.668
ACTOR4	4.401	1.7406	Moderate	1.0	7.0	-.330	-.934
ACTOR5	2.780	1.4666	Slightly low	1.0	7.0	1.197	.716
NB							
Narciss1	4.997	1.4555	Slightly high	1.0	7.0	-.921	.422
Narciss2	2.946	1.7472	Slightly low	1.0	7.0	.807	-.390
Narciss4	3.669	1.7093	Moderate	1.0	7.0	.096	-.993

Narciss5	3.432	1.5793	Slightly low	1.0	7.0	.217	-.878
VB							
Voice1	6.280	.6623	Very high	2.0	7.0	-1.691	7.242
Voice2	6.289	.6569	Very high	2.0	7.0	-1.847	9.190
Voice3	6.068	.9171	High	1.0	7.0	-1.961	6.542
The DM style of the PJM (experiential)							
Experiential1	4.464	1.4305	slightly high	1.0	7.0	-.509	-.308
Experiential2	3.990	1.4947	Moderate	1.0	7.0	-.154	-.632
Experiential3	4.562	1.4408	Slightly high	1.0	7.0	-.421	-.264
Experiential4	2.707	1.3755	Slightly low	1.0	7.0	1.273	1.442
Experiential10	2.898	1.3667	Slightly low	1.0	7.0	.883	.338
The DM style of the PJM (rational)							
Rational11	5.760	1.0900	High	2.0	7.0	-1.670	3.375
Rational13	6.066	.7992	High	1.0	7.0	-2.073	8.506
Rational14	6.105	0.812	High	2.0	7.0	-2.042	7.248
Rational15	4.869	1.4881	Slightly high	1.0	7.0	-.645	-.048
Project success							
Outcome1	5.647	0.9769	High	1	7	-1.53	4.08
Outcome2	5.743	0.9287	High	1	7	-1.60	5.24
Outcome3	5.808	0.8511	High	2	7	-1.56	4.89
Outcome4	5.839	0.8545	High	2	7	-1.56	4.70
Outcome5	5.312	1.106	High	1	7	-0.98	1.56
Outcome6	4.928	1.29	Slightly high	1	7	-0.63	0.16
Outcome7	5.925	0.7886	High	2	7	-1.29	3.29

Table 5. 51: Study summated variables descriptive statistics

	Factor	Mean	Std. Deviation	Order	Mean level	Min.	Max.	Skewness	Kurtosis
Perception and behaviour bias	Interest bias	4.74	1.09	2	Slightly high	1	7	-.578	.639
	Pattern recognition bias	4.01	1.20	3	Moderate	1	7	.074	-.369
	Perception bias	4.78	1.28	1	Slightly high	1	7	-.759	.144
	Decision bias	3.17	1.20	4	Slightly low	1	7	.699	.527
BPEB	Stability bias	3.86	1.02	1	Moderate	1	7	.383	.240
	Action-oriented bias	3.25	1.16	2	Slightly low	1	7	.561	.410
Behaviour	NB	3.76	1.12	2	Moderate	1	7	.016	-.223
	VB	6.21	0.61	1	Very high	2	7	-1.562	7.161
Decision_ making style	Experiential	3.72	1.00	1	Moderate	1	7	.127	.448
	Rational	5.70	0.77	2	High	2	7	-.999	2.276
Project outcomes	Success	5.60	0.71	--	High	3	7	-.798	2.049

Results in the table 5.51 shows that PJMs perceived the attributes for the perception and behaviour bias higher the way they perceived the attributes of estimating probabilities and beliefs. The most practised degree of perception and behaviour bias is in the perception bias type, followed by the interest bias type, then the pattern recognition bias, and finally comes the least practised bias, decision bias. The respondent’s perception of the mean level of PJMs practise stability bias to a moderate degree, which is greater than that for action-oriented bias, which was graded slightly low in BPEB. The respondent’s perception of the mean level of PJMs VB to a very high degree, which is greater than the degree of NB perception whish was graded as moderate.

The respondent’s perception of the mean level of rational DM of the PJM is high, while the respondent’s perception of mean of experiential DM style of the PJM is moderate; it is also noticed that the respondent’s perception for project success mean is high.

Correlations

Correlation measures the degree of relatedness of variables (Black, 2010), it is one of the most common analyses used in scientific researches (Taylor, 1990). It determines the if a relationship exist between two variables and how significant this relationship either strong or weak (Taylor, 1990).

The correlation coefficient (sometimes referred as Pearson correlation) measure represents the linear correlation between two variables in sign and magnitude. The correlations ***r*** value represents the magnitude and the direction of the relationship, either it is a positive or negative (Taylor, 1990). The range of ***r*** value ranged between (-1/+1) where zero value indicates that no relationship between the two variables. The strength of the relationship is determined by the close the ***r*** value to -/+ 1 regardless of the direction. Thus, the value of (r = + 0.85) or (r = - 0.85) are the same in the association of the measured variables, however, positive relationship indicates that an increase in the first variable lead to in an increase the second variable, on the other hand, negative correlation represents an opposite relationship between measured variables where one variable increases the other variable decrease (Taylor, 1990).

Pearson’s correlation can be used to check the assumption of linearity before testing the regression. Additionally, the Pearson correlations value can be used as an indicator for multicollinearity, where a correlation higher than 0.9 can be a sign of multicollinearity (Garson, 2009).

Table 5. 52: Pearson’s correlation

		1	2	3	4	5	6	7	8	9	10	11
1	Interest Bias	1										
2	Pattern recognition bias	.482**	1									
3	Perception bias	.324**	.458**	1								
4	Decision bias	.386**	.479**	.386**	1							
5	Stability Bias	.350**	.588**	.444**	.508**	1						
6	Action-oriented bias	.340**	.448**	.330**	.533**	.521**	1					
7	NB	.336**	.264**	.248**	.304**	.391**	.357**	1				
8	VB	.027	-.033	.077	-.103*	-.067	-.126*	.019	1			
9	Experiential	.357**	.379**	.307**	.328**	.437**	.405**	.328**	-.006	1		
10	Rational	-.019	-.014	.096	.007	-.029	-.083	-.043	.379**	.064	1	
11	Success	.087	.166**	.249**	.135**	.140**	.125*	.127*	.351**	.151**	.322**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Based on the results in table 5.52, the independent variables coded from 1 to 6 have a significant linear correlation with the dependent variable experiential DM style of the PJM, while the correlation between the independent variables and rational DM style of the PJM variable was insignificant; accordingly, no linear correlation is found. For the dependent variable (project success), it can be noticed that all the independent variables have a significant positive correlation with the success, except for interest bias.

5.11 Testing study hypotheses

Hypothesis testing refers to analysing the results that indicate whether a particular hypothesis is a valid statement. In this study, multiple regression analysis was used using IBM SPSS statistics version 20.

Regression analysis is the process of “constructing a mathematical model or function that can be used to predict or determine one variable by another variable or other variables” (Black, 2010.). Regression analysis might be linear, bivariate, or multivariate, depending on the conceptual study model. A level of significance must be determined to accept or reject hypotheses. For this study, the significance level is 0.05 (i.e. 95% confidence interval) since it is the most acceptable level in management study (Sekaran & Bougie, 2012).

The regression assumptions that must be checked before accepting the regression results are- multivariate normality, which is checked by the scatter plot and the normal probability plot (p-p) plot. This test is called the residual analysis test and is used to test any violation of the regression assumptions.

Multicollinearity increases the standard error of the β coefficients, thus causing the regression coefficients to be unstable; a high level of multicollinearity increases the probability that a predictor of the outcome is found to be non-significant and rejected from the model while it is significant (Hair et al., 2010). Multicollinearity is checked by tolerance (i.e., Tolerance > 0.1) and variance inflation factor (VIF) (i.e., VIF< 10).

The correlation coefficient is less important if not interpreted properly (Taylor, 1990); although it is hard to interpret it there is category to determine the value the interpretation of the ***r*** coefficient value as generally interpreted as follow:

1- Values that are less or equal 0.35 are considered low or weak correlation.

2- Values ranged between 0.36-.067 considered moderate correlations.

3- Values ranged between 0.68-1.0 considered strong correlation.

The use of coefficient correlations relies on the scale where data is available and on interval ratio scale (Udovičić, et al 2007).

Testing the first hypothesis (Experiential)

The first section of testing the hypotheses is testing the first hypothesis based on the experiential DM style. Hence:

H1: There is a direct relationship between perception and behavioural bias and the DM style of the PJM (experiential) during IT software development projects.

<u>Sub-hypotheses</u>

H1-1: There is a direct relationship between interest bias and the DM style of the PJM (experiential) during IT software development projects.

H1-2: There is a direct a relationship between pattern recognition and the DM style of the PJM (experiential) during IT software development projects.

H1-3: There is a direct relationship between perception bias and the DM style of the PJM (experiential) during IT software development projects.

H1-4 There is a direct relationship between decision bias and the DM style of the PJM (experiential) during IT software development projects.

The regression test results are presented in the following tables (5.53 and 5.54). The model summary results, including R, R^2 and Adjusted $R^{2,}$ are represented in table 8.1. The correlation coefficient R = 0.459 indicates a positive correlation between PBB dimensions and the DM style of the PJM; this shows that the independent and dependent variables change in the same direction.

R-square, coefficient of determination, offers information about the "goodness of fit" of the regression model; it represents the percentage of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2016). The value of R^2=0.210 indicates the amount of variation in the DM style of the PJM that is due to the fitted model and has been explained by PBB dimensions, which means that these dimensions explain 21% of the variance of the DM style of the PJM (experiential).

The adjusted R^2 indicates the generalizability of the model, and it gives an idea regarding generalizing the results taken from the sample to the entire population. It is noticed that the value of the adjusted $R^2 = 0.202$, which is close to the value of $R^2 = 0.210$. By subtracting the adjusted R^2 from R^2, the value is 0.008. This amount indicates that if the entire population participates in the study, there is a 0.8% reduction in the outcome variance.

Table 5. 53: Multiple regression model summary H1

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.459	0.210	0.202	0.894

Predictors: (Constant), Decision, Interest, Perception, Pattern

The analysis of variance (ANOVA) results is presented in table 8.1; these results allow the study to test the main null hypothesis statistically. The results of the ANOVA table show that the F = 25.031, which is significant at level $p<0.05$ (sig. < 0.001). Multiple regressions ANOVA results indicate that the model as a whole (including the four dimensions) is significant (Pallant, 2016).

Table 5. 54: Multiple regression ANOVA table for H1

ANOVA

	Model	Sum of squares	df	Mean square	F	Sig.
	Regression	80.075	4	20.019	25.031	.000[b]
1	Residual	300.705	376	.800		
	Total	380.780	380			

a. Dependent Variable: Experiential

b. Predictors: (Constant), Decision, Interest, Perception, Pattern

For evaluating each of the independent variables, results from the coefficient table indicate the effect of each predictor variable on the dependent variable. This effect is evaluated using t-value and p-value. The p-value <0.05 is considered significant; the results are presented in table 5.54.

Results show that all dimensions of PBB are significant contributors to the DM style of the PJM (p-value <0.05). Furthermore, Interest Bias has a significant positive effect on the DM style of the PJM (experiential) with a β of 0.186 (p=0.001<0.05), which indicates that a unit increase in interest bias leads to a 0.18 unit increase in the DM style of the PJM (experiential). Pattern recognition bias significantly and positively affects the DM style of the PJM with a β of 0.175 (p=0.003<0.05). Perception bias has a significant positive effect on the DM style of the PJM (experiential) with a β of 0.118 (p=0.027<0.05). Decision bias has a significant positive effect on the DM style of the PJM (experiential) with a β of 0.127 (p=0.020<0.05). This indicates that H1-1, H1-2, H1-3, and H1-4 are supported.

Table 5. 55: Multiple regression coefficients for H1

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.561	.235		6.648	.000		
	Interest bias	.170	.049	.186	3.461	.001	.730	1.369
	Pattern recognition bias	.145	.049	.175	2.982	.003	.611	1.635
	Perception bias	.092	.041	.118	2.222	.027	.747	1.338
	Decision bias	.106	.045	.127	2.338	.020	.712	1.405

a. Dependent variable: Experiential

Moreover, the multivariate normality assumption is satisfied from the normal p-p plot and the scatter plot presented in figures 5.23 and 5.24. Additionally, from the tolerance and the VIF values presented in table 5.40, it can be concluded that no issue of multicollinearity is detected since tolerance values ranged from 0.611 to 0.747 >0.1 and VIF values ranged from 1.338 to 1.635 <10 (Garson, 2009). Thus, the results of the regression analysis for H1 are accepted.

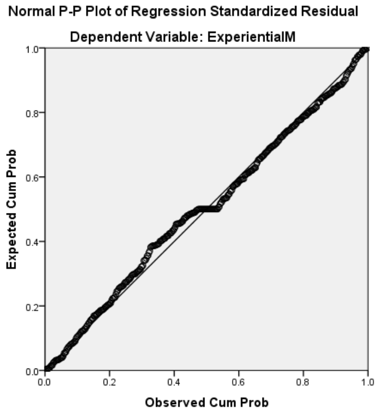


Figure 5. 23: Multiple regression normal p-p plot (H1)

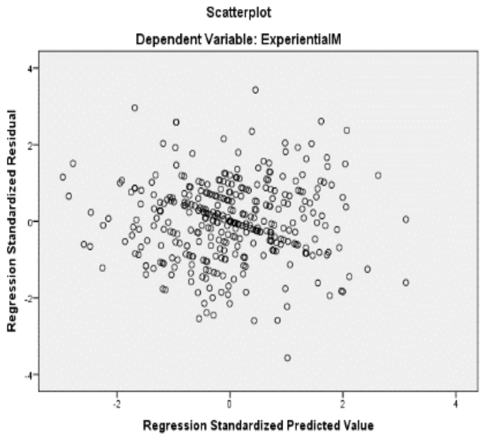


Figure 5. 24: Multiple regression scatter plot (H1)

Testing the first hypothesis (Rational)

H1: There is a direct relationship between perception and behavioural bias and the DM style of the PJM (rational) during IT software development projects.

Sub-hypotheses

H1-1: There is a direct relationship between interest bias and the DM style of the PJM **(**rational) during IT software development projects.

H1-2: There is a direct relationship between pattern recognition bias and the DM style of the PJM **(**rational) during IT software development projects.

H1-3: There is a direct relationship between perception bias and the DM style of the PJM **(**rational) during IT software development projects.

H1-4: There is a direct relationship between decision bias and the DM style of the PJM **(**rational) during IT software development projects.

The regression test results are presented in the following tables (5.56 to 5.58). The model summary results, including R, R^2 and adjusted R^2, are represented in table 5.56. The correlation coefficient R = 0.120 indicates a positive correlation between PBB dimensions and the DM style of the PJM **(**rational); this shows that the independent and dependent variables change in the same direction. a value of 0.120 is considered a weak or correlation (Black, 2009). However, the relationship exists between the two variables, but it is statistically rejected. The researcher agrees with Black, (2009) for a certain level where strong relationship does' mean that the relationship is appropriate; statistics can give great value that closer to +/-1 but these values is based on the attitude of the respondents (Udovičić, et. Al 2007).

R-square, coefficient of determination, offers information about the "goodness of fit" of the regression model; it represents the percentage of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2016). The value of R^2=0.014 indicates the proportion of variation in the DM style of the PJM that is due to the fitted model and has been explained by the PBB dimensions, which means that these dimensions explain 1.4% of the variance of the DM style of the PJM (rational)**.**

The adjusted R^2 indicates the generalizability of the model, and it gives an idea regarding generalizing the results taken from the sample to the entire population; it is noticed that the value of the adjusted R^2= 0.004, which is close to the value of R^2 = 0.014. By subtracting the adjusted R^2 from R^2, the value is 0.01; this amount indicates that if the entire population participates in the study, there is a 1% reduction in the outcome variance.

Table 5. 56: Multiple regression model summary H1 (Rational)

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.120[a]	.014	.004	.77262

Predictors: (Constant), Decision, Interest, Perception, Pattern

The analysis of variance (ANOVA) results is presented in table 5.57; these results allow the study to test the main null hypothesis statistically. Multiple regression ANOVA results indicate that the model as a whole (including the four dimensions) is significant (Pallant, 2016). The results of the ANOVA table show that the F = 1.365, which is insignificant at level p<0.05 (p=

0.246). This indicates that the whole model of perception behaviour bias has an insignificant effect on the DM style of the PJM (rational).

Table 5. 57: Multiple regression ANOVA for H1 (Rational)

Model		Sum of squares	df	Mean square	F	Sig.
	Regression	3.259	4	.815	1.365	.246[b]
1	Residual	224.451	376	.597		
	Total	227.710	380			

a. Dependent Variable: Rational
b. Predictors: (Constant), Decision, Interest, Perception, Pattern

Table 5.58 presents the multiple regression coefficients; however, the regression coefficients are unnecessary since the F value was insignificant.

Table 5. 58: Multiple regression coefficients for H1 (Rational)

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. error	Beta			Tolerance	VIF
1	(Constant)	5.579	.203		27.509	.000		
	Interest Bias	-.023	.043	-.033	-.552	.582	.730	1.369
	Pattern recognition bias	-.037	.042	-.058	-.881	.379	.611	1.635
	Perception bias	.081	.036	.135	2.274	.024	.747	1.338
	Decision bias	-.003	.039	-.004	-.069	.945	.712	1.405
a. Dependent Variable: Rational								

Testing the second hypothesis (Experiential)

H2: There is a direct relationship between belief and probability estimation bias and the DM style of the PJM (experiential) during IT software development projects.

Sub-hypotheses

H2-1: There is a direct relationship between stability bias and the DM style of the PJM (experiential) during IT software development projects.

H2-2: There is a direct relationship between action-oriented bias and the DM style of the PJM (experiential) during IT software development projects.

The regression test results are presented in the following tables (5.59 to 5.61). The model summary results, including R, R2 and Adjusted R2, are represented in table 8.7. The correlation coefficient R = 0.484 indicates a positive correlation between BPEB dimensions and the DM style of the PJM (experiential); this shows that the independent and dependent variables change in the same direction.

R-square, coefficient of determination, offers information about the "goodness of fit" of the regression model; it represents the percentage of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2003). The value of R^2=0.234 indicates the proportion of variation in the DM style of the PJM that is due to the fitted model and has been explained by BPEB dimensions, which means that these sources of bias explain 21% of the variance of the DM style of the PJM (experiential).

The adjusted R^2 indicates the generalizability of the model, and it gives an idea regarding generalizing the results taken from the sample to the entire population; it is noticed that the value of the adjusted R^2= 0.230, which is close to the value of R^2 = 0.234. By subtracting the adjusted R^2 from $R^{2,}$ the value is 0.004. This amount indicates that if the entire population participates in the study, there is 0.4% reduction in the outcome variance.

Table 5. 59: Model summary for H2

Model	R	R square	Adjusted R square	Std. error of the estimate
1	.484[a]	.234	.230	.87844

a. Predictors: (Constant), Action-oriented, Stability

b. Dependent Variable: Experiential

The analysis of variance (ANOVA) results is presented in table 5.60; these results allow the study to test the main null hypothesis statistically; multiple regressions ANOVA results indicate that the model as a whole (including the two dimensions) is significant (Pallant, 2003). The results of the ANOVA in table 5.60 show that the F = 54.731, which is significant at level p<0.05 (p= 0.000). This indicates that the whole model of BPEB significantly affects the DM style of the PJM (experiential).

