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MSc Real Estate -12252033 (Facilities Management/Property Development Management)

Research Topic

An Investigation of the Early Involvement of Facilities-Management Specialists into the Traditional Design-Development Process: the Causes of Conflicts

Thesis Presented in Fulfilment of the Requirements for the MSc Degree in Real Estate in the Field of Facilities Management/Property Development Management with the School of Construction Economics (Faculty of Engineering and the Built Environment) of the University of Pretoria

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Declaration

I, Madimetja Solomon Sekhu (Student No. 28172206), declare that this dissertation/thesis entitled "An Investigation of Early Involvement of Facilities Management's Specialists into the Traditional Design-Development Process – the Causes of Conflicts" is my original work; and it has not been written for me, in whole or in part, by any other person(s), or submitted/presented previously for any degree or examination to any other University; and it is not currently being submitted in the candidature of any another degree. I also declare that where secondary data from the published or unpublished work have been used, has been duly acknowledged by a reference in the work, which I present for examination.

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Signature ---

Date --

Supervisor: Professor Hoffie Cruywage:

Signature...

Date...

Dedication

“Isn’t it a pleasure to study and practise what you have learned?” - Confucius

It is indeed a great pleasure to learn and put into practice that which I have acquired during all those years in construction and facilities management in South Africa.

In honour of the beloved ones, this research report is dedicated to: My dearest late parents, who never went to any formal school; my brothers and sisters, who also never went beyond Grade 12; and more particularly to my elder brother, who took the initiative of paying my school fees up to Grade 12 (Matric), for giving me all the love, support and encouragement throughout the duration of my studies.

My beloved wife and dearest children, for their sacrifices, support and tolerance, given throughout the period of my studies. Thank you all for always supporting me and showering me with unconditional love.

As C. S. Lewis once said, “It is never too late to set another goal or to dream a new dream.”

Acknowledgement

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Furthermore, I would like to express my acknowledgement with deep gratitude and appreciation, inspiration, encouragement, precious time and continuous guidance given to me by my supervisor Prof. Hoffie Cruywagen for his constructive guidance, support and valuable suggestions and comments throughout the research study.

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Abstract

The traditional procurement and contracting method within the architectural, engineering and construction industry is often criticised for its fragmented approach and its isolation of designers from contractor and Facilities Management(FM). However, adversarial relationships often occur among the project-team members due to disagreements relating to poor communication, processes, specifications, compliance, cost overruns and the extension of times. Therefore, the integration of FM's specialists into early design development process comes with challenges, such as conflict between the design team and FM's specialists over the specifications, local statutory compliance, commissioning method statements and the hand-over process. Furthermore, conflicts have critical effects on cost and schedule in complex projects and creates breakdown of relationships among project participants and results in project delays, claims and disputes.

The Purpose: The main purpose of this study was to "to explore effective involvement of FM specialists in the early design-development process of complex building projects in South Africa is perceived to be causing conflicts between the multi-disciplinary professional design team members."

Design/methodology: Mixed methods was adopted for this study including extensive related literature review and pilot study. Purposive (8 interviews) and snowballing (102 participants) sampling techniques were used in data collection.

Findings: According to descriptive analysis, participants slightly greed that FM specialists should be involved in the early stage of the design development process with mean score ranging from 3.21 (Inception stage) and 3.71 (Concept and Viability stage). Participants agreed that that FM specialists should be involved during design development stage with a mean score of 4.19 and project close out stage with a mean score of 4.29. Furthermore, from 41 causes of conflicts, 10 received mean scores ranging from 2.66 and 2.97 meaning that there is a low possibilities of causing conflicts while 31 variables received mean scores ranging from 3.00 to 3.97 meaning that there is a moderate possibilities of causing conflicts among FM specialists and design team during design development process.

Research limitation/Implications: Potential participants are architects, engineers, project managers, property-development managers and facilities managers. Furthermore, the focus of the study is on medium and large complex projects with buildings systems. In addition, this

Originality/Value: The high costs of maintenance during operation and non-compliance with the local statutory requirements of the building systems will affect the results and the application thereof. The integration of the design team and FM's specialists will provide the client with the final product that is functional and safe to occupy and use for its intent. Furthermore, FM's specialists' involvement early in the design-development process would reduce operational and maintenance costs during the operational stage of the building; and they would further ensure that the facility complies with the local statutory requirements.

Keywords: Facilities Management, Early Involvement, Design-Development Process, Commissioning, Conflict-Management Skills.

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Chapter 1: Introduction

1.1 Motivation

The complexity of construction projects around the world is growing all the time along with changing human life, styles and technologies (Khosravi & Kähkönen, 2015). Complex construction-project design is a collaborative undertaking that involves a number of different organisations brought together to form the construction-project design team (Senaratne & Udawatta, 2012). The design processes of complex construction projects involve multi-disciplinary participants with different backgrounds, knowledge, culture, experience and skills: both technical and soft skills. As asserted by Khosravi & Kähkönen (2015), the complexity of new projects provide challenges for project planning and management. However, ccollaborative design and construction activities undertaken by multi-disciplinary teams enable proper information transfer, knowledge creation, technological co-ordination and resource allocation to operate effectively and to reduce unnecessary conflicts (Liu, Van Nederveen & Hertogh, 2016). Consequently, FM specialists and design teams need to be involved in early-design processes, in order to participate in making decisions on how to resolve complex building problems (Awomolo, 2017).

As asserted by Jawdeh (2013), in the absence of additional management efforts, complex buildings can become dysfuctioned early in the design stage. Furthermore, Ju, Ding & Skibniewski (2017) state that the lack of common objectives and values among the multi-disciplinary participants of complex construction projects results in a limited understanding of how the behaviour of one discipline impacts on the other project participants involved in the same activities; and ultimately, it leads to unnessary interface conflicts; and it affects the project's effectiveness.

According to Gunarathna, Yang & Fernando (2016), conflicts are inevitable, because of the complexity, the lengthy time of construction and multi-disciplinary involment. In addition, Mitkus (2014) and Ejohwomu; Oshodi & Onifade (2016), cited in Osei-Kyei (2018), assert that conflicts in the construction industry are inevitable, due to the high differences in interests among the participants in the construction projects. According to Maiti & and Choi (2018), conflicts are an unavoidable part of the organisation; but what is important is how the organisation determines the root cause of the conflicts, and manages them.

The approach of this study is to emphasise the integration of FM's specialists early in the dsign process; so that significant decisions are made that consider the entire project-life cycle (Slimani, Ferreira Da Silva, Medini & Ghodous, 2006). According to the British Institute of Facilities Management (BIFM) (2012), cited in Kassem *et al.* (2015), design decisions are not usually challenged for their impact on operational cost or maintenance. However, FM's specialists' involvement in the early design stages may serve to identify the challenges in the future (Kjolle & Blakstad, 2011) operational and maintenance cost of buildings. Based on BIFM statement, as cited in Kassem *et al.* (2015), this study has aimed to assess the views of South African professionals on (Khahro & Ali, 2014) the perceived causes of conflicts among FM's specialists and design teams during the early design processes.

1.2 Background of Facilities Managemnt

The construction industry is deeply fragmented; and this can be attributed to the traditional differentiation and specialisation of the professionals involved throughout the design development process (Adewale, 2016). Consequently, the architectural, engineering, property development and construction industry are faced with challenges relating to the complex client requirements, the complexity of building services, the multi-disciplinary nature of the stakeholders, decreased productivity and poor workmanship (Vegard & Ola, 2017; Adewale, 2016). According to El-Reifi & Emmitt (2013), as cited in Adewale (2016), these challenges can be resolved adequately during the design stages. However, most of these challenges can be dealt with early in the design-development phase of the construction projects (Vegard & Ola, 2017).