Table 5. 60: ANOVA for H2

ANOVA						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	89.097	2	44.548	57.731	.000
	Residual	291.683	378	.772		
	Total	380.780	380			
a. Dependent Variable: Experiential						
b. Predictors: (Constant), Action, Stability						

For evaluating each of the independent variables, results from the coefficient table indicate the effect of each predictor variable on the dependent variable. This effect is evaluated using t-value and p-value; the p-value <0.05 is considered significant.

Results show that all dimensions of perception and BPEB are significant contributors to the DM style of the PJM (experiential) (p-value <0.05). Furthermore, stability bias has a significant positive effect on the DM style of the PJM (experiential) with a β of 0.304 (p=0.000<0.05), which indicates that a unit increase in stability bias leads to a 0.304 unit increase in the DM style of the PJM (experiential). Action-oriented bias significantly positively affects the DM style of the PJM. These results indicate that H2-1 and H2-2 are supported.

Table 5. 61: Multiple regression coefficients for H2 (*Experiential*)

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. error	Beta			Tolerance	VIF
1	(Constant)	1.869	.182		10.286	.000		
	Stability Bias	.304	.052	.310	5.873	.000	.728	1.373
	Action-Oriented bias	.210	.045	.244	4.616	.000	.728	1.373

a. Dependent Variable: Experiential

Moreover, the multivariate normality assumption is satisfied from the normal p-p plot and the scatter plot presented in figures 5.25 and 5.26. Additionally, from the tolerance and the VIF values presented in table 8.9, it can be concluded that no issue of multicollinearity is detected since tolerance values ranged from 0.611 to 0.747 >0.1 and VIF values ranged from 1.338 to 1.635 <10 (Garson, 2009). Thus, the results of the regression analysis for H2 are accepted.

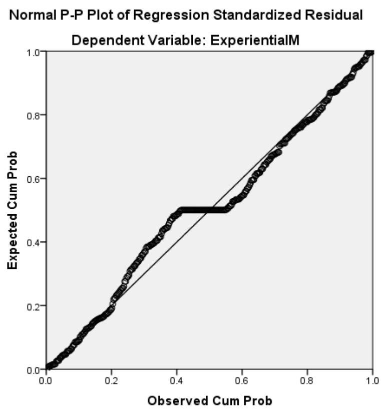


Figure 5. 25: Multiple regression scatter plot for H2

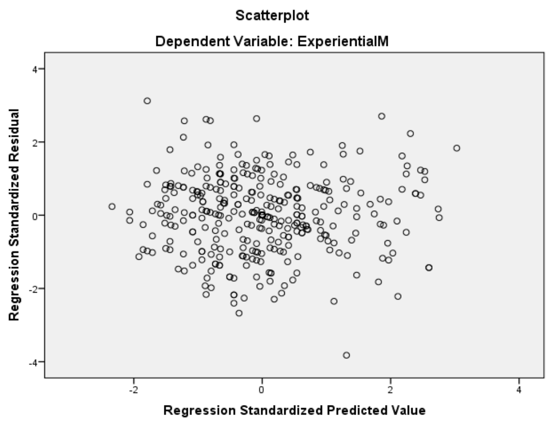


Figure 5. 26: Multiple regression normal p-p plot for H2

Testing the second hypothesis (Rational)

H2: There is a direct relationship between belief and probability estimation bias and the DM style of the PJM (rational) during IT software development projects.

<u>Sub-hypotheses</u>

H2-1: There is a direct relationship between stability bias and the DM style of the PJM (rational) during IT software development projects.

H2-2: There is a direct relationship between action-oriented bias and the DM style of the PJM (rational) during IT software development projects.

The regression test results are presented in the following tables (5.62 to 5.64). The model summary results, including R, R^2 and Adjusted R^2, are represented in table 5.62. The correlation coefficient R = 0.084 indicates a positive correlation between BPEB dimensions and the DM style of the PJM (rational); this shows that the independent and dependent variables change in the same direction. However, a value of 0.084 is considered a weak correlation (Black, 2010). R-square, coefficient of determination, offers information about the "goodness of fit" of the regression model; it represents the percentage of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2016). The value of R^2=0.007 indicates the proportion of variation in the DM style of the PJM that is due to the fitted model and has been explained by PBB dimensions, which means that these dimensions explain 1.4% of the variance of the DM style of the PJM (rational).

The adjusted R^2 indicates the generalizability of the model, and it gives an idea regarding generalizing the results taken from the sample to the entire population. It is noticed that the value of the adjusted R^2= 0.002, which is close to the value of R^2 = 0.007. By subtracting the adjusted R^2 from R^2, the value is 0.005. This amount indicates that if the entire population participates in the study, there is 0.3% reduction in the outcome variance.

Table 5. 62: Multiple regression model summary for H2 (Rational)

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	.084 [a]	.007	.002	.77338

a. Predictors: (Constant), Action-Oriented, Stability

b. Dependent Variable: Rational

The analysis of variance (ANOVA) results is presented in table 5.48; these results allow the study to test the main null hypothesis statistically. The multiple regression ANOVA results indicate that the model as a whole (including the two dimensions) is insignificant (Pallant, 2003). The results of the ANOVA in table 5.63 show that the F = 1.353, which is insignificant at level p<0.05 (p= 0.260). This indicates that the whole model of BPEB insignificantly affects the DM style of the PJM (rational).

Table 5. 63: Multiple regression ANOVA for H2 (Rational)

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1.619	2	.809	1.353	.260[b]
	Residual	226.091	378	.598		
	Total	227.710	380			

a. Dependent variable: Rational
b. Predictors: (Constant), action-oriented, stability

Table 5.64 presents the multiple regression coefficients; however, since the F value was insignificant, the regression coefficients values are not of much value.

Table 5. 64: Multiple regression coefficients for H2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.844	.160		36.532	.000		
	Stability Bias	.014	.046	.019	.316	.753	.728	1.373
	Action-Oriented bias	-.062	.040	-.093	-1.542	.124	.728	1.373

a. Dependent Variable: Rational

Testing the moderation effect hypothesis

The moderation effect is being tested using the Process Hayes macro. According to Hayes and Rockwood (2017), moderation analysis is used to "address, when, or under what circumstances, or for what types of people that effect exist or does not and in what magnitude" (p.9). The following figure 5.20 represents the concept of moderation.

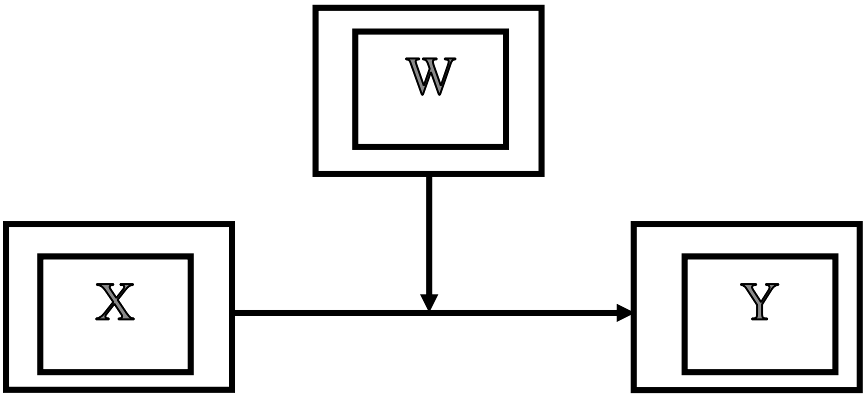


Figure 5. 27: The Moderation conceptual model

Where X represents the independent variable, Y represents the dependent variable, and W represents the moderation variable. Hence, the linking arrow from W to the effect of X on Y denotes that the effect of X on Y is affected by W (Hayes & Rockwood, 2017).

The statistical model of the moderation effect is represented in figure 5.28 by the interaction effect XW, which is multiplying X with W.

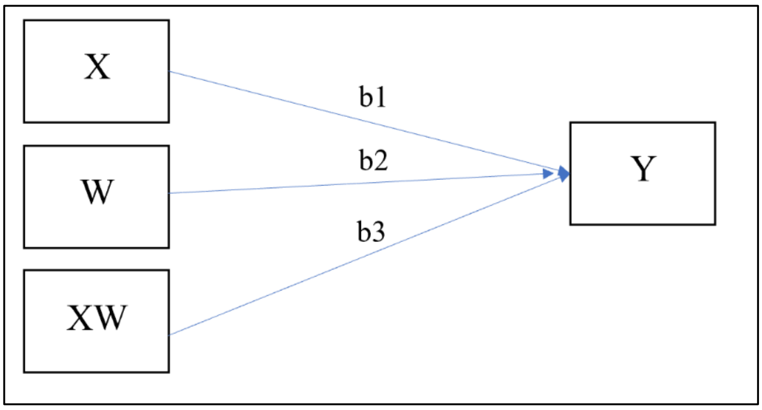


Figure 5. 28: The moderation effect statistical model

Testing the third hypothesis – moderator hypothesis – narcissistic behaviour

H3: NB moderates the relationship between CBA and the DM style of the PJM.

For the moderation regression analysis, CBA and the DM style of the PJM were tested in the moderation model. The results are presented in table 5.65; if the interaction term (CBA * NB) is insignificant, this indicates the nonexistence of a moderation effect of the NB on the relationship between independent variables the DM style of the PJM. The variables were mean centred on avoiding any multicollinearity issues.

Table 5. 65: Testing the moderation effect of NB on the relationship between a PJM's CBA and their DM *style*

Model	Coefficient	SE	t	p	LLCI	ULCI
Constant	3.3559	0.4612	7.27	0.0000	2.449	4.262
(b1) CBA	0.3009	0.118	2.5292	0.0118	0.0669	0.5341
(b2) NB	0.0459	0.1182	0.642	0.5208	-0.1564	0.383
(b3) Interaction cognitive* Narcissistic	-0.008*	0.0286	-0.2787	0.7806	-0.0642	0.0482
R	0.3885					
R^2	0.1509					
F (p)	22.33 (0.0000)					

*Insignificant interaction term (negative moderation effect)

As can be seen from the previous table, none of the interaction terms was significant; accordingly, it can be concluded that NB does not moderate the relation between any CBA and the DM style of the PJM.

Testing the fourth hypothesis – moderator hypothesis – voice behaviour

H4: VB moderates the relationship between CBA and the DM style of the PJM.

Table 5. 66: Testing the moderation effect of VB on the relation between a PJM's CBA and their DM style

Model	Coefficient	SE	t	p	LLCI	ULCI
Constant	2.5396	0.5091	4.985	0.0000	1.5386	3.5406
(b1) CBA	0.2549	0.1325	1.9237	0.0551	-0.0056	0.5154
(b2) VB	-0.2934	0.1612	1.820	0.0696	-0.614	0.0236
(b3) Interaction effect: CBA X Voice	0.0291*	0.0134	2.4334	0.0154	0.0159	0.149
R	0.517					
R^2	0.268					
F (p)	45.9348 (0.000)					

* Significant interaction term (there is a positive significant moderation effect)

For the moderation regression analysis, CBA and the DM style of the PJM were tested in the moderation model. The variables were mean centred on avoiding any multicollinearity issues. The results are presented in table 5.66; if the interaction term (CBA*VB) is significant, VB indicates a moderation effect on the relationship between CBA and the DM style of PJMs.

As can be seen from the previous table, none of the interaction terms was significant except term (b3) interaction effect; accordingly, it can be concluded that VB does not moderate the relation between any CBA and the DM style of the PJM.

VB has a positive significant moderation effect on the relationship between the PJM's CBA and their DM style in one term only. Since the interaction term has an effect of 0.0291 ($p<0.05$), this means that VB leads to a higher effect on the DM style of the PJM in the interaction term only, but the other VB terms (CBA term and VB term) do not have a significant moderation effect. In general, and by looking at the multiple regression model, we can note there is no positive significant moderation effect of VB on the relationship between PJMs' CBA and their DM style.

Testing the fifth hypothesis

H5: The DM style of the PJM influences the ITSD project success.

Sub-hypotheses

H5-1: The DM style of the PJM (experiential) influences ITSD project success.

H5-2: The PJM (rational) DM style influences ITSD project success.

The regression model summary results, including R, R^2 and Adjusted R^2, are represented in table 5.52. The correlation coefficient R = 0.347 indicates a positive correlation between the DM style of the PJMs (experiential and rational) and the ITSD projects, which shows that the independent and dependent variables change in the same direction.

R-square, coefficient of determination, offers information about the" goodness of fit" of the regression model; it represents the proportion of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2003). R^2= (0.121) value indicated the proportion of variance in the outcomes due to the fitted model and explained by the DM style of the PJM (experiential and rational) dimensions. That means that the DM style of the PJMs explains (12.1%) of the variance in the project success.

The adjusted R^2 indicates the model's generalizability and gives an idea regarding the likelihood of generalizing the results taken from the sample to the entire population. It is noticed that the adjusted R^2= (0.116) value is close to the value of R^2 = (0.121). By subtracting the adjusted R^2 from R^2, the value is 0.005. This amount indicates that if the entire population participates in the study, there is 0.5% reduction in the outcome variance.

Table 5. 67: Multiple regression model summary for H5

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	.347[a]	.121	.116	.66496

a. Predictors: (constant), Rational, Experiential
b. Dependent variable: project success

The variance (ANOVA) analysis results are presented in table 5.68; these results allow the study to test the main null hypothesis statistically. The multiple regression ANOVA results indicate that the model as a whole (including the two dimensions) is significant (Pallant, 2003). The results of the ANOVA in table 5.68 show that the F = 25.918 is significant at level p <0.05 (p= 0.000). This indicates that the whole model of the DM style of the PJM has a significant effect on project success.

Table 5. 68: Multiple regression ANOVA for H5

Model		Sum of squares	df	Mean square	F	Sig.
	Regression	22.920	2	11.460	25.918	.000[b]
1	Residual	167.142	378	.442		
	Total	190.063	380			

a. Dependent variable: project success.
b. Predictors: (constant), Rational, Experiential

For evaluating each of the independent variables, results from the coefficient table indicate the effect of each predictor variable on the dependent variable. This effect is evaluated using t-value and p-value; a p-value <0.05 is considered significant.

Results show that all the DM styles of the PJM dimensions are significant contributors to project success (p-value <0.05). Furthermore, the DM style of the PJM (experiential) has a significant positive effect on the project success with a β of (0.093) (p=0.007<0.05), which indicates that a unit increase in the DM style of the PJM (experiential) leads to a 0.093 unit increase in the project success.

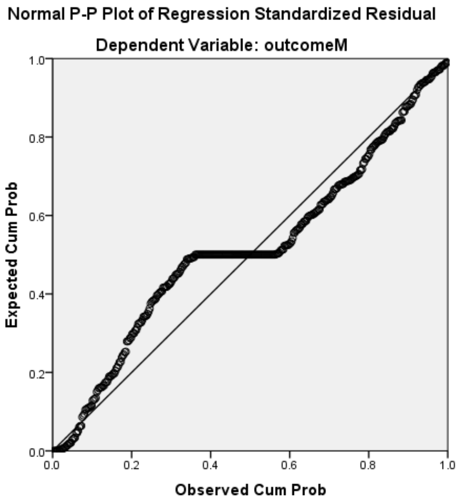
The DM style of the PJM (rational) has a significant positive effect on project success with a β of 0.286 (p=0.000<0.05). These results indicate that H5 is supported. Consequently, the DM style of the PJM (rational) has a higher effect on project success than the DM style of the PJM (experiential).

Table 5. 69: Coefficient for H5

Model		**Unstandardized coefficients**		**Standardized coefficients**	**t**	**Sig.**	**Collinearity statistics**	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.624	.277		13.095	.000		
	Experiential	.093	.034	.131	2.713	.007	.996	1.004
	Rational	.286	.044	.313	6.483	.000	.996	1.004

a**.** Dependent variable: project success.

Moreover, the multivariate normality assumption is satisfied from the normal p-p plot and the scatter plot presented in figures 5.30 and 5.31. Additionally, from the tolerance and the VIF values presented in table 5.69, it can be supposed that no issue of multicollinearity is detected since the tolerance value was 0.996>0.1 and the VIF value was 1.004 <10 (Garson, 2009). Thus, the results of the regression analysis for H5 are accepted.



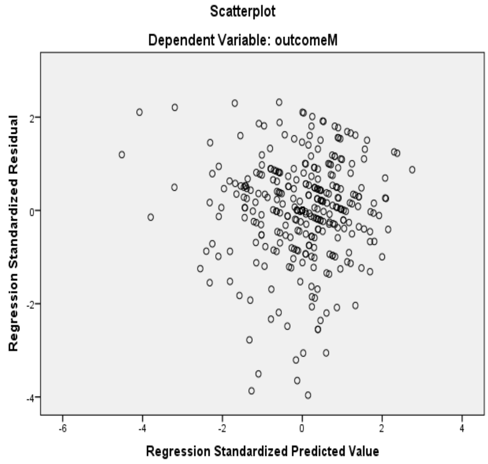


Figure 5. 30: Multiple regression scatter plot (H5)

Figure 5. 29: Multiple regression p-p plot (H5)

Testing the sixth hypothesis

H6: There is a direct relationship between the CBA and ITSD project success.

<u>Sub-hypotheses</u>

H6-1: There is a direct relationship between the perception and behavioural bias and ITSD project success.

H6-2: There is a direct relationship between the belief and probability estimation bias and ITSD project success.

The model summary results, including R, R^2 and Adjusted R^2, are represented in table 5.55. The correlation coefficient R = 0.258 indicates a positive correlation between the CBA (PBB) and ITSD project success; this shows that the independent and dependent variables change in the same direction.

R-square, coefficient of determination, offers information about the "goodness of fit" of the regression model; it represents the percentage of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2003). R^2= 0.066 value indicated the number of variations in the success due to the fitted model and explained by the CBA (PBB) and ITSD project success. That means that the CBA explains 6.6% of the variance in the project success.

The adjusted R^2 indicates the generalizability of the model. It gives an idea regarding generalizing the results taken from the sample to the entire population. It is noticed that the adjusted R^2= 0.056 value is close to the value of R^2 = 0.066. By subtracting the adjusted R^2 from R^2, the value is 0.010. This amount indicates that if the entire population participates in the study, there is 1.00% reduction in the outcome variance.

Table 5. 70: Multiple regression model summary for H6-1

Model Summary [b]

Model	R	R Square	Adjusted R Square	Std. error of the Estimate
1	.258[a]	.066	.056	.68708

a. Predictors: (Constant), DECI_MEAN, INT_MEAN, PERE_MEAN, PAT_MEAN
b. Dependent variable: OUTCOME_MEAN

The variance (ANOVA) analysis results are presented in table 5.71; these results allow the study to test the main null hypothesis statistically. The multiple regressions ANOVA results indicate that the model as a whole is significant (Pallant, 2003). The results of the ANOVA in table 5.71 show that the F = 6.678 is significant at level $p < 0.05$ (p= 0.000). This indicates that the whole model of the CBA (PBB) has a significant effect on project success.

Table 5. 71: Multiple regression ANOVA for H6-1

ANOVA[a]

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	12.611	4	3.153	6.678	.000[b]
	Residual	177.501	376	.472		
	Total	190.112	380			

a. Dependent variable: OUTCOME_MEAN
b. Predictors: (Constant), DECI_MEAN, INT_MEAN, PERE_MEAN, PAT_MEAN

For evaluating each of the independent variables, results from the coefficient table indicate the effect of each predictor variable on the dependent variable. This effect is evaluated using t-value and p-value; a p-value <0.05 is considered significant.

Results show that some of the CBA (PBB) dimensions are significant contributors to project success (p-value <0.05).

Table 5. 72: Coefficient for H6-1

Coefficients [a]

Model		Unstandardized Coefficients B	Std. error	Standardized coefficients Beta	t	Sig.
1	(Constant)	4.903	.180		27.179	.000
	INT_MEAN	-.017-	.038	-.027-	-.459-	.647
	PAT_MEAN	.039	.037	.066	1.036	.301
	PERE_MEAN	.119	.032	.215	3.732	.000
	DECI_MEAN	.018	.035	.031	.522	.602

a. Dependent Variable: OUTCOME_MEAN

Moreover, the multivariate normality assumption is satisfied from the normal p-p plot and the scatter plot presented in figures 5.31, 5.32 and 5.33. Additionally, from the tolerance and the VIF values presented in table 5.72, it can be supposed that there is no issue of multicollinearity. Thus, the results of the regression analysis for H6-1 are partially accepted.

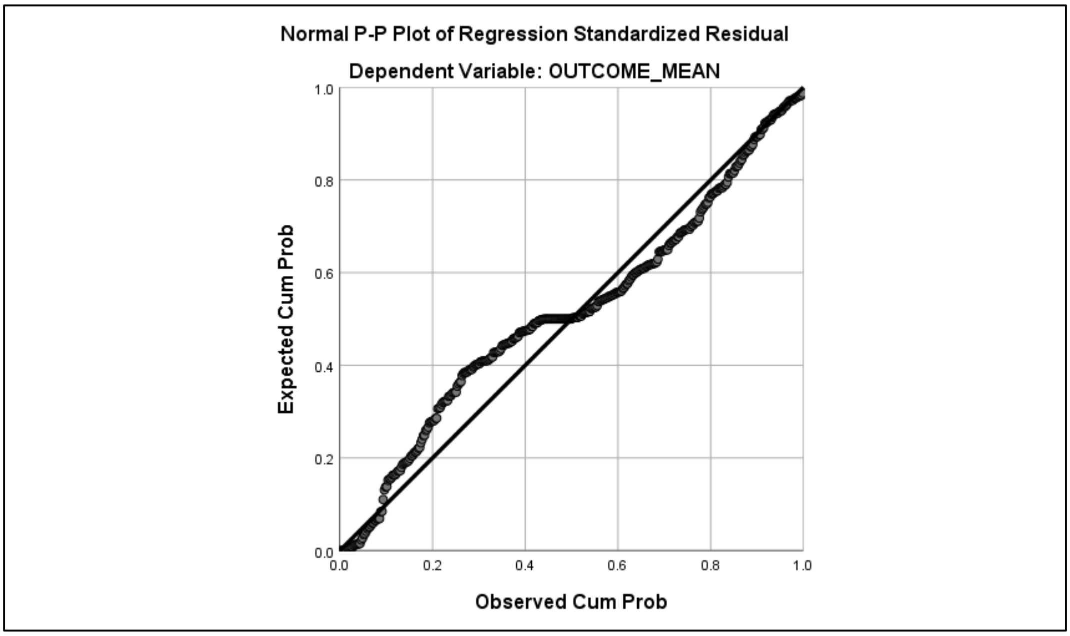


Figure 5. 31: Multiple regression p-p plot (H6)

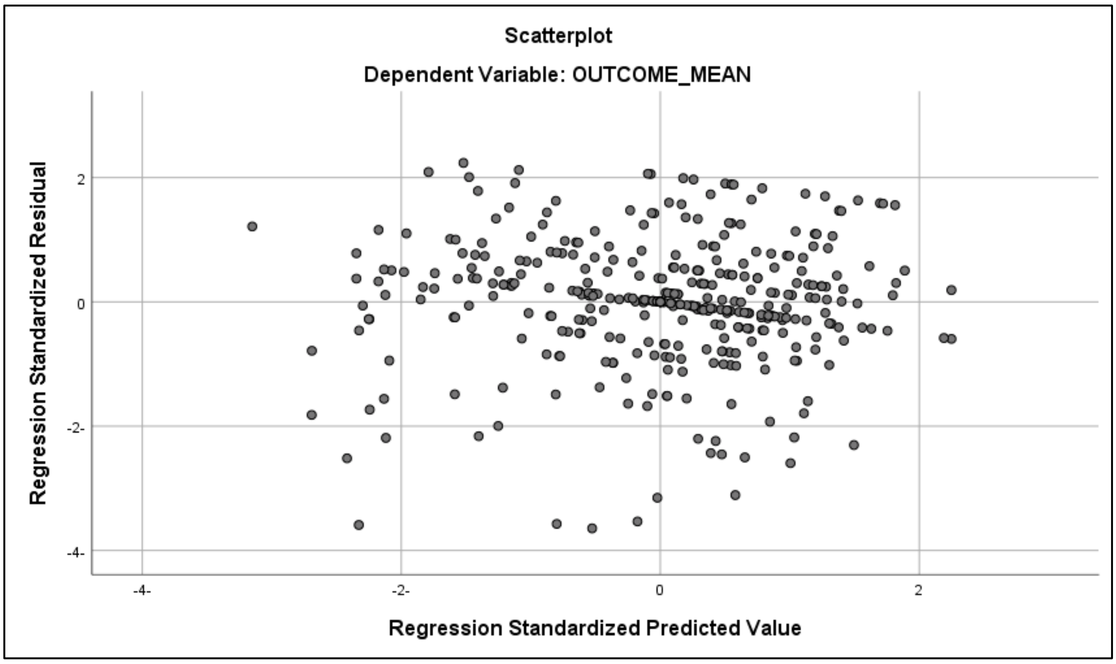


Figure 5. 32: Multiple regression scatter plot (H6)

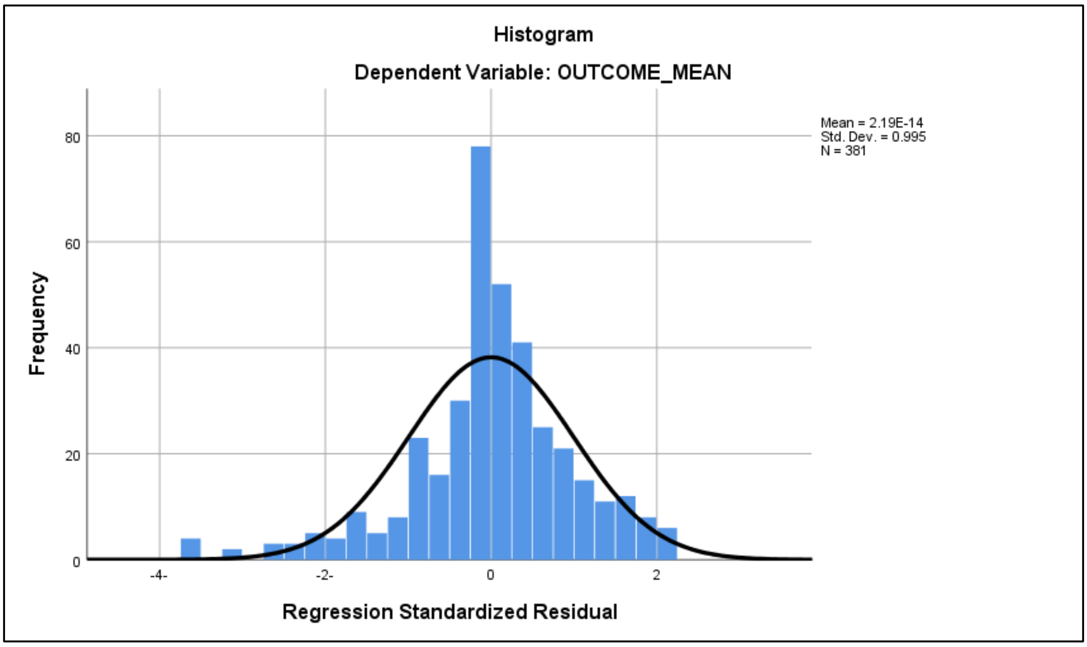


Figure 5. 33: Histogram dependent variables

H6-2: There is a direct relationship between the belief and probability estimation bias and ITSD project success.

The model summary results, including R, R^2 and Adjusted R^2, are represented in table 5.73. The correlation coefficient R = 0.153 indicates a positive correlation between the CBA (BPEB) and ITSD project success; this shows that the independent and dependent variables change in the same direction.

R-square, coefficient of determination, offers information about the "goodness of fit" of the regression model; it represents the percentage of variance in the dependent variable explained by the variation in the independent variable (Pallant, 2003). R^2= 0.023 value indicated the number of variations in the outcome due to the fitted model and explained by the CBA (BPEB) and ITSD project success. That means that the CBA explains 2.3% of the variance in the project success.

The adjusted R^2 indicates the generalizability of the model. It gives an idea regarding generalizing the results taken from the sample to the entire population. It is noticed that the adjusted R^2= 0.018 value is close to the value of R^2 = 0.023. By subtracting the adjusted R^2 from R^2, the value is 0.005. This amount indicates that if the entire population participates in the study, there is 0.50% reduction in the outcome variance.

Table 5. 73: Multiple regression model summary for H6-2

Model Summary[b]

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	.153[a]	.023	.018	.70081

a. Predictors: (Constant), ACTOR_MEAN, STAB_MEAN
b. Dependent variable: OUTCOME_MEAN

The analysis of variance (ANOVA) results is presented in table 5.74; these results allow the study to test the main null hypothesis statistically. The multiple regression ANOVA results indicate that the model as a whole is significant (Pallant, 2003). The results of the ANOVA in table 5.74 show that the F = 4.541 is significant at level $p <0.05$ ($p= 0.011$). This indicates that the whole model of the CBA (BPEB) has a significant effect on project success.

Table 5. 74: Multiple regression ANOVA for H6-2

ANOVA[a]

	Model	Sum of squares	df	Mean square	F	Sig.
1	Regression	4.460	2	2.230	4.541	.011[b]
	Residual	185.651	378	.491		
	Total	190.112	380			

a. Dependent Variable: Outcome MEAN
b. Predictors: (Constant), Actor MEAN, STAB_MEAN

For evaluating each of the independent variables, results from the coefficient table indicate the effect of each predictor variable on the dependent variable. This effect is evaluated using t-value and p-value; a p-value <0.05 is considered significant.

Results show that the stability bias (BPEB) dimensions are significant contributors to project success (p-value <0.05), but the action-oriented bias is not significant.

Table 5. 75: Coefficient for H6-2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized coefficients		
		B	Std. error	Beta	t	Sig.
1	(Constant)	5.183	.145		35.759	.000
	STAB_MEAN	.071	.041	.103	1.726	.085
	ACTOR_MEAN	.044	.036	.072	1.209	.228

a. Dependent Variable: OUTCOME_MEAN

Moreover, the multivariate normality assumption is satisfied from the normal p-p plot and the scatter plot presented in figures 5.34, 5.35 and 5.36. Additionally, from the tolerance and the VIF values presented in table 5.75, it can be supposed that there is no issue of multicollinearity. Thus, the results of the regression analysis for H6-2 are partially accepted.

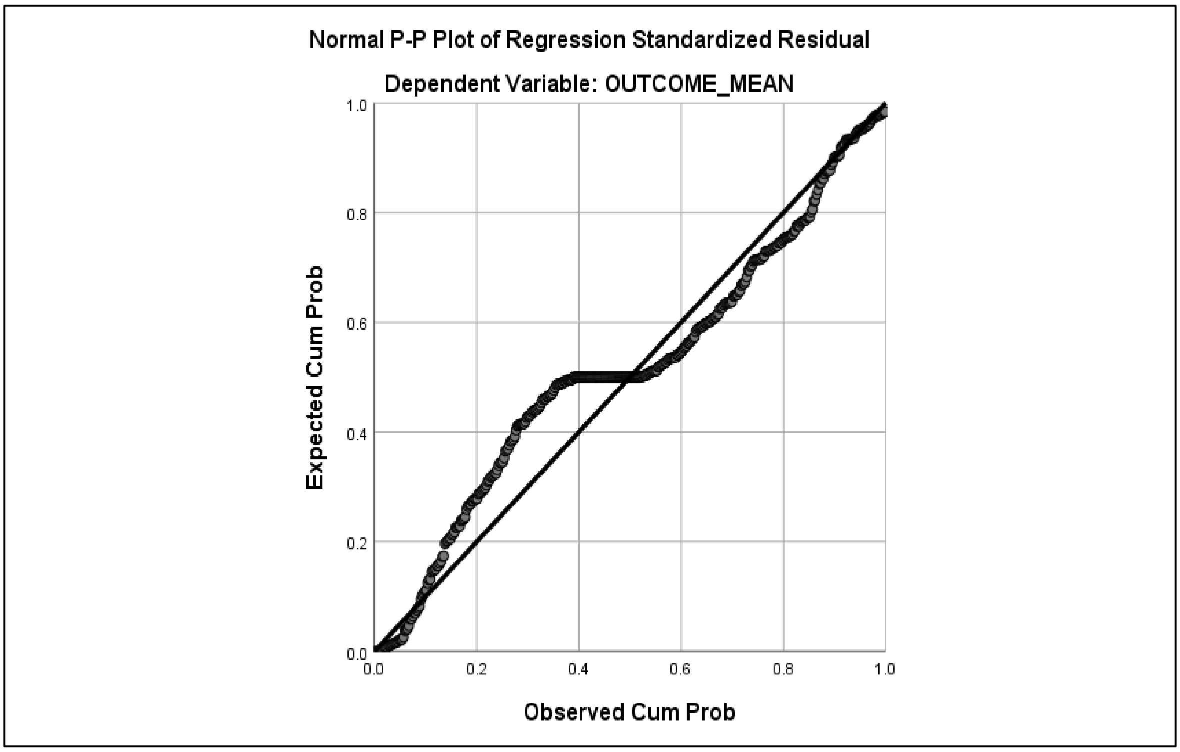


Figure 5. 34: Scatter plot dependent variables

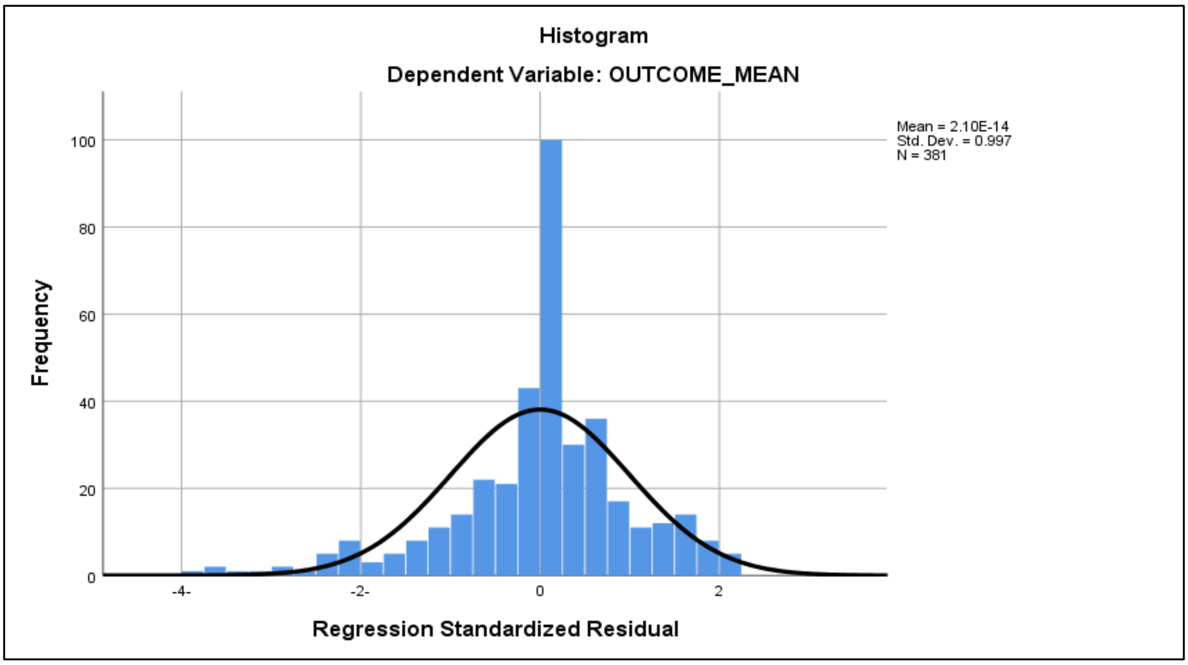


Figure 5. 35: Histogram dependent variables

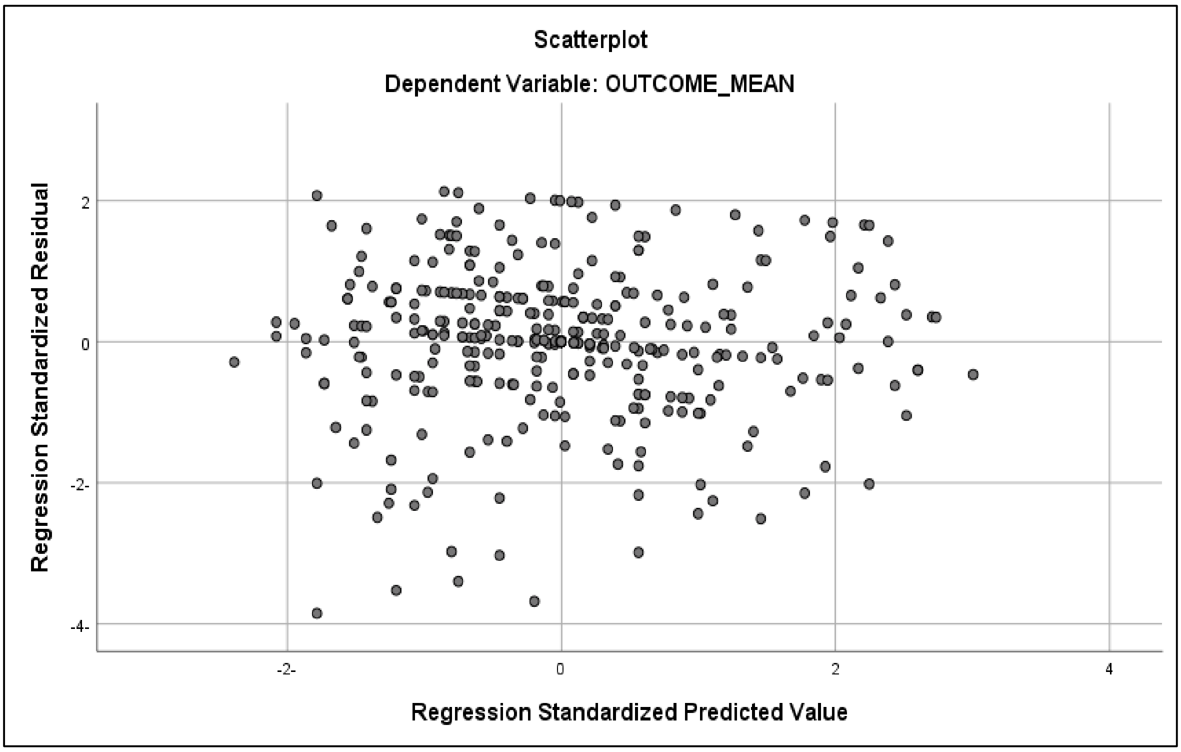


Figure 5. 36: Scatter plot dependent variables

5.12 Chapter summary

This chapter has presented the survey data in numerical values, where 467 responses were collected. Replace the missing value method technique was used to reach an acceptable percentage of less than 10% to achieve this endeavour; eventually, 381 responses were adequate for analysis using the MCAR test and SPSS remedy function used to treat the missing values.