FM emerged as a discipline in the 1970s (Bascoul, 2017; Kamaruzzama, 2017; Masuri 2015; Pitt, 2014), in order to suport and improve the effectiveness of the core business (organisation) by focusing on planning, operating, maintaining, upgrading physical infrastructures, and the replacing of moveable assets cost effectively (Ramli, 2017). According to Firdauz (2013), facility management encompasses various disciplines to ensure workplace environment functionality – by implementing integration between people, places, processes, and technology. Furthermore, from the late 1980s, facilities management (FM) has gradually evolved into a new discipline and profession in the construction and property industry, one that is based on their responsibility in looking after the buildings, there is a great need to place greater emphasis on integrating their expertise to the design process (Meng, 2013).

Facilities Management (FM) was introduced as a measure of cost-cutting, when the oursourcing was initiated (Pitt, 2014). According to Meng (2013), from the late 1980s, FM gradually evolved into a new discipline and profession in the construction and property industry, based on their responsibilities of looking after the buildings, there is a great need to place greater emphasis on integrating their expertise into the design process. FM is emphasised as a growing field of professionals, who administrate the operational aspects of large, multi-use buildings; hence, it is critically important for architectural designers to understand the role that FM could play both at the design stage and the occupancy stage (Kalantari, 2017).

Furthermore, FM emerged because the gap between the expected performance and the actual performance, such as the calculated and the actual energy consumption, lack of functionality, poor indoor climate, difficulties in operation and maintenance, poor cleaning possibililities and health and safety issues, which persist until changes are necessary and can be implemented (Rasmussen, 2017). Kalantari (2017) further states that if FMs and designers do not communicate well, the results are waste and error, which can lead to higher operating costs, as well as decreased building performance and a low level of satisfaction among the building occupants.

Irrespective of the fast growth of FM worldwide, the involvement thereof in early design is still not adequately considered in the construction industry; hence, a legacy of challenges is left behind; and this needs to be dealt with once the facility has been constructed and handed over for occupational use, which would lead to many forms of obsolescence (Towsend, 2017).

Many studies have been carried out to harmonise multi-disciplinary knowledge and various experts in the early stage of development process; but there is a general lack of understating and real consensus on the importance of the integration of FM, which limits the role of FM in the full design developmet process (Adeyemi, 2015). According to Kalantari (2017), the integrated approach is becoming increasingly useful, as buildings become larger, more complex and more challenging to maintain.

Due to daily interaction with the end-users, FM's operational and maintenance (O & M) teams have in-depth valuable knowledge and experience in buildings that can support the core bussines of an organisation; if it is used appropriately in the planning and design stage of complex construction projects (Jensen 2011). However, FM has not yet achieved the status and recognition of the other management disciplines, such as leadership management, financial management and organisational management (Roberson, 2016). Due to different views on the importance of FM and various opinions on how the discipline can contribute (Tucker, 2018), during the design development process, like many other disciplines, FM has for too long been excluded from the early-design development process, which has resulted in the lack of knowledge transfer between the design team and the FM team.

However, during the life cycle of the building, FM is traditionaly tasked with listening to occupants' complains, capturing their needs, prioritising them and developing budget and plans to act on them (Bascoul, 2017). Hence, FM's main focus area is on the needed resources to meet the occupants' needs, and the need to improve the quality of life, to reduce possible risks, and to ensure the value of money for the core organisation (Ramli, 2017).

Given the unavoidable characteristics and the detrimental influence of conflict, many researchers have tried to explore the underlying mechanism of conflict on construction-project performance (Zhang & Huo, 2015), and of conflict between the client and the contractors, the contractor and the consultant, or the contractor and the sub-contractors; but there is insufficient information on conflict among FM's specialist and design teams. Based on the literature review, it has been established that the challenges faced by FM operation and maintainance specialists during the occupancy stage are design-related problems (Islam, 2018). The integration of FM's specialists into early design comes with challenges, such as conflict between the design team and FM's specialists over the specifications, local statutory compliance, commissioning method statements and the hand-over process.

Therefore, it is important that FM specialists and designers' interactions on complex building project design are good and co-operative, in order for them to be fair and collaborative between the multi-organisations