Ten outliners were removed using the Mahalanobis distance test. The validity of the survey instrument was achieved using construct validity. EFA and CFA tests were used, and all survey items are significant. On the other hand, and to achieve reliability, Cronbach's alpha was achieved at an acceptable range above 0.6, and, to ensure no variance in data, the CMV test was used where all items passed without any CMB issue.

Demographic analysis showed that most respondents are male (78%), 201 respondents are PMP certified, the majority are aged between 31 and 40 years, and most populations hold a graduate degree.

Finally, means and standard deviation, skewness, and kurtosis were tested, and most items show a significant linear correlation.

This chapter demonstrated the hypothesis test to verify the impact of CBA on the DM style of the PJM from one side and evaluated the moderating role of narcissistic and VB on the DM style of the PJM from the other side. The model tested the impact of the DM style of the PJM on project outcomes.

The study developed six hypotheses to test the study variables. The analysis was carried out via IBM SPSS, and the results are promising according to the analysis of multiple regressions ANOVA, coefficient, t-test, f-test, R, Square, p-value, β, and P-P plot numbers.

CHAPTER 6: DISCUSSION OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter aims to impart and interpret the results of the study based on the analytical study method (i.e., the quantitative analysis) and elaborate on the significance and the implications of these results by assessing the influence of CBA on the DM style of PJMs in ITSD projects in Dubai, the moderating impact of NB and VB. In this chapter, the researcher situates the results according to the study questions and relates them to the previous studies presented in the literature review. In addition, this chapter considers how these results are relevant to the field of study and argues for these results to support the conclusions that are deducted and projected in the conclusion chapter. Finally, the researcher acknowledged the study's limitations from a theoretical perspective to be built on in future study.

This chapter concluded the study by summarizing the key results concerning the study aim and objectives represented by investigating the influence of a spectrum of CBA resources on the DM style of the PJMs and how that affects the success of ITSD projects in Dubai. The chapter demonstrates how the study contributes to the field of PM in terms of both academia and practice. Furthermore, it reflects on the study's limitations and make recommendations for future study and how other researchers can build upon it to develop the body of knowledge. Lastly, the chapter wrap up with a closing summary, which briefly reference what the researcher included in the conclusion chapter.

6.1 Discussion of findings

While transforming Dubai into a smart city through undertaking ITSD projects, some results have been against expectations in terms of the relatively high rates of failure in this sort of project, which caused a considerable loss in budget and resources. Therefore, the study takes an interest in intently investigating the main causes and effects that are expected to have played a critical role in that failure (including CBA sources, experiential and rational DM style, and the moderating role of NB and VB).

In this context, the researcher aims to: 1) examine the impact of CBA on the DM style of PJMs during the ITSD projects in Dubai, 2) recognize the moderating role of narcissistic and VB on the relation between CBA and the DM style of the PJMs, 3) define the DM style of the PJMs using the cognitive-experiential self-theory (CEST) model, which comprises the experiential and rational approaches, 4) propose a model that comprises DM methods and the types of behaviours to assist PJMs when making decisions. To this end, the study adopts a set of theories such as the PM theory, the W theory, the theory of constraints, and the cognitive-experiential self-theory, which serve as a concrete body of knowledge, support or contradict the expected results, and impart the correct framework for this study to follow while analysing and processing data.

Question one discussion

Q1: What is the relation between the CBA and the DM style of the PJMs?

Table 6. 1: First hypothesis results (Experiential)

Number	Hypothesis	Relationship	Results
H1	There is a relation between PBB and the DM style of the PJMs (experiential) during ITSD projects.	Positive	Supported
Sub-hypotheses (**Experiential)**			
H1-1	There is a relationship between interest bias and the DM style of the PJM (experiential) during IT software development projects.	Positive	Supported
H1-2	There is a relationship between pattern recognition and the DM style of the PJM (experiential) during IT software development projects.	Positive	Supported
H1-3	There is a relationship between perception bias and the DM style of the PJM (experiential) during IT software development projects.	Positive	Supported
H1-4	There is a relationship between decision bias and the DM style of the project (experiential) during IT software development projects.	Positive	Supported

*Coefficient R = 0.459

The result in table 6.1 of positive coefficient correlations relationship between the PBB and DM style of the PJMs (experiential), the value of correlation coefficient (0.459) considered moderate (Taylor, 1990); this measurement takes into consideration how much there two variables are related.

Table 6. 2: First Hypothesis results (Rational)

Number	Hypothesis	Relationship	Results
H1	There is a relation between PBB and the DM style of the PJMs (rational) during ITSD projects.	Positive/Weak	Not supported
Sub-hypotheses (**Rational**)			
H1-1	There is a relationship between interest bias and the DM style of the PJM (rational) during IT software development projects.	Positive /Weak	Not supported
H1-2	There is a relationship between pattern recognition and the DM style of the PJM (rational) during IT software development projects.	Positive /Weak	Not supported
H1-3	There is a relationship between perception bias and the DM style of the PJM (rational) during IT software development projects.	Positive /Weak	Not supported
H1-4	There is a relationship between decision bias and the DM style of the project (rational) during IT software development projects.	Positive /Weak	Not supported

*Coefficient R = 0.120

According to the regression test, the correlation coefficient values for this family of bias (which consists of interest bias, pattern recognition bias, perception bias, and decision bias) regarding the experiential DM style include R=0.459, R^2=0.210, and adjusted R^2= 0.202, which is significant. On the other hand, the values for this sort of bias and the rational DM style include R=0.120, R^2=0.014, and adjusted R^2= 0.004, which shows that the independent and the dependent variables change in the same direction.

The result in table 6.2 of positive coefficient correlations relationship between the PBB and DM style of the PJMs (rational), the value of correlation coefficient (0.120) considered weak or low (Taylor, 1990); this measurement takes into consideration how much there two variables are related. Despite the hypothesis was rejected but the coefficient correlations show a relationship between the two variables.

The analysis of variance (ANOVA) shows that the result for this sort of bias and the experiential DM style is F=25.031 at level $p<0.05$ (sig. < 0.001), which indicates that the whole group of bias is significant. In contrast, the result for the rational style is F = 1.365, which is insignificant at level $p<0.05$ ($p= 0.246$), which indicates that the whole group of bias is insignificant.[4]

Using t-value and p-value to evaluate each of the independent variables, results show that all dimensions of this sort of bias are considered significant contributors to the experiential DM style of the PJMs (p-value <0.05). On the other hand, as the F-value of this sort of bias and the rational DM style is insignificant, the use of t-value and p-value is insignificant.[5]

H1: There is a relation between perception and behavioural bias and the DM style (experiential/rational) of the PJMs during ITSD projects.

- Interest bias (which consists of confirmation, wishful thinking and IKEA) in regard to "the experiential DM style has a significant β value of 0.186 ($p=0.001<0.05$), which means that, if there is a unit increase in this bias, there is a 0.18 increase in this DM style. On the other hand, the F value for this bias and the rational DM style is insignificant, so the regression coefficients are unnecessary[6].
- Pattern recognition bias (which consists of availability, fixation, mere exposure effect and Semmelweis reflex) has a significant β value of 0.175 ($p=0.003<0.05$) regarding the "experiential DM style, while the F value for this bias and the rational DM style is insignificant, so the regression coefficients are unnecessary.
- Perception bias (which consists of framing, selective perception, and primacy and recency effect) has a significant β value of 0.118 ($p=0.027<0.05$) in regard to the experiential DM style. In contrast, the F value for this bias and the rational DM style is insignificant, so the regression coefficients are unnecessary.

[4] F value is the ratio of the mean regression sum of squares divided by the mean error sum of squares, which is the likelihood that the null hypothesis for a full model is true.
[5] T-test is used to analyze the rate difference between the means of the samples while p-value is used to achieve evidence that can be utilized to negate the indifference between the averages of two samples.
[6] B in regression refers to unstandardized beta, which represents the slope of the line between the predictor variable and the dependent variable.

- Decision bias (which comprises sunk cost bias, planning fallacy and omission bias) has a significant β value of 0.127 ($p=0.020<0.05$) in regard to experiential DM style. In contrast, the F value for this bias and the rational DM style is insignificant, so the regression coefficients are unnecessary.

H2: There is a relation between belief and probability estimation bias and the DM style (experiential/rational) of the PJM during IT software development projects**.**

Table 6. 3: Second hypothesis results (Experiential)

Number	Hypothesis	Relationship	Results
H2	There is a relationship between BPEB and the DM style of the PJM (experiential) during IT software development projects.	Positive	Supported
Sub-hypotheses (Experiential)			
H2-1	There is a relationship between stability bias and the DM style of the PJM (experiential) during IT software development projects.	Positive	Supported
H2-2	There is a relationship between action-oriented bias and the DM style of the PJM (experiential) during IT software development projects.	Positive	Supported

*Coefficient R = 0.484

The result in table 6.3 of positive coefficient correlations relationship between the BPEB and DM style of the PJMs (experiential), the value of correlation coefficient (0.484) considered moderate (Taylor, 1990); this measurement takes into consideration how much there two variables are related.

Table 6. 4: Second hypothesis results (Rational)

Number	Hypothesis	Relationship	Results
H2	There is a relationship between BPEB and the DM style of the PJM (rational) during IT software development projects.	Positive /Weak	Not supported
Sub-hypotheses (Rational)			
H2-1	There is a relationship between stability bias and the DM style of the PJM (rational) during IT software development projects.	Positive /Weak	Not supported
H2-2	There is a relationship between action-oriented bias and the DM style of the PJM (experiential) during IT software development projects.	Positive /Weak	Not supported

*Coefficient R = 0.084

The result in table 6.4 of positive coefficient correlations relationship between the BPEB and DM style of the PJMs (rational), the value of correlation coefficient (0.084) considered weak or low (Taylor, 1990); this measurement takes into consideration how much there two variables are related. Despite the hypothesis was rejected but the coefficient correlations show a relationship between the two variables.

- According to the regression test, the correlation coefficient values for this sort of bias (which comprises stability bias and action-oriented bias) in regard to the experiential DM style include R=0.484, R^2=0.234, and adjusted R^2= 0.230, which indicates that: 1) the independent and dependent variables change in the same directions, 2) this sort of bias explains 21% of the variance in this DM style, 3) by subtracting the adjusted R^2 from $R^{2,}$ the value is 0.004, which means that, if the entire population participates in the study, there is a 0.4% reduction in the outcome variance. On the other hand, the values for this sort of bias in regard to the rational DM style include R=0.084, R^2=0.007, and adjusted R^2= 0.002, which shows that: 1) the independent and the dependent variables change in the same direction, 2) the amount of variation in this DM is explained by the PBB dimensions, which explain 1.4% of the variance of this sort of DM style, 3) by subtracting the adjusted R^2 from $R^{2,}$ the value is 0.005, which indicates that, if the entire population participates in the study, there is a 0.3% reduction in the outcome variance. However, the value of 0.084 is considered a weak correlation.
- The analysis of variance (ANOVA) shows that the result for this sort of bias in regard to the experiential DM style is F=54.731at level $p<0.05$ (p= 0.000), which is significant. In contrast, the result in regard to the rational style is F = 1.353, which is insignificant at level $p<0.05$ (p= 0.260).
- Using t-value and p-value to evaluate each independent variable, the results show that all dimensions of this sort of bias are considered significant contributors to the experiential DM style (p-value <0.05). Thus, the use of t-value and p-value is insignificant. On the other hand, as the F-value of this sort of bias and the rational DM style is insignificant.
- Stability Bias (which consists of anchoring, status quo, and familiarity) has a significant β value of 0.304 (p=0.000<0.05) in regard to the experiential DM style, which means that if

there is a unit increase in this bias, there is a 0.304 increase in this DM style. On the other hand, the F value for this bias and the rational DM style is insignificant, so the regression coefficients are unnecessary.

- Action-oriented bias (which consists of overconfidence, the illusion of control, gambler fallacy, miserly information processing and misleading information) has a significant β value of 0.210 ($p=0.000<0.05$) related to the experiential DM style. In contrast, the F value for this bias and the rational DM style is insignificant, so the regression coefficients are unnecessary.

According to the above results, the interpretation regarding the first and second hypotheses, which are applied to provide an answer for the first question, are summarized below:

1. All dimensions of PBB have a significant correlation with the experiential DM style, whereas they have a weak correlation with the rational approach. Although the experiential approach has a significant correlation with CBA, according to the cognitive-experiential self-theory, the experiential PJMs are more spontaneous and rely on their past experience and emotions to make judgments, which might be a viable way to make appropriate decisions, but when it comes to making decisions under uncertain environments and project constraints where CBA is often dominant, the experiential approach is more likely to lead to unexpected outcomes. Therefore, the significance of adopting the rational approach comes to light.
2. BPEB have a significant correlation with the experiential DM style, whereas the correlation is weak regarding the rational approach

In this context, results obtained from the previous literature indicate that: PJMs make decisions based on two main approaches: rational and experiential; sources of bias impact the PJM's DM process; Overconfidence Bias plays a critical role when PJMs assess and plan for projects; PJMs tend to be experiential when making decisions under uncertain environments; PJMs are more likely to achieve the expected outcomes of projects when they resort to a rational approach when making decisions, and CBA impacts PJMs in the ITSD industry when making decisions. However, the previous literature, as reviewed earlier in previous chapters, does not include all angles of this aspect and is limited due to the following:

- Each study focused only on addressing one source of bias and its impact on human reactions under certain circumstances like uncertainty, fear, and pressure, rather than covering all sources of bias in one study.
- Most of the studies explored the impact of bias on PJMs' DM style based on a qualitative approach.
- The studies that included all sources of bias had been conducted utilizing a mapping study method rather than extensive analysis.

No studies had integrated all sources of CB into families; therefore, the results of this study are compatible with and supportive of the cognitive-experiential self-theory (CEST), which assumes that experiential individuals react automatically with precociousness and take a holistic view of events, whereas rational systems propose that individuals react to events by analysing the situation and considering the consequences of the results. The CEST model considers that individuals who follow experiential systems rely on quick decisions and do not spend time balancing alternatives for particular decisions; their reactions are based on intuition and feelings. Thus, their decisions are prone to bias (Schutte et al., 2010). In contrast, individuals who follow the rational system take logical and slow steps to make decisions, follow methodologies for analysing the events, and process information. Thus, their decisions are clear of bias. In this regard, it is evident that the first question is answered, the first and the second hypotheses are validated, and the following contributions are fulfilled:

1. The importance of the PJM's DM approach.

2. The differences between the rational and experiential PJMs.
3. The impact of CBA on the DM style of the PJM.
4. The accuracy of decisions is based on an analytical and rational approach and requires careful consideration of the information.
5. The necessity of using analytical tools when making a decision under uncertain events.

Question two discussion

Q. 2: *Does the NB act as a moderating mechanism in the relation between CBA and the DM style of the PJMs?*

In order to answer question two, hypothesis three is applied to recognize whether or not the NB acts as a moderator in the relation between CBA and the DM style of the PJMs as follows:

H3: NB moderates the relation between CBA and the DM style of the PJMs.

Table 6. 5: Third hypothesis results - Moderator

Number	Hypothesis	Results
H3	NB moderates the relationship between CBA and the DM style of the PJM.	Not supported

Based on the quantitative study method, the following sections impart the results analysis of the respective hypotheses in regard to NB as a moderator on the relation between CBA and the experiential DM style of PJMs since there is no correlation between CBA and the rational DM style:

- According to the moderation regression analysis indicated in the below table, the results of the interaction term (CBA * NB) show an effect of -0.008 at level ($p<0.05$), which is insignificant.

*Table 6. 6: CBA * NB*

Model	Coefficient	SE	t	p	LLCI	ULCI
Constant	3.3559	0.4612	7.27	0.0000	2.449	4.262
(b1) CBA	0.3009	0.118	2.5292	0.0118	0.0669	0.5341
(b2) NB	0.0459	0.1182	0.642	0.5208	-0.1564	0.383
(b3) Interaction	-0.008*	0.0286	-0.2787	0.7806	-0.0642	0.0482

cognitive* Narcissistic	
R	0.3885
R²	0.1509
F (p)	22.33 (0.0000)

Based on the analytical study method, the standardized factor loading for narcissistic items shows a loading factor of 0.45, which is considered fair and means that the model is valid for this case and provides an adequate fit for data.

Based on the results, the results related to the third hypothesis, and which provide an answer to the second question can be summarized below:

There is no confirmed indication that the NB acts as a moderator on the relation between CBA and the DM style of PJMs. Literature indicated a strong relation between PJMs' NB and project success (Pinto & Patanakul, 2015); furthermore, a relation was found between NB and optimism bias (Pinto & Patanakul, 2015). On the other hand, Ouimet (2010) found that NB has a risky impact on organizations as it leads to a toxic environment. However, the investigation of NB requires more investigation as:

1. There is a lack of studies in the realm of organizational psychology which can identify odd and extreme behaviour.
2. Knowledge about NB is confined to the world of psychology under "Dark Triads", which refers to three personality traits: narcissism, Machiavellianism, and psychopathy.
3. Only one study has addressed narcissism and its relation to CBA and the DM style. Moreover, the study was conducted on champions and did not take PJMs into account and did not look in detail into factors that affect narcissistic individuals.

Although studies have found a relationship between NB and the success of projects, this thesis could not accurately determine the moderating impact of NB on CBA and the DM style of the PJMs. The interpretation of the results shows that NB does not moderate the relation between

CBA and the PJMs' decisions due to the lack of interaction terms and insignificant relation; thus, the study recalls the statements to test the NB variable, as depicted in table 6.7

Table 6. 7: NB traits

Statement No.	NB	Questionnaire statements
24	Arrogance	You always see yourself as important
25	Interpersonally exploitative	You may use others to achieve your personal benefits
26	Lacking empathy	You do not care about others' feelings when making a decision under uncertain events
27	Grandiosity	You always look to be essential to and admired by others
28	Antagonistic	When deciding on uncertain events, you may be hostile against others

The above statements describe the situations where the respondents perceived the answer based on their own beliefs; thus, it is evident that each respondent perceived themself as completely the opposite of the implications of the statements. Consecutively, this does not ascertain the accurate existence of the NB as a moderator on the relation between CBA and the DM style. Therefore, to acquire a more in-depth understanding of this, the following procedures need to be taken into consideration in future studies:

1. Interviews are required to interject clarification questions to enable the researcher to understand how respondents perceived mean and gain a broad perspective about their answers.
2. Gaining accurate data using a third-person questionnaire or creating an extensive data survey characterized by anonymity where respondents interact objectively and remain anonymous.

According to these results, the thesis achieved the third objective and provided the answer to the second question; on the other hand, the statistical analysis could not prove the moderating role of NB on the relation between CBA and the DM style due to the subjective responses.

Question three discussion

Q3: Does the VB act as a moderating mechanism in the relation between CBA and the DM style of the PJMs?

In order to answer question three, hypothesis four is applied to recognize whether or not VB acts as a moderator in the relation between CBA and the DM style of the PJMs as follows:

H4: VB moderates the relation between CBA and the DM style of the PJM.

Table 6. 8: Third hypothesis results - Moderator

Number	Hypothesis	Results
H4	VB moderates the relationship between CBA and the DM style of the PJM.	Partially supported

According to the quantitative study method, the following sections state the discussion of the results to the respective hypotheses regarding VB as a moderator on the relation between CBA and the experiential DM style of PJMs since the rational style has an insignificant relation with CBA:

- With reference to the moderation regression analysis, the interaction term (CBA*VB) has a value of 0.0291 ($p<0.05$), which is significant.

The interpretation of this result related to the fourth hypothesis, which provides an answer to the third question, can be summarized below:

- VB has a significant moderation effect on the correlation between the CBA and the experiential DM style. This means that when PJMs use VB associated with CBA, they are more likely to rely on emotions, which, according to cognitive-experiential self-theory (CEST), means that they tend to adopt the experiential approach in which they use their emotions, previous experiences, and solid examples, and follow intuitive mode when communicating ideas, thoughts, and concerns to solve problems and make decisions.

Previous literature indicates that VB with a pure intention to enhance an organization's DM process is positive and leads to better performance (Ekrot, Rank & Gemünden, 2016); communicates ideas, makes suggestions, and shows concern toward critical events, which increases the likelihood of accurate decisions. This behaviour is spontaneous yet could be innovative (Ekrot, Rank & Gemünden, 2016). In addition, VB PJMs are spontaneous; they speak their minds in an endeavour to solve a particular issue. Their decisions may be correct, and they speak their minds to rectify events within an uncertain environment; their decisions may be considered accurate and effective. In the matter of speaking, previous studies highlighted the importance of VB to enhance the performance of employees and suggested that organizations encourage their employees to speak up.

In addition, no previous studies have investigated the impact of VB in terms of its association with CBA and the DM style and how this would impact the success of projects. The current study came to light from this perspective as it unfolds another dimension to VB when associated with CBA and the DM style. This dimension is interpreted below:

1. The adverse implication of VB is associated with CBA.
2. PJMs with VB and CBA are more likely to resort to an experiential DM style.
3. If associated with CBA, VB turns the experiential DM into an ineffective approach under uncertain circumstances.

Accordingly, VB moderates the mechanism of experiential DM and CBA; thus, the fourth hypothesis is validated, and the third study question is answered.

Question four discussion

Q4: Does the DM style of the PJMs influence the success of ITSD projects in Dubai?

The fourth part of the discussion focuses on the impact of DM style on ITSD project outcomes, and the impact is measured based on the same basic approaches for DM: the *rational approach*, which follows an analytical and logical process to reach the best alternatives, and the *experiential approach*, which follows human emotions and hunches to make decisions.

In order to answer question four, the fifth hypothesis is tested to determine if the DM style has an influence of any sort on the success of the ITSD project in Dubai. Accordingly, hypothesis five is:

H5: The DM style of the PJMs influences the success of ITSD projects.

Table 6. 9: Fifth hypothesis results

Number	Hypothesis	Coefficient	Results
H5	The DM style of the PJM influences the ITSD project success.	Positive	Supported
H5-1	The DM style of the PJM's (experiential) approaches influences ITSD project success.	Positive	Supported
H5-2	The DM style of the PJM's (rational) approaches influences ITSD project success.	Positive	Supported

* Coefficient R = 0.347
**Rational DM style has a higher effect

According to the quantitative study method in Chapter 8, the following sections state the discussion of the results of the respective hypotheses regarding the influence of the DM style (rational/experiential) of the PJMs on the success of ITSD projects:

- The correlation coefficient R = 0.347 shows a positive correlation as the independent and the dependent variables change in a direct proportion, which means that the DM style impacts the success of the ITSD projects in Dubai.
- The value R2 = 0.121 indicates the proportion of variance in the outcomes explained by the DM style. This is to say that the variance in the DM style explains 12.1% of the variance in the project outcomes.
- The adjusted R^2 = 0.116, which indicates the generalizability of the results from one sample to the entire population, is close to the value of the value R^2 = (0.121). By subtracting the former from the latter, the value is 0.005, which indicates that if the entire population participates in the study, there is a 0.5% reduction in the outcome variance.
- According to the analysis of variance results (ANOVA), the F = 25.918 at level $p < 0.05$ (p= 0.000), which means that the whole model of the DM style of the PJM has a significant effect on project outcomes.
- The experiential DM style has a β value of 0.093 ($p=0.007<0.05$), which is significant and indicates that a unit increase in the experiential style results in almost 1% in the project outcomes.

- The rational DM style has a β value of 0.286 ($p=0.000<0.05$), which is significant and indicates that a unit increase in the rational style results in almost 3% in the project outcomes.
- The tolerance value was $0.996 > 0.1$, and the VIF value was $1.004 <10$, which illustrates that the regression analysis for H5 is accepted.

Based on the results above, the correlation and the impact of the DM style of the PJMs, which is significantly affected by the CBA, can be specified, and interpreted as the following:

1. The statistical analysis results substantiate that the variance of the DM style of the PJMs has a confirmed effect on the success of the ITSD projects.
2. The rational DM style of the PJMs has a more significant effect on the success of ITSD projects than the experiential approach. The explanation for this is that the rational approach is based upon logical foundations by which PJMs adopt detailed analysis and transform reality into numbers and figures while managing their feelings and emotions, while the experiential approach is holistic and uses minimum efforts; the reactions are mostly affected by experience and belief in self-experience, while the emotions are loose.
3. Both the rational and experiential approaches positively impact the success of projects under normal conditions where they do not encounter project constraints (time, scope, cost). In contrast, when it comes to uncertain events, the matter is different as these constraints become pressing where the experiential approach, contrary to the rational approach, is driven by the CBA, as validated by the first and second hypotheses, which affects the accuracy of the decisions.

According to theories in this discipline, the influence of CBA and the DM style is validated. For instance, the descriptive decision theory states that people look for decisions that satisfy their personal needs or interests even if they do not have sufficient information to make that decision. In other words, people rely on the bias when making decisions under uncertain events. Prospect theory discusses the DM process under uncertain events and assumes that it consists of two dimensions, the framing and the valuation. In the former, decision-makers depend on experience and heuristics or rule of thumb, while in the latter, they begin to assess the prospect outcome of each decision (Kahneman & Tversky, 2018).

In addition, the cognitive-experiential self-theory states that the experiential approach is linked to heuristic bias, fewer efforts, and the absence of cognitive awareness (Monacis et al., 2016), while the rational approach is governed by the process where high potential, efforts and high cognitive awareness are required (Monacis et al., 2016).

According to the literature review, many studies have investigated the correlation and influence of CBA and the DM style on the success of projects. It has been found that insufficient information creates a conflict within projects; there is a positive relationship between the DM processes and information based on analysis and rational calculations (Eweje, Turner & Müller, 2012). Furthermore, Parkin (1996) assumes that the DM process is derived from the psychological state of the human mind: it is affected by individual stress and behaviour, which limits the ability of the PJM to make rational decisions; hence, the PJM makes cognitive decisions based on a bias (Parkin, 1996).

Tversky and Kahneman (1978) investigated the theory of bounded rationality and prospect theory. They found a vast space for the human mind's limitation to make accurate decisions under uncertainty, especially when events are uncertain, and people are not given enough time to analyse and accurately calculate the information feed.

In summary, the significance of this study is manifested in the fact that it is the first study to have explored the influence of CBA integrated with the DM style on the success of ITSD projects. Based on the psychological impact on PJMs' behaviour, this thesis investigated the

PJMs' rational and experiential DM approach. The investigation took into consideration the analytical and logical approach associated with rational behaviour and the spontaneous, impulsive, and emotional approach associated with experiential behaviour guided by a global theory of personality, the CEST model (Epstein et al., 1996), where evidence shows that experiential information processing is constant with CBA; thus, it affects the quality of decisions. Furthermore, the rational information-processing approach is consistent with a logical and analytical DM process, which results in a more accurate decision, hence better outcomes.

Accordingly, and based on results from the literature and the results of this study, the DM style of the PJM impact the project success; thus, question number four is fulfilled.

According to the above discussion, question number four is answered, the hypothesis is validated, and the following contributions are substantiated by the theories, literature review and the results of the statistical analysis:

1. CBA has an impact on the DM style of the PJM.
2. The DM style of the PJM is controlled by two primary DM approaches, the rational and experiential.
3. The experiential approach to DM may result in good decisions but still may lead to inaccurate outcomes, specifically under uncertain events.
4. The rational DM approach positively impacts the success of ITSD projects as it is less associated with CBA.

Question five discussion

Q5: Does the CBA influence the ITSD project success?

The fifth part of the discussion focuses on the impact of the CBA on ITSD project outcomes. To answer question number five, the sixth hypothesis is tested to determine if the CBA has an influence on the success of the ITSD project in Dubai. Accordingly, hypothesis six is:

H6: There is a relationship between the CBA and ITSD project success.

Table 6. 10: Sixth hypothesis results

Number	Hypothesis	Coefficient	Results
H6	There is a relationship between the CBA and ITSD project success.	Positive	Partially supported
Sub-hypotheses			
H6-1	There is a relationship between the PBB) ITSD project success.	Positive	Partially supported
H6-2	There is a relationship between the BPEB ITSD project success.	Positive	Partially supported

*H6-1 coefficient R = 0.258
**H6-2: coefficient R = 0.153

Number	Hypothesis	Coefficient	Results
H6	There is a relationship between the CBA and ITSD project success.	Positive	Partially supported
Sub-hypothesis			
H6-1	There is a relationship between the PBB) ITSD project success.	Positive	Partially supported
H6-2	There is a relationship between the BPEB ITSD project success.	Positive	Partially supported

*H6-1 coefficient R = 0.258
**H6-2: coefficient R = 0.153

According to the quantitative study method in Chapter 8, the following sections state the discussion of the results of the respective hypotheses in regard to the influence of the CBA on the success of ITSD projects:

- The correlation coefficient R = 0.258 shows a positive correlation as the independent and the dependent variables change in a direct proportion, which means that the PBB have an impact on the success of the ITSD projects in Dubai.
- The correlation coefficient R = 0.153 shows a positive correlation as the independent and the dependent variables change in a direct proportion, which means that the belief and probability estimation has an impact on the success of the ITSD projects in Dubai.
- R^2= 0.066 value indicated the number of variations in the outcome due to the fitted model and is explained by the CBA (PBB) and ITSD project success. That means that the CBA explains 6.6% of the variance in the project success.

- The adjusted R^2 indicates the generalizability of the model. It gives an idea regarding generalizing the results taken from the sample to the entire population. It is noticed that the adjusted $R^2 = 0.056$ value is close to the value of $R^2 = 0.066$. By subtracting the adjusted R^2 from R^2, the value is 0.010. This amount indicates that if the entire population participates in the study, there is a 1.00% reduction in the outcome variance.
- According to the results of the ANOVA, $F = 6.678$ is significant at level $p < 0.05$ ($p = 0.000$). This indicates that the whole model of the CBA (PBB) has a significant effect on the project success.
- This effect is evaluated using t-value and p-value; a p-value <0.05 is considered significant. Results show that some of the CBA (PBB) dimensions are significant contributors to project success (p-value <0.05).
- The correlation coefficient $R = 0.153$ indicates a positive correlation between the CBA (BPEB) and ITSD project success; this shows that the independent and dependent variables change in the same direction.
- $R^2 = 0.023$ value indicated the number of variations in the outcome due to the fitted model and is explained by the CBA (BPEB) and ITSD project success. That means that the CBA explains 2.3% of the variance in the project success.
- The results of the ANOVA in table 8.22 show that the $F = 4.541$ is significant at level $p < 0.05$ ($p = 0.011$). This indicates that the whole model of the CBA (BPEB) has a significant effect on project success.

Based on the results above, the correlation and the impact of the CBA that affect the success of ITSD projects can be specified and interpreted as the following:

1. The statistical analysis results substantiate that the variance of the CBA style of the PJMs has a confirmed effect on the success of the ITSD projects.

2. The PBB have a more significant effect on the success of the ITSD project than the BPEB. The explanation for this is that the PBB family include more sources of bias and have received more focus in literature due to the fact that this family includes sources of bias that are related to human judgment, observations, and beliefs; these sources of bias associated with PJM's feeling and emotions. On the other hand, BPEB are associated with the PJMs' satisfaction with a decision that matches their beliefs instead of analysing the facts that support it. These results are supported by previous literature, which determines CBA as a deviation of human judgment over particular decisions, which is closer to the first family of biases.
3. CBA influences the project outcomes. The study results show a significant relationship that supports the study objectives of proving the relationship between biased decisions and ITSD projects.

According to theories in the PM discipline, the influence of CBA on project success is validated. For instance, the CB theories assume that human minds deviate from rational thinking and commit errors. In other words, people rely on the bias when making decisions under uncertain events. Prospect theory discusses the DM process under uncertain events and assumes that the DM process consists of two dimensions, the framing and the valuation. In the former, decision-makers depend on experience and heuristics or rule of thumb, while in the latter, they begin to assess the prospect outcome of each decision (Kahneman and Tversky, 2018).

Cunha, Moura and Vasconcellos (2016) concluded that future study is required to explore the influence of CBA on ITSD project success and emphasized the relationship between sources of bias and project deliverables. This study found a relationship between CBA and ITSD project outcomes, which fills this gap.

Furthermore, literature has focused on one particular source of bias instead of explaining the impact of related sources of bias, which can work together in formulating the decisions that affect ITSD projects' success (Mohanani et al., 2018). this study grouped multiple sources of bias under certain families. This contribution focused on the impact of related sources of bias that can affect the success instead of only examining one source of bias.

In addition, the literature recommended applying a model that can help PJMs make rational decisions ad avoid bias that affects the outcomes, as concluded by Al-Ali, Emes and Leal (2018); and stressed that PJMs in practice should be aware of CBA. The study model presented in Chapter 10 paves the way for a new model that can assess what sources of bias PJMs may encounter during ITSD projects and how they may impact the project success accordingly.

6.2 Conclusions

This study aims to explore the impact of CBA on the DM style of ITSD PJMs in Dubai; the study also investigates the NB and VB as moderators on the DM style of the PJMs and the overall impact of their DM style on project outcomes.

ITSD projects have emerged as a dynamic power during the last couple of decades, and the rapid changes in technology advancement and digital transformation put the focus on this domain even more. Thus, it is a fact that managers of ITSD projects affect the DM process; this effect is due to the systematic deviation from rationality caused by CBA; hence, the more biased decisions are, the less accurate they are.

In addition, PJMs are responsible for the success of projects. At the same time, their behaviours are a crucial factor in driving projects towards good outcomes. Their decisions are a key performance indicator that also determines the organization's performance, especially when a project is critical and supports its strategic objectives. Nevertheless, the PJMs' decisions are subject to vast sources of bias that influence their information processing and change the course of action of the project outcomes. These biases are related to many behavioural factors and PJMs' experiences (i.e. voice and NBs). Furthermore, bias is inherited in the human psychological system, and they are part of the PJMs' daily routine.

From this perspective, the study placed similar sources of bias under these families according to literature and for flexible data collection, which indicates each source of bias separately according to the results. These sources of bias proved to influence the PJMs' DM style, where the impact is evident in both literature and thesis results.

Proceeding with the objectives, the study investigated the DM process and found a relationship between CBA and the DM style of the PJMs. This relationship was investigated using cognitive-experiential self-theory (CEST), which implies that humans are divided according to two main information processing techniques: the *rational*, who build their decisions based on analysis and logical interpretation of data, and the *experiential*, who make decisions based on their previous experience and emotions. Literature confirmed that information-processing techniques influence the DM process.

The results of this thesis confirmed a significant relationship between PJMs' CBA and the rational and experiential DM style. The relationship between the experiential PJMs and CBA is stronger than the relationship between the rational approach and CBA, which is an indicator that PJMs make fast judgments due to the experiential DM style, which CBA drives.

This study also investigated the moderating role of the VB and NB. According to literature, VB has a correlation with the experiential DM style of the PJMs, which might positively influence the decisions made under certain events, as it gives the PJMs the room for creative ideas, better communication, and shows concerns regarding unpleasant activities, which contributes to enhancing the performance of organizations. Moreover, this study found a positive relationship between the moderating role of VB from one side and CBA and the experiential DM style of the PJMs from the other side, which might increase the inaccuracy of decisions made hastily under uncertain events without analysis.

On the other hand, the study found that the relationship between rational information processing and VB is weak, confirming that rational decisions take time and require effort while being vocal requires an open environment and positive PJMs. Accordingly, ITSD should create an open environment to communicate information, show concerns, and present ideas to ensure that the DM process goes through all possible ways to generate the best alternatives.

As to the NB, the literature review indicated a direct relationship between the success of projects and the behaviours of PJMs and found a relationship between narcissism and optimism bias (Pinto & Patanakul, 2015; Ouimet, 2010). In addition, a few studies found that PJMs with the NB result in a failure during the lifecycle of projects as this behaviour creates a toxic environment in organizations (Pinto & Patanakul, 2015). However, this study did not manage to find a confirmed statistical relationship between this moderating factor from one side and CBA and the DM style from the other side.

ITSD companies focus on project results and seek satisfied stakeholders and less waste of time, cost, and resources, and this thesis found a strong relationship between PJMs' CBA, their DM style, and project outcomes. This indicates that PJMs with CBA tend to resort to the experiential DM approach by which they count on their past experience and emotions, which might be viable during ordinary circumstances, but when it comes to uncertain events, the decisions made will be prone to bias and not accurate, which leads to unwanted outcomes. In contrast, PJMs not influenced by CBA tend to adopt the rational approach where they count on rationality and analysis to make their decisions, which increases the potential of achieving better outcomes. Therefore, the more accurate the decisions, the better the outcomes and vice versa.

The CB model designed in Chapter ten is a prelude to a standardized DM process that compromises all DM components and de-biasing techniques in one process; thus, project constraint decisions are expected to improve in the future within the ITSD companies.

6.2.1 Contribution to the field of research

Considering the endeavour of the Emirate of Dubai to build a smart society aimed at making life easier for its citizens, the initiative comes through launching a variety of ITSD projects, which involved some unwanted consequences that resulted, in some instances, from inaccurate decisions that PJMs made under uncertain events. From this perspective, the significance of this study lies in its contributions to the following:

1. Contributions to CB: the study contributes to CB by shedding light on 27 sources of bias, thoroughly investigating 21 sources of bias in one study, which was unprecedented in previous literature that had addressed each source of bias solely. Moreover, the study correlated the impact of these resources on the DM style in the PM discipline based on the quantitative methodology that comprises authentic responses provided by 381 PJMs. Therefore, the study bridges the gap in information in this field by imparting a solid foundation for future study to build on.
2. Contributions to the theory of DM: the study comprehensively addresses the DM styles validated by cognitive-experiential self-theory, which illustrates the patterns of making decisions based on the rational and experiential approaches. It links it to the sources of bias that can negatively influence PJMs when making decisions under uncertain events in the discipline of ITSD PM. Accordingly, the study indicates the correlation between the various sources of bias and the DM styles through the statistical analysis, outlines the pros and cons of each approach, and connects this process to the behavioural aspect represented by the NB and VB as potential external moderators, which has not been studied in prior study.

3. Contributions to PM: This study aims to unravel the ambiguity of the failure of many ITSD projects in Dubai by investigating the mechanism of decision-making and linking it to the CB resources that impact the integrity of this process. From this perspective, the study put the pieces together in one context of knowledge, which has not been seen in previous studies, by highlighting the influence of CBA on the DM process, determining the correlation between CBA and the experiential and rational DM styles, outlining the moderating roles of narcissistic and VBs of PJMs and linking that with the success of the projects, and finally providing a validated model that can be used a reference in PM to mitigate the influence of CBA in future projects.

6.2.2 Limitations of the study

This section of the study focuses on the limitations of this study. It is assumed that the study's limitations do not affect the results, but the study is meant to pave the way forward for more studies; hence, the study aim and objectives are reliable.

The study concluded the following limitations based on the literature and results:

1. The focus of this study is CBA, but it did not include all sources of bias due to the following reasons:
   - There are more than 201 sources of bias; hence the time and effort to collect and analyse all these sources in one study within the given time frame is challenging.
   - Many sources of bias are not addressed by articles and studies in an analytical approach; hence, supporting the results is subject to vulnerability.
   - Some sources of bias, like representativeness, do not fall under any of the mentioned families; thus, supporting these sources of bias is weak and needs to be classified.
2. Many aspects of PJM behaviours are involved in the DM process, but the study focuses on only two aspects, with limited studies that support this behaviour.

3. Even though NB is hazardous to PM, the study could not find a strong statistical link between this behaviour and CBA and its impact on the DM style of the PJM; nevertheless, the latest studies support that most societies are biased towards themselves, according to self-serving bias theory.

6.2.3 Study Challenges

1. Although the quantitative analysis method to study behaviours is elaborate and effective, it is quite challenging and time-consuming.
2. It was not easy to reach all respondents to clarify their responses, and it took about 60 days to finish collecting all responses.
3. The lack of previous studies that have addressed CBA, behaviours, and the DM style of PJMs in ITSD projects, made collecting data more challenging. Moreover, previous studies in this context focused on addressing only one source of bias at a time and its impact on one of the project constraints.

6.2.4 Practical and academic implications

Practical implications

The results of this study have various practical implications that can be utilized by ITSD companies in Dubai, UAE, and the region in general. By empirical investigation of the impact of CBA on the DM style of PJMs, companies can use this model to assess sources of bias that PJMs fall for when making project-related decisions. The human resources unit can provide training courses to teach PJMs how to avoid bias. Additionally, processing information has potential room for improvement within ITSD companies, where the significant differences between rational and experiential approaches are apparent, and PM offices (PMOs) or human resources units can provide workshops to facilitate the DM process.

On the other hand, companies' owners are also part of the study's promising results; they can learn how to make decisions under uncertain events and appraise PJMs. Behaviours are diverse, and their encouragement to PJMs to speak their minds and communicate their ideas and concerns is a positive gesture that enhances the PJMs' DM style but should follow the rational approach.

The results also emphasize the importance of rational DM and how these decisions affect the ITSD projects, a crucial indicator for a sustainable business and the maintenance of a long-lasting strategy that empowers the companies, increases their control over resources, and satisfies customers.

Furthermore, hiring units inside ITSD can change the interview process by exposing PJM candidates to different situations, including bias and behaviour, and then assessing their reaction to each situation. This process will help the recruitment department select the ideal candidate who managed to make decisions based on a rational information-processing approach and their ability to avoid biased situations.

The model of the study is comprehensive and provides a coherent paradigm that enables PJMs to read and learn since all the results, both from literature and primary data, are supported by an actual response from PJMs in the ITSD industry, where the data have been through different statistical and mathematical approaches. On the other hand, all information and variables either explained or clarified in the study are supported by references from international journals in PM and psychology.

Academic implications

This study provides promising implications for the academic literature on CB, PJMs' narcissistic and VB, the DM style of the PJM, and project success. While many empirical studies have investigated the impact of CBA on projects (the effect of sources of bias like anchoring, framing, availability, illusions of control), the impact of rational/experiential information processing on the DM process, and the impact of DM on project outcomes, this study took a holistic approach in assessing the impact of CBA on the DM style of the PJM using rational/experiential approaches, and the impact on the project outcomes. At the same time, this study assessed the moderating impact of voice and NB from a psychological perspective. The study's results filled a gap related to the CBA and the DM style of the PJM in academia, and this assumption is based on reliable and valid measurements and a solid model.

This study confirms that PJMs' PBB and BPEB directly impact their DM style. Unlike previous studies, this study classified source of bias into two families and six main groups consisting of 21 sources of bias. Furthermore, the study combined the CBA, behaviours, and DM approaches (rational/experiential), which is unprecedented in previous studies in both PM and the UAE.

The results show a weak relationship between bias and the moderating factor NB, yet a strong and positive relationship between bias and the moderating factor VB. Additionally, the study shows the differences between the rational and the experiential DM styles of the PJM from another angle and their impact on project outcomes.

This study contributes to the literature on CBA, behaviour, and the DM style of the PJM.

6.3 Recommendations

Recommendations for future studies

In study, each study should shed light on some never-explored dimensions of a matter or a problem and frankly specify some of the intricacies experienced and may not be successfully managed by a researcher. In this study, some of the gaps in knowledge have been addressed, while some others still need further study to be authenticated and clarified. Therefore, the researcher highlights the following recommendations to be considered in future study to streamline the process and achieve objectives emphatically. Future study should:

1. Conduct in-depth study and elaborate on more sources of bias that influence the process of DM related to PM.
2. Be conducted through a qualitative method in a controlled and unbiased environment where decision-makers are unaware of the execution of such studies.
3. Focus more on the NB as there is a noticeable scarcity of knowledge related to this aspect through questionnaires and interviews built on twofold sorts of questions, first- and second-person questions, to avoid the self-serving kind of bias.
4. Focus on the VB since knowledge is scarce regarding this aspect in relation to the field of PM.
5. Pay more attention to the ITSD industry as it is becoming the lifeline nowadays in all organizations, so a solid body of concrete knowledge is required to increase the rate of success and decrease the rate of failure of this critical industry.
6. Investigating more sources of bias like group and social bias, effects and memory bias, and representative bias.
7. Collect data across the UAE, Gulf Cooperation Council (GCC) and the Middle East and North Africa (MENA) to compare results and assess the differences in behaviour in these regions and how far the study model fits other populations.
8. Investigate the impact of each group of bias on project constraint decisions, but, in this case, it is better to break down the constraints into variables like scope, time, cost, risk, resources, quality and stakeholder satisfaction.
9. Define other behavioural aspects, gather them in the same model, and assess the moderating role of these variables.

10. Investigate the influence of PJMs' personality on project constraints, assess the differences and similarities between personality and bias, and find conformance between these variables.
11. Assess the impact of PJMs' personalities on rational/experiential information-processing techniques.
12. Use another statistical analysis to demonstrate new results and assess the differences/similarities between this study and future study.
13. Some sources of bias, like representative bias, do not fit in any bias family; hence, more investigation should be carried out to analyse such sources of bias.
14. When drafting a questionnaire to survey the designated sample about their perspectives on any psychological matters, the set of questions should be formulated in the third-person point of view, where the respondents perceived their thoughts about others so that their answers will be unbiased and more objective.

Recommendation to the ITSD industry

Based on the thesis analysis, some recommendations can be provided to the industry for a better DM process, and satisfactory outcomes:

1- The rapid change in IT requires more accurate decisions that can satisfy the stakeholders, save organizational resources, and provide successful objectives and satisfied customers. Accordingly, the need for efficient recruitment and appraisal for PJMs should take another curve that focuses on personality, behaviour, and experience. However, the assessment and the questions for the candidate must be about situational decisions to analyse the approach that PJMs follow when making decisions. Even though professional certification and experience are a necessity, the need for a positive rational PJM is essential.

2- Adopting a DM model that decreases the impact of biased decisions is an essential tool that can save time and resources; accordingly, ITSD companies can benefit from the model provided by this study. Furthermore, this will create a database of all the decisions made about projects during a specific time, an excellent database repository for future projects.

3- ITSD companies must be aware of the behaviour and DM models and theory, where spending money on study and development is a fruitful approach for organizations, which will help them train and adjust their PJMs' behaviour to reach optimum solutions.

4- PM institute- PMI and PRINCE 2 institute should consider the importance of PJMs CBA and their approach to making decisions; behaviour and personality are not covered in detail in these books despite the importance of the PJM's role to project success.

5- To decrease the influence of confirmation bias in practice, the PJM should be sceptical, ask critical questions, discuss disagreement, accept, and tolerate uncertainty, be humble, and believe that their opinion may not be valid.

6- Wishful thinking bias can be avoided if PJMs act objectively and control their behaviour to alleviate their behaviour and impact DM.

7- To mitigate the side effect of such decisions, the PJM should collect as much reliable and valid information as possible and analyse this information practically and scientifically, which will decrease the risk of an adverse decision and eliminate availability as a source of bias.

6.4 Chapter summary

This chapter discussed the quantitative results and tested the hypotheses depicted in chapter 5. It has demonstrated the study objectives, concluded the answers to the study and provided evidence for accepting the study's hypotheses. The study results show a relationship between CBA and the DM style of the PJM and demonstrate the impact of VB on the DM style of the PJM when applying the experiential information processing approach to reach a decision. On the other hand, the study results did not find a relationship between NB and the DM style of the PJM, which requires further investigation in future study. In the end, the study's theoretical and academic implications were discussed in detail.

CHAPTER 7: COGNITIVE BIAS MODEL

This chapter focuses on establishing the CBA model to fulfil the study obligation to design a model that mitigate CBA during DM process in ITSD companies. It follows a verification and validation process and assess the ability to implement that model in practice. It demonstrates the variables that affect the DM during ITSD projects; that step is essential to explore the PJMs' attitude towards handling critical decisions in projects.

7.1 The importance of the model

The conceptual model is one of the major factors needed in the study process (Légaré et al., 2011). It has essential tools to bridge the gap between theories and practical implementation (Irobi, Andersson & Wall, 2004). It provides a basis for how much detail and information it can demonstrate to individuals while making particular decisions (Irobi, Andersson & Wall, 2004). Furthermore, the conceptual model is widely known to support solving problems and making decisions (Irobi, &ersson & Wall, 2004).

7.2 The foundations of the model

This model integrated the DM process into a dynamic flow, and it goes through detailed steps to reach its optimum use. The process comprises meaningful steps that include the formulation of decisions, a criterion to avoid bias, evaluation and implementation of decisions, assessment of decisions, and archiving of the results into lessons learned for future consideration.

The value of the model appears when multiple decisions under uncertain events surface in the future; thus, both organizations and PJMs will have the direct and solid experience and knowledge to make the right decision, avoid bias, and shorten the time to reach a consensus.

This model's terminology and the interrelationship among variables and processes are illustrated in the next section.

Cognitive bias attributes and project manager's psychological and mental state

Social psychology science focuses on the study into human behaviours and the interaction among people in the social field (Jones & Deckro, 1993). This part of science is related to the role theory, which has emerged based on human behaviours when interacting with the surrounding social environment and engaging with social groups, of which PJMs are also a part. The word 'PJM' is generally defined in PM as being biased when making decisions under uncertain events such as the increasing project constraints and the necessity for an adequate balance, which have a high negative psychological impact on PJMs (Haynes & Love, 2004). Nonetheless, not all PJMs react to this condition in the same way, nor is their psychological state the same. Nevertheless, the psychological and mental state influences the DM process (Haynes & Love, 2004).

Decision-making (Rational vs Experiential)

According to Jung's classic psychological theory, humans are different in the way they perceive, process and evaluate information; these differences have a potential impact on PJMs' decisions (Culp & Smith, 2001). From this perspective, literature classifies DM based on three major categories: the first category is based on intuitive-based theories, which refer to individuals who gain information through associated learning and long-term memory, which is accessed unconsciously to make a decision; the second category is based on the mind limitation of the PJM's mind when making decisions, and the systematic bias embedded in the human mind and is wholly associated with psychological behaviour theory; the third category is based on the conflict-free organization, random DM process, and low political interference

Parkin (1993, 1996) suggested that the individual DM process goes through consequential phases and is impacted by different influences; figure 7.1 illustrates the personal decision-making process as cited in Parkin (2013).

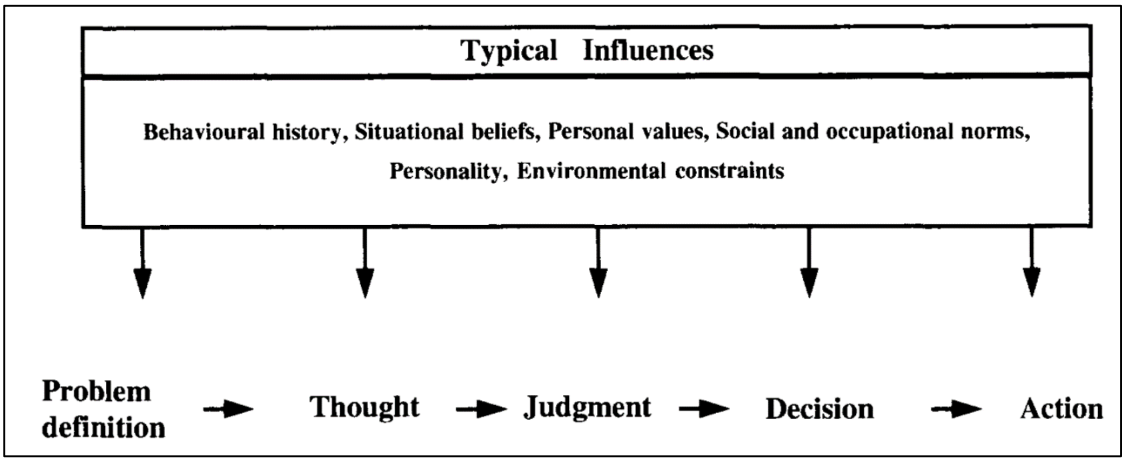


Figure 7. 1: The personal decision process (Source: Parkin, 2013)

The model exhibits the DM process from the beginning of the problem; accordingly, this model comprises the DM process flow.

7.3 De-biasing

De-biasing is a process established to eliminate the effects of CBA on the human mind. This process goes through several stages: warning decision-makers about bias in general; defining the impact, providing decision-makers with personal feedback, and training decision-makers to control their bias. (Vinaja, 2012). Many studies begin to find a solution for biased decisions by creating tools and techniques that eliminate the effects of bias in an organizational context (Meissner & Wulf, 2016); these techniques may be scenario planning or mind mapping (Adodo, 2013).

Previous studies have identified four strategies to avoid bias. These strategies vary depending on the definition and status of bias, i.e., considering other decisions made by people facing the same situation, generating alternative options, referring to similar previous decisions, and consulting subject matter experts (Meissner & Wulf, 2016). Furthermore, other studies suggest that decision-makers can learn from their competitors when making strategic and critical decisions (Liu et al., 2017); nevertheless, these decisions may not be accurate due to the differences in information in organizations. However, few studies suggest that empowering employees and giving them the space to speak their minds can help de-biasing (Hunziker, 2019).

7.4 Judgment under uncertainty

Decision-makers seek to minimize the negative consequences of uncertain events because the consequences of their decisions cause a gap between taking action and achieving the desired success; to achieve positive results, decision-makers look for more information about the current situation that jeopardizes the possibility of reaching the project objectives. Uncertainty is derived from risk management, which aims to decrease adverse events in projects while increasing the positive impact of risk that turns into an opportunity (PMBOK, 2017. p.314; Allen et al., 2015). Studies claim that technology projects contain a high level of uncertain events, requiring further analysis and risk management tools and techniques to reduce the influence of risky adverse events on the project (Control, Performance & Contexts, 2008).

Efficient uncertainty management is crucial in successful projects (Qi, 2015). Highly uncertain events require experienced decision-makers and a straightforward process (Control, Performance & Contexts, 2008); besides, uncertainty requires standardized procedures for decision-makers to follow during the DM process. Moreover, Tversky and Kahneman (1978) found a relationship between making judgments under uncertainty and CBA; besides, they asserted that managing bias leads to better judgment under uncertainty. On the other hand, uncertainty generates different sources of bias during the DM process, like anchoring bias (Mohanani et al., 2018). Despite the possibility of a positive outcome, decisions under uncertainty involve a high level of bias even if the decisions are excellent (Stacy & Macmillan, 1995).

Nevertheless, failure to have a lessons learned repository and a lack of sufficient information within uncertainty enhances the possibility of biased decisions (Cunha et al., 2014). On the other side of the equation, the PJMs have to deal with uncertainty when making a decision, which leads them to adopt the simplified version of the decision and make a biased judgment that causes errors when delivering the project success (McCray, Purvis & McCray, 2002). Making decisions without sufficient information, and falling into the trap of bias, leads to project failure and rework, which means losing the organization's resources, and creating unhappy stakeholders (Johnson et al., 2013; Ralph, 2011; Meissner & Wulf, 2017). More information is required to control the adverse impact of uncertainty (Wirfs-Brock, 2007).

The investigation of uncertainty is necessary for all industries, including ITSD, construction and services, which require more effort and study to develop a coherent model that eliminates bias during uncertainty and decreases the influence of negative judgment (Skitmore, Stradling & Tuohy, 1989).

The study looked into the systematic deviation of thinking during ITSD projects. It has explored the influence of CBA on the DM style and successfully linked it to the PJMs who are experiential and have VB and explored how rationality decreases CBA and affects project outcomes. The study has suggested that assessing the PJMs' decisions requires a scientific process that mitigates or eliminates bias and ensures that the right decisions are accepted; hence, reducing the gap between misjudgement and impulsive decisions. Decisions should not be arbitrary; having a process to assess the consequences with a bias-free approach will inevitably lead to prosperous project outcomes.

7.5 Why CB debiasing techniques fail?

Until the years 2022, few studies looked into de-biasing techniques and strategies to mitigate the impact of bias on decision-making (Neal *et al.*, 2022)where a few studies focused on specific sources of bias and how to decrease the impact of these biases on DM process. Results shows that most debiasing strategies are have a low impact and effect on bias, this statistic is based on 87,418 respondents in almost 492 studies (Forscher, et al 2019). That study triggers the awareness of the applicability of debasing strategies in practical implication; where some strategies hold staff accountable for their decisions to force them to make rational decisions; furthermore studies suggested that decisions makers can reduce the impact of CB by receiving immediate feedback and receive training to avoid such biases (Neal *et al.*, 2022); these studies also suggested that the work environment should be more encouraging to make rational decisions (Neal *et al.*, 2022); and the organization should develop policies and procedures to address de-biasing techniques and the process that decision makers have to follow under uncertainty (Neal *et al.*, 2022). However, it is evident that these strategies last only for few months until the decision makers back to commit biased decisions (Neal *et al.*, 2022).

The question is why decision makers can't apply debiasing techniques and follow policies and procedures for as long as they are working? First, it was found that there is a lack of collaboration between academic research and practical implications (Neal *et al.*, 2022), second, access to conduct experimental research and case studies that investigate the reason why people make biased decisions is limited (Berthet, 2022); fourth, lack of studies on actual cases in management science (Berthet, 2022).

On the other hand barriers exist with the organisations that prevent the decision makers from implementing debiasing techniques like: time constraints to apply the DM models, lack of resources, insufficient training programmes (Koyama *et al.*, 2022), management resistance to change and applying new procedures in addition to scarcity in translating academic research results into practice (Quigley-McBride *et al.*, 2022); fear of failure (Berthet, 2022).

Thus and based on the result of this study, the following inputs were considered to formulate the model:

1- CBA affects the DM style of the PJM; CBA highly affects experiential decision-makers, unlike rational decision-makers, whilst CBA has a low impact on rational decision-makers.
2- PBB have a more impactful DM style than BPEB.
3- CBA impacts the success of the ITSD development.
4- The decision of an experiential PJM influences the success of the ITSD project.
5- Barriers to implement the debiasing model.

Table 7.1 demonstrates the major components of the model used in the study and the validation of the proposed model; this model consists of the sources of bias in the DM style of experiential PJMs, and project outcomes.

Table 7. 1: CBA model components

CBA					
PBB				**BPEB**	
Interest bias	Pattern recognition bias	Perception bias	Decision bias	Stability bias	Action-oriented bias
- Confirmation - Wishful Thinking - IKEA	- Availability - Fixation - Mere exposure effect - Semmelweis reflex	- Framing - Selective Perception - Primacy and recency effect:	- Sunk cost bias - Planning Fallacy - Omission bias	- Anchoring - Status quo: - Familiarity	- Overconfidence - Illusion of control - Gambler fallacy - Miserly information processing - Misleading information
Experiential/Rational DM approach					
Project success					

This table is integrated with figure 7.2 to show a process flow that can be used in practice and enhance the DM process during ITSD projects. Therefore, to validate this model, the researcher approached PJMs in ITSD development companies in Dubai via different channels like Zoom meetings and LinkedIn. Most of the participants welcomed participation in this study, where the participants' identities were kept anonymous to protect the confidentiality and integrity of the respondents. The study demonstrated the aim and objectives of the study, demonstrated the results to the respondents and asked them to do three things:

1- Fill in a questionnaire about their basic knowledge of sources of bias.
2- Validate the model.
3- The ability to implement the model in the practice/professional domain.

Figure 10.2 illustrates the CBA model under uncertainty events, which gathers the study variables' successful variables into a coherent whole. The model aims to draw a pathway for PJMs to follow the correct approach before making a decision: implement a de-biasing technique, evaluate the decision, assess the impact, and repeat the process or archive the outcome in the lessons learned archive.

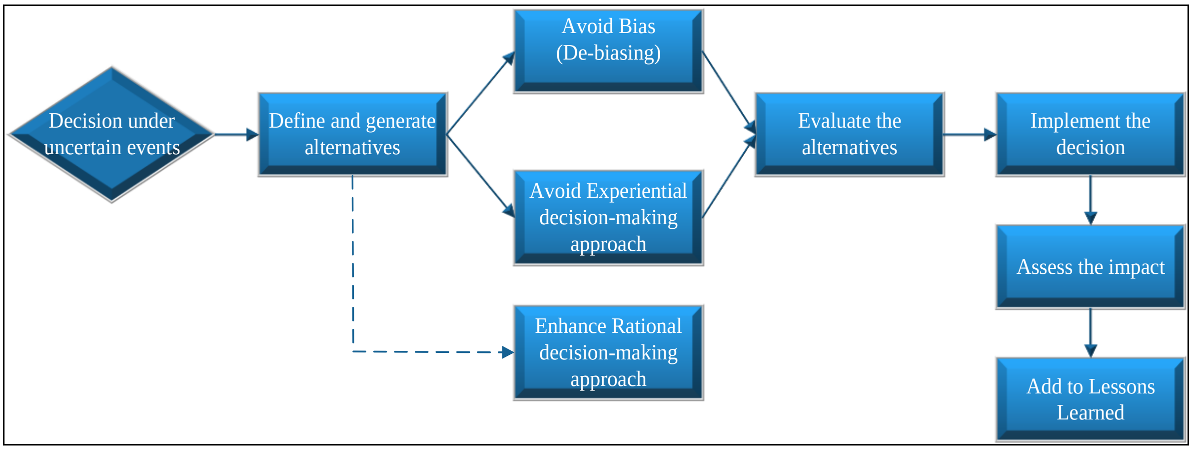


Figure 7. 2: The model of CB – source: Author

The PJM defines and generates alternatives to reach the best decision that leads to desirable outcomes. They follow the workflow to make the decision, considering the need to avoid making a biased decision (de-biasing) based on a bias sheet and avoid experiential decisions based on emotions, feelings, intuition, hunches, and previous experiences of similar situations. Furthermore, the PJM should follow a rational approach when generating alternative solutions to the issues and look for further analysis. Then, a process of alternative assessment is followed to evaluate the solutions. Once an agreement is reached, the PJM implements the decision and assesses the impact; eventually, the output of the decision is added to the organization's lessons learned archive.

Next, each step to help the PJM understand each component will be explained.

Step 1 (decisions): Selecting alternatives based on screening options and choosing that do not contradict the PJM's values, beliefs, and standards can achieve a positive outcome (Beach, 1993).

Step 2: (uncertain events): It is a situation with an unknown event that negatively impacts the project, and it is a source of risk related to the project scope and requirements (Besner & Hobbs, 2012). This situation is associated with the probability of not achieving the project objectives (Perminova, Gustafsson & Wikström, 2008);

Step 3 (Rational DM):

- Collect detailed information.
- Analyse the situation with logical connections.
- Spend intentional efforts to evaluate the situation.
- Transfer facts into figures.
- Take an adequate slow approach to processing information.
- Support and justify choices with evidence.

Step 4 (debiasing techniques):

- Make decisions according to what corresponds to reality, not your beliefs only.
- Do not make decisions based on previous unpleasant results.
- Let others decide whether your decisions are adequate.
- Do not make decisions based on easily recalled information.
- Focus on multiple angles of the situation.
- Make decisions based on new tools and techniques.
- Accept new information even if it contradicts your beliefs.
- Make decisions according to what corresponds to reality and logic.
- Sunk costs cannot be redeemed; move on if this situation happens to you.
- Be optimistic but also be rational.

- Do not build your decision based on initial information; look for more inputs.
- Review other alternatives even if you believe your decision is correct.
- Make decisions based on experience but consider the circumstances.
- Avoid simple decisions if the event is uncertain.

Step 5 (evaluation): If applicable, perform decisions evaluation techniques like SWOT, tree analysis, cost-benefit analysis, and expert analysis.

Step 6: decisions implementation and assessment.

Step 7: Archive the process, alternatives, methods, tools and expert judgments for an easy future-accessible database to be more flexible and ready for future projects (Perminova, Gustafsson & Wikström, 2008).

hence, the PJM's decisions are bias-free and follow a logical model that enhances the DM process in ITSD projects in particular. Accordingly, these steps present recommendations for PJMs to implement while making decisions and introduce a simple tool. These recommendations are beneficial to assess the urgency of the event, trigger the alarm for the PJM to avoid falling into undesirable behaviour and ensure they follow the right steps to express their thoughts. Additionally, it lists sources of bias and their interpretation that could match the PJM's thoughts and make them reconsider the decisions they make while moving ahead with the process.

This model and table can be delivered through a training course and a workshop to understand and memorize the process flow of the model and to realize the sources of bias that may occur during the DM process. Furthermore, part of the most effective tool to implement this model is to record it as "lessons learned".

The model

This section reports the results of model validation contributed by respondents in ITSD companies who work as PJMs and how do they perceive the relationship between steps.

The purpose of the model validation is to bring conceptual models to reality and bridge the gap of misunderstanding of the model, hence developing a model that can be used in practice and which is also supported by academic study. Thus, the purpose is to provide a cohesive and generic model that aids PJMs to make decisions during the ITSD project. Due to COVID-19 restrictions, 20 participants were invited to attend an online Teams workshop. All the participants were IT PM practitioners who also responded to the study survey instrument during the data collection process. Two sessions were completed on Wednesday, 26th January 2022, at 12 noon and 1 p.m. (links in Appendix F). A presentation was given to brief the attendants about the purpose of the study and its findings; the attendees were asked to type their questions to be answered by the end of every slide. The attendees asked questions about the definition of CB, the CEST approach. There was a debate about the differences between narcissism characteristics and NB; however, the debate was rectified by providing a logical definition based on literature.

7.6 Model validation results

Step 1: an email was sent to the PM practitioners who responded to the study's main survey related to the study variables. This step aims to validate their knowledge of CB and the concept and sources of bias. The respondents were selected from five companies extracted from the Dubai Chamber of Commerce list provided to the researcher to conduct the study survey. There were 20 respondents.

The results of the survey are depicted in table 7.3:

Table 7. 2: Model validation survey results - CB

Question	**Yes**	**No**
Are you familiar with the CB concept?	50%	50%
Are you familiar with the below sources of bias?	**Yes**	No
Confirmation bias	30%	70%
Wishful thinking bias	25%	75%
IKEA bias	10%	90%

Availability bias	20%	80%
Fixation bias	10%	90%
Mere exposure effects	20%	80%
Semmelweis reflex bias	5%	95%
Framing bias	25%	75%
Selective perception bias	30%	70%
Primacy and recency effect	15%	85%
Sunk cost bias	25%	75%
Planning fallacy	10%	90%
Omission bias	20%	80%
Anchoring bias	15%	85%
Status quo	25%	75%
Familiarity bias	35%	65%
Overconfidence bias	35%	65%
Illusion of control bias	15%	85%
Gambler fallacy	15%	85%
Miserly information processing bias	10%	90%
Misleading information bias	30%	70%
Overall percentage	**22%**	**78%**

Based on the results in table 7.3, it is obvious that 50% of the respondents are familiar with the CB concept; furthermore, the results of the sources of bias percentages show that only 22% are familiar with most sources of bias, whilst most PJMs (78%) have no idea about sources of bias. On the other hand, these results show that (35%) of the PJMs are familiar with the terms overconfidence bias and familiarity bias, whereas only 5% are familiar with the Semmelweis reflex bias. These results show the gap between academic and professional orientation, as such concepts should be familiar to decision-makers, especially in critical sectors like the ITSD industry.

Step 2: these companies were contacted to organize a workshop with them, but due to COVID-19 procedures, most of the respondents were working from home due to the nature of their work, which does not require office attendance. Additionally, only crucial meetings are held on company premises; thus, online workshops were conducted via Teams meeting software. Each workshop lasted for 30 minutes, and the thesis aim, objectives, hypotheses, and results were presented. Later on, the model was presented to the participants in order for them to validate it. At the end of the meetings, the attendees were asked to respond to a questionnaire constructed to evaluate the model; validation results are discussed and illustrated in the next section.

The researcher used a 5-point Likert scale ranging from strongly agree to strongly disagree to validate the model. Seven dimensions were used to assess this model; these dimensions are based on (Légaré et al., 2011; Irobi, Andersson & Wall, 2004) and are summarized next:

1- Logical
2- Relevant
3- Informative
4- Is the relationship between the model components clear?
5- Is the schematic presentation clear?
6- Is the model applicable in your organization?
7- Are you willing to implement the model in practice?

Each Likert scale demonstrates the following:

1- Strongly agree: the participant is sure the model is valid.
2- Agree: in general, respondents believe the model is valid.
3- Neutral: respondents cannot confirm or make a decision regarding the model.
4- Disagree: in general, respondents believe the model is not valid.
5- Strongly disagree: the participant is sure the model is not valid.

The questionnaire results are illustrated in table 7.4:

Table 7. 3: Model validation results

Dimension	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
Is the above model logical?	3	15%	14	70%	2	10%	1	5%	0	0
Is the above model relevant?	2	10%	15	75%	2	10%	1	5%	0	0
Is the above model informative?	12	60%	5	25%	3	15%	0	0	0	0
Is the relationship between the model components clear?	4	20%	13	65%	3	15%	0	0	0	0
Is the schematic presentation clear?	12	60%	5	25%	3	15%	0	0	0	0
Is the model applicable in your organization?	3	15%	3	15%	14	70%	0	0	0	0
Are you willing to implement the model in practice?	3	15%	12	60%	5	25%	0	0	0	0

The model validation results demonstrated next based on the highest responses percentage:

- 70% of respondents agreed that the model is logical.
- 75% agrees that the model is relevant.
- 60% of respondents strongly agreed that the model is informative.
- 65% of the respondents agreed that the relationship between model components is clear.
- 60% of respondents strongly agreed that the model schematic presentation is clear, and,
- 60% of respondents agreed that they are willing to implement the model in practice.

7.7 Model implementation in practice

A unique result shows that 25% of the respondents are neutral about implementing this model in their organization. This could be due to management and hierarchy limitations, where the respondents implied that they do not have the time and luxury to make decisions based on a rational approach; instead, they focus on their experience even in uncertain events. Others feel that this model is necessary to help them make logical decisions when they face uncertain events.

The continuous advancement in the ITSD industry requires more attention to decisions made during projects, especially now that technology has become involved in every process. Thus, it is no wonder that most companies require their developers to be graduates, and some companies like Google hire people even if they do not have a university degree but can understand programming languages. As proposed in the study, it is necessary to increase the PJMs' awareness of sources of bias that they can fall for during ITSD projects. Many participants believed that these awareness and training courses could mitigate the risk of project failure and help achieve the desired outcomes with minimum losses in terms of their time, reputation, and resources.

Eventually, to implement this model, top management must adopt this tool in the first place, and then it should move down the hierarchy. This will enforce the organization's culture to adopt a logical DM approach when encountering undesirable events that could halt the delivery of project activities or even when making strategic decisions.

7.8 Chapter summary

The chapter's main focus is to fulfil the study obligation to design a model that can help ITSD PJMs to mitigate CB during DM process and provide recommendations for ITSD PJMs when making a decision. This chapter discussed decision-makers' psychological and mental states, rational and experiential information-processing techniques, de-biasing approach, and judgment under uncertainty.

This chapter also reviewed the results of model validation endeavours from professional PJM who work on ITSD projects in Dubai. The purpose of the validation was to provide a valuable model to assist PJM in implementing the thesis results in practice.

The model validation results showed that this model can assist the PJMs in making a rational decision under uncertain events.

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Appendix A: Questionnaire

Study questionnaire

Dear Participants,

You are invited to participate in a research study titled The Influence of Project Manager Cognitive Bias on the Decision-making Style of the Project Manager: The Moderating Role of Narcissistic and Voice Behaviour.

This survey aims to understand how IT project managers' cognitive bias impact project constraints decision-making during IT projects in Dubai.

We highly value your participation in this study, which will take not more than 10-20 minutes of your time. The survey is voluntary and strictly anonymous to maintain confidentiality and prevent the identification of specific respondents; also, you can withdraw from the study at any time while completing the survey.

The study is conducted under the British University in Dubai (BUiD) ethical guidelines and has been reviewed and approved by the ethics committee.

Should you have any questions relating to this survey, please email at:

2015232052@student.buid.ac.ae

sulafa.badi@buid.ac.ae

Thank you for your interest and participation in this study.

Omar Salem Obeidat
Student ID: 2015232052
The British University in Dubai - BUiD

STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS STUDY

- I have read and understood the information above, and I freely and voluntarily give my consent to participate in this study.

Yes, I consent

No, I do not consent

Qualifying question:

Are you currently A project manager in charge of managing IT software development projects?

Yes, I am

No, I am not (Thank you for your time)

Part one: Demographic factors

No	Factor	Category				
1	Age	22-30	31-40	41-50	51-60	61 Above

No	Factor	Category	
2	Gender	Male	Female

No	Factor	Category				
3	Education Level	Diploma	Bachelor	Master	PhD	Other – Please Mention (----------------)

No	Factor	Category				
4	Number of Years of Experience in Project Management	1-5	6-10	11-15	16-20	21 Above

No	Factor	Category (You may select more than two)							
5	Professional Certificates in PM	CAPM	PMP	Agile	Scrum	Prince 2	PgMP	PfMP	Other – Please Mention (----------------)

No	Factor	Category				
6	Number of Successful Projects	1-5	6-10	11-15	16-20	21 Above

No	Factor	Category
7	Current Position	- Project Manager, Senior project manager - Program Manager - Portfolio Manager - Project Leader - Delivery, Technical or Development Manager - Other

Part two: PJM CB

First family: Perceptions and behavioural bias

For the following statements, please tick ✓ the box that matches your view most closely

No	Interest bias	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
1	You make decisions based on what corresponds to your beliefs							
2	You underestimate the possibility of unpleasant results when you make a decision							
3	You gave extra credit to the decision you make							

No	Pattern recognition bias	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
4	You make decisions based on information that is easy to recall							
5	You focus on the angle of the situation when making a judgment							
6	You make decisions based on routine and familiar process, tools, and techniques							
7	Under uncertain events, you reject new information if it contradicts your beliefs							

No	Perception bias	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
8	You might change your decision if the way information presented changes							
9	You make a judgment based on your perception of information							
10	Information presented at the beginning and end of a meeting determines your decision							

No	Decision bias	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
11	You hold on to your past decisions even if you know that expected results will not be achieved and cost can't be recovered							
12	You always tend to be over-optimistic about the outcome of planned activities.							
13	In high stake decisions, you prefer not to take action even if you know that taking action leads to objectively better outcome.							

Second family: Belief and probability estimation bias

For the following statements, please tick ✓ the box that matches your view most closely

No	Stability bias	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
14	You make your decision based on the initially received information							
15	You prefer to stick to and defend the default option rather than reviewing other alternatives							
16	You make decisions based on previous experience that have similar circumstances							

No	Action-oriented bias	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
17	You assume that positive results will happen because you have sufficient planning skills and abilities							
18	You feel that you have the ability to control or influence project outcomes							
19	You believe that your next decision will be wrong due to the several right decisions you previously made							
20	You prefer to keep decisions simple and avoid complicated and rational analysis							

21	You follow provided information without attempting self-evaluation of this information							

Part three: PJM NB

For the following statements, please tick ✓ the box that matches your view most closely

No	NB	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
22	You always see yourself as important							
23	You may use others to achieve your personal benefits							
24	You do not care about other feelings when making a decision under uncertain events							
25	You always look for being important and admired by others.							
26	When making a decision under uncertain events, you may be hostile towards others							

Part four: PJM VB

No	VB	Strongly Agree	Moderately Agree	Slightly Agree	Uncertain	Slightly Disagree	Moderately Disagree	Strongly Disagree
27	You usually present ideas to make/support decisions that are important to the project							
28	You use initiative, provide proposals, recommendations, and hints to make/support decisions that are important to the project							
29	You usually show your concerns to stakeholders regarding the adverse and negative events that impact the decisions related to the project							

Part five: Experiential/Rational decision-making CEST

For the following statements, please tick ✓ the box that matches your view most closely

No	Statement	Strongly Agree	Moderately Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Moderately Disagree	Strongly Disagree
30	When I make project-related decisions, I like to rely on my intuitive impressions and trust in my hunches to solve problems							
31	Using my feelings usually works well for me in figuring out problems in the project							
32	I trust my initial feelings about people							
33	When I make project-related decisions, I do not like to have to do much thinking							
34	I am much better at figuring things out logically than most people							
35	Thinking hard and for a long time about something gives me little satisfaction							
36	Knowing the answer without having to understand the reasoning behind it is good enough for me							
37	Learning new ways to think would be very appealing to me							
38	I do not think it is a good idea to rely on one’s intuition for important decisions							
39	When I make project-related decisions, I tend to use my heart as a guide for my decisions							
40	When I make project-related decisions, I enjoy solving problems that require hard thinking							
41	When I make project-related decisions, I am not that good at figuring out complicated problems							
42	I usually have clear, explainable reasons for my decisions							
43	I have a logical mind and enjoy intellectual challenges							
44	I prefer complex to simple problems							

Part six: Project success measurements

For the following statements, please tick ✓ the box that matches your view most closely

No	Statements	Strongly Agree	Moderately Agree	Slightly Agree	Neither agree nor disagree	Slightly Disagree	Moderately Disagree/	Strongly Disagree
45	You always achieve the project objectives							
45	You always meet the project technical specifications							
46	You always achieve a high level of satisfaction concerning the project outcomes among internal stakeholders							
47	You consistently achieve a high level of satisfaction concerning the project outcomes with clients							
48	You consistently achieve projects outcomes within scope, time, and cost							
49	You always complete projects with minimal issues, troubleshooting and rework							
50	Your projects are directly benefiting the end-users, and increase efficiency and effectiveness							

Appendix B: Statement and variables measurements guide

In order to generate unbiased responses from respondents, CB and behaviour variables are replaced with a statement that describes the situation; the analysis of these statements will show the relationship of sources of bias when described in the results.

Statement No.	Sources of bias	Questionnaire statements
1	Confirmation	You make decisions based on what corresponds to your beliefs
2	Wishful Thinking	You underestimate the possibility of unpleasant results when you make a decision
3	IKEA	You give higher value to the decisions you make
4	Availability	You make decisions based on information that is easy to recall
5	Fixation	You focus on one angle of the situation when making a judgment
6	Mere exposure effect	You make decisions based on routine and familiar process, tools, and techniques
7	Semmelweis reflex	Under uncertain events, you reject new information if it contradicts your beliefs
8	Framing	You might change your decision if the way information is presented changes
9	Selective perception	You make a judgment based on your perception of information
10	Primacy and recency effect	Information presented at the beginning and end of a meeting determines your decision
11	Sunk cost Bias	You hold on to your past decisions even if this requires more resources in the future
12	Planning Fallacy	You have the confidence to complete the project as planned
13	Omission bias	You might observe a potential problem in the project and do nothing rather than being part of that problem if it happened
14	Anchoring	You make your decision based on the initially received information
15	Status Quo	You prefer to stick to and defend the default option rather than reviewing other alternatives
16	Familiarity	You make decisions based on previous experiences that have similar circumstances
17	Overconfidence	You assume that positive results will happen because you have sufficient skills and abilities
18	Illusion of Control	You feel that you have the ability to control or influence project outcomes
19	Gambler Fallacy	You believe that your next decision will be wrong due to the several right decisions you previously made.
20	Miserly information processing	You prefer to keep decisions simple and avoid complicated and rational analysis
21	Misleading information	You follow provided information without attempting self-evaluation of this information

Statement No.	NB	Questionnaire statements
24	Arrogance	You always see yourself as important
25	Interpersonally exploitative	You may use others to achieve your personal benefits
26	Lacking empathy	You do not care about others' feelings when making a decision under uncertain events
27	Grandiosity	You always look to be essential to and admired by others.
28	Antagonistic	When deciding on uncertain events, you may be hostile towards others

Statement No.	VB	Questionnaire statements
29	Discretionary communication of ideas	You usually present ideas to make/support decisions that are important to the project
30	Suggestions	You use initiative, present proposals, recommendations, and hints to make/support decisions that are important to the project

31	Concerns	You usually show your concerns to stakeholders regarding the adverse and negative events that impact the decisions related to the project

Appendix C: Study variables with missing data details

Univariate Statistics, Missing data percentages

	N	Mean*	Std. Deviation*	Missing		No. of Extremes	
				Count	Percent	Low	High
INT1	360	5.139	1.5843	23	6.0	11	0
INT2	360	3.611	1.8310	23	6.0	0	0
INT3	360	5.378	1.4537	23	6.0	38	0
PAT1	355	4.428	1.7779	28	7.3	0	0
PAT2	355	3.617	1.9700	28	7.3	0	0
PAT3	355	5.006	1.6382	28	7.3	10	0
PAT4	355	2.896	1.6934	28	7.3	0	5
PERCE1	350	5.263	1.4890	33	8.6	47	0
PERCE2	350	4.757	1.6930	33	8.6	12	0
PERCE3	350	4.749	1.6756	33	8.6	11	0
DECI1	339	2.546	1.6481	44	11.5	0	37
DECI2	339	4.168	1.7587	44	11.5	0	0
DECI3	339	2.729	1.5830	44	11.5	0	7
STAB1	333	3.622	1.6990	50	13.1	0	0
STAB2	333	2.538	1.4978	50	13.1	2	45
STAB3	333	5.363	1.2883	50	13.1	28	0
ACTOR1	324	5.194	1.5021	59	15.4	44	0
ACTOR2	324	5.685	1.1617	59	15.4	14	0
ACTOR3	324	2.552	1.5719	59	15.4	0	0
ACTOR4	324	4.373	1.9193	59	15.4	0	0
ACTOR5	324	2.762	1.6056	59	15.4	2	56
Narciss1	319	4.966	1.6394	64	16.7	11	0
Narciss2	319	2.928	1.9241	64	16.7	0	0
Narciss3	319	3.091	1.7594	64	16.7	0	0
Narciss4	319	3.646	1.8909	64	16.7	0	0
Narciss5	319	3.411	1.7476	64	16.7	0	0
Voice1	313	6.240	.8862	70	18.3	8	0
Voice2	313	6.249	.8817	70	18.3	7	0
Voice3	313	6.029	1.1220	70	18.3	20	0
Experiential1	306	4.435	1.6369	77	20.1	0	0
Experiential2	306	3.964	1.6992	77	20.1	0	0
Experiential3	306	4.533	1.6498	77	20.1	0	0
Experiential4	306	2.690	1.5508	77	20.1	2	47
Rational5	306	4.899	1.3954	77	20.1	4	0
Rational6	306	4.431	1.6783	77	20.1	0	0
Experiential7	306	2.673	1.5229	77	20.1	2	45
Rational8	306	6.131	1.0846	77	20.1	14	0

Rational9	306	4.997	1.6782	77	20.1	8	0
Experiential10	306	2.879	1.5434	77	20.1	0	4
Rational11	306	5.722	1.3024	77	20.1	14	0
Experiential12	306	2.752	1.5735	77	20.1	0	7
Rational13	306	6.026	1.0175	77	20.1	18	0
Rational14	306	6.065	1.0318	77	20.1	21	0
Rational15	306	4.833	1.7068	77	20.1	10	0
Outcome1	294	5.609	1.2058	89	23.2	18	0
Outcome2	294	5.704	1.1585	89	23.2	12	0
Outcome3	294	5.769	1.0808	89	23.2	10	0
Outcome4	294	5.799	1.0854	89	23.2	12	0
Outcome5	294	5.276	1.3331	89	23.2	32	0
Outcome6	294	4.895	1.5254	89	23.2	4	0
Outcome7	294	5.884	1.0221	89	23.2	.	.

** Mean and standard deviation for the items before contributing to the missing data.

Appendix D: Test of outliers

Case ID	MAH_1	outlier	Case ID	MAH_1	outlier
375	63.3559	0	366	8.81099	0.4549
127	52.89914	0	25	8.80671	0.4553
61	36.24484	0.00004	124	8.76494	0.45925
316	33.59599	0.00011	108	8.66053	0.46918
338	32.87166	0.00014	168	8.63011	0.47209
112	31.1833	0.00028	391	8.57132	0.47775
133	30.72761	0.00033	137	8.56557	0.4783
163	30.70012	0.00033	160	8.54602	0.48019
55	29.78116	0.00048	224	8.41042	0.49337
178	28.16264	0.0009	120	8.39586	0.4948
243	27.45846	0.00117	138	8.38223	0.49613
233	27.31781	0.00124	369	8.30903	0.50333
10	25.86031	0.00215	145	8.29507	0.50471
110	25.64634	0.00233	202	8.20657	0.51347
169	25.46272	0.0025	308	8.17157	0.51695
43	25.19594	0.00276	50	8.15792	0.51831
300	25.18567	0.00277	356	8.15072	0.51903
152	24.73384	0.00328	156	8.13582	0.52052
69	24.46337	0.00363	343	8.13404	0.5207
3	24.28966	0.00387	223	8.09475	0.52463
63	23.70773	0.00479	80	8.0934	0.52476
174	23.25982	0.00564	257	8.07638	0.52647
241	22.34259	0.00785	395	8.02445	0.53168
322	22.11257	0.00853	173	8.00525	0.53362
301	22.02309	0.00881	329	7.95807	0.53838
106	21.80044	0.00953	349	7.93197	0.54102
83	21.73269	0.00977	317	7.91981	0.54225
318	21.13929	0.01205	357	7.87964	0.54632
180	20.87833	0.0132	77	7.8101	0.55339
22	20.33728	0.01594	262	7.79145	0.55529
254	20.27487	0.01629	248	7.75058	0.55946
293	19.44896	0.02163	105	7.71579	0.56302
151	19.41651	0.02188	64	7.60316	0.57458
229	19.33138	0.02252	250	7.59572	0.57534
235	18.79988	0.02695	374	7.59278	0.57565
57	18.68599	0.028	211	7.54279	0.58079
339	18.64826	0.02836	154	7.53874	0.58121
238	18.28406	0.03202	265	7.51676	0.58348
14	18.22923	0.03261	306	7.49611	0.58561
166	17.93042	0.03599	104	7.41638	0.59385
359	17.78705	0.03773	307	7.39214	0.59636

381	17.62616	0.03977	291	7.38543	0.59706
249	17.40198	0.04278	181	7.38188	0.59743
87	17.20042	0.04567	132	7.38042	0.59758
136	17.15261	0.04638	74	7.36597	0.59907
282	17.08565	0.04739	210	7.32913	0.60289
226	16.86301	0.0509	373	7.27442	0.60857
89	16.83566	0.05135	325	7.26569	0.60948
197	16.80233	0.0519	192	7.25617	0.61047
149	16.69185	0.05377	122	7.08249	0.62853
72	16.65498	0.0544	268	7.03141	0.63385
231	16.48795	0.05737	9	6.99773	0.63736
242	16.43294	0.05837	344	6.95248	0.64207
311	16.35522	0.05982	162	6.8638	0.6513
19	16.25721	0.0617	303	6.74504	0.66364
15	16.18804	0.06306	264	6.72804	0.66541
351	16.15927	0.06363	8	6.69137	0.66922
345	15.81681	0.07081	266	6.67196	0.67123
32	15.64847	0.0746	88	6.64002	0.67454
100	15.48333	0.07849	320	6.52082	0.68687
269	15.47238	0.07875	60	6.42651	0.69659
348	15.40832	0.08031	284	6.41081	0.6982
85	15.40807	0.08032	158	6.41025	0.69826
259	15.38198	0.08096	283	6.3843	0.70092
147	15.31332	0.08268	115	6.36374	0.70303
84	15.22177	0.08502	182	6.3573	0.70369
376	15.2047	0.08546	34	6.31365	0.70816
389	15.14427	0.08705	48	6.29315	0.71026
313	15.07579	0.08887	205	6.22825	0.71687
91	14.96897	0.09179	121	6.21435	0.71829
309	14.77331	0.09735	29	6.19926	0.71982
94	14.66839	0.10046	319	6.18432	0.72134
44	14.66812	0.10046	398	6.16466	0.72333
175	14.61219	0.10215	143	6.15485	0.72433
368	14.51972	0.105	330	6.12756	0.72709
388	14.41572	0.10829	81	6.12389	0.72746
45	14.30688	0.11182	255	6.09587	0.73029
393	14.05778	0.12028	188	6.07618	0.73227
79	14.01802	0.12169	47	6.07149	0.73274
129	13.71226	0.13294	193	6.00249	0.73967
230	13.69118	0.13374	119	5.98531	0.74139
261	13.68282	0.13406	96	5.95255	0.74466
73	13.67763	0.13426	379	5.87035	0.75282
42	13.59402	0.13752	278	5.82707	0.75709

213	13.5775	0.13817	378	5.79631	0.76012
386	13.48614	0.14181	200	5.70243	0.76929
62	13.43884	0.14373	271	5.67474	0.77198
65	13.41858	0.14456	290	5.63934	0.7754
184	13.203	0.15363	6	5.62407	0.77687
296	13.1482	0.15601	392	5.51675	0.78714
76	12.95923	0.16446	364	5.50712	0.78805
380	12.81946	0.17095	148	5.46095	0.79242
277	12.73303	0.17506	41	5.44771	0.79367
333	12.72072	0.17566	18	5.43692	0.79468
99	12.69339	0.17698	346	5.41804	0.79645
332	12.67203	0.17802	286	5.40209	0.79794
23	12.61905	0.18061	331	5.35659	0.80218
377	12.5928	0.18191	247	5.31466	0.80606
340	12.53216	0.18494	253	5.3046	0.80699
187	12.52926	0.18509	228	5.27969	0.80928
125	12.51607	0.18575	39	5.25458	0.81157
335	12.36079	0.19373	397	5.23408	0.81344
298	12.24085	0.20007	305	5.22983	0.81383
198	12.23114	0.20059	144	5.22222	0.81452
78	12.20439	0.20203	157	5.19667	0.81684
164	12.17278	0.20374	203	5.06562	0.82855
239	12.07503	0.20911	186	5.05243	0.82971
204	12.06054	0.20992	1	5.02082	0.83249
222	12.05908	0.21	189	5.0094	0.83349
68	11.95638	0.21578	123	4.90112	0.84284
327	11.85652	0.22152	246	4.86847	0.84562
113	11.79185	0.2253	279	4.85936	0.84639
252	11.78854	0.22549	172	4.79837	0.85152
66	11.71917	0.22961	59	4.70549	0.85919
24	11.65181	0.23366	140	4.64812	0.86384
183	11.54338	0.24029	46	4.60833	0.86703
26	11.48541	0.2439	245	4.60369	0.8674
2	11.47748	0.24439	394	4.58559	0.86884
219	11.4576	0.24564	256	4.43061	0.88086
103	11.39992	0.24929	263	4.41943	0.88171
385	11.3393	0.25317	236	4.4084	0.88254
212	11.33896	0.25319	371	4.40238	0.88299
194	11.33113	0.25369	216	4.40097	0.8831
260	11.16201	0.26477	118	4.36319	0.88593
295	11.13383	0.26665	139	4.32982	0.8884
328	11.09981	0.26893	21	4.29291	0.8911
299	10.94236	0.27968	58	4.18825	0.89859

116	10.8684	0.28484	5	4.18024	0.89915
334	10.85146	0.28603	358	4.1116	0.90392
93	10.70946	0.29615	70	4.08164	0.90596
326	10.70609	0.29639	126	4.0035	0.91118
302	10.70222	0.29667	206	3.97502	0.91305
396	10.69689	0.29706	384	3.90702	0.91742
221	10.68422	0.29798	362	3.88879	0.91858
86	10.67624	0.29856	134	3.84706	0.92119
159	10.65194	0.30032	288	3.81561	0.92312
310	10.61563	0.30298	176	3.7801	0.92528
142	10.54658	0.30807	237	3.7554	0.92676
225	10.54074	0.30851	280	3.73003	0.92827
363	10.537	0.30878	135	3.68658	0.9308
131	10.51942	0.31009	274	3.65034	0.93288
370	10.49317	0.31205	155	3.62725	0.93419
54	10.44961	0.31533	365	3.56241	0.93779
285	10.33932	0.32372	82	3.45044	0.94374
75	10.31721	0.32542	17	3.39307	0.94666
314	10.30577	0.3263	13	3.35448	0.94857
272	10.29756	0.32694	56	3.07256	0.96135
150	10.29614	0.32705	281	2.97242	0.96538
52	10.21104	0.33367	342	2.7709	0.97269
304	10.20506	0.33414	49	2.75614	0.97318
165	10.14209	0.33911	353	2.64657	0.97668
128	10.13993	0.33928	312	2.53831	0.97984
53	10.12538	0.34043	20	2.51597	0.98045
117	10.09371	0.34295	367	2.49587	0.98099
251	10.07768	0.34423	114	2.48021	0.98141
195	10.06933	0.3449	209	2.4575	0.982
92	10.00147	0.35037	267	2.36488	0.9843
95	9.99176	0.35115	51	2.22509	0.98739
214	9.90176	0.3585	323	2.21681	0.98756
30	9.8616	0.3618	97	2.11512	0.98951
38	9.85626	0.36225	33	1.94983	0.99224
234	9.85439	0.3624	324	1.39536	0.99785
161	9.80651	0.36638	382	1.35335	0.9981
336	9.80399	0.36659	130	0.98834	0.99946
71	9.79622	0.36723	4	0.7071	0.99987
67	9.79064	0.3677	37	0.43618	0.99998
273	9.78214	0.36841	170	0.43618	0.99998
7	9.78002	0.36859	171	0.08731	1
218	9.75083	0.37103	177	0.08731	1
315	9.6779	0.37719	31	0.00403	1

227	9.60457	0.38343	35	0.00403	1
199	9.50033	0.39243	90	0.00403	1
190	9.48269	0.39396	98	0.00403	1
101	9.44606	0.39716	107	0.00403	1
102	9.43428	0.39819	109	0.00403	1
146	9.39911	0.40128	111	0.00403	1
220	9.38045	0.40292	153	0.00403	1
347	9.27097	0.41265	179	0.00403	1
232	9.22379	0.41688	191	0.00403	1
36	9.2115	0.41798	201	0.00403	1
27	9.20333	0.41872	207	0.00403	1
258	9.15497	0.42309	215	0.00403	1
141	9.09061	0.42895	240	0.00403	1
40	9.06505	0.43129	270	0.00403	1
361	8.94616	0.44226	275	0.00403	1
217	8.89867	0.44668	287	0.00403	1
28	8.88677	0.44779	292	0.00403	1
244	8.85316	0.45094	294	0.00403	1
167	8.83598	0.45255	297	0.00403	1
			360	0.00403	1
			372	0.00403	1
			383	0.00403	1

Appendix E: Teams meeting links

https://teams.microsoft.com/meetingOptions/?organizerId=0784d03c-fb15-41fb-81a8-e86468525edf&tenantId=f580b035-16dd-4870-9f3d-c3d523913786&threadId=19_meeting_Y2I1Zjc3YjItNWFhMS00ZTFhLWI0ZWQtMjM2YzIxMDI3Y2I1@thread.v2&messageId=0&language=en-US.

https://teams.microsoft.com/meetingOptions/?organizerId=de832a4c-b1f7-41a5-8b4b-92805796dc32&tenantId=bef7c58b-5197-4479-903d-9fb2e68261a7&threadId=19_meeting_YTE0NjY4OWUtNDEyYS00MDM3LTkyOGMtNmIwMTYzOGQ0OGUx@thread.v2&messageId=0&language=en-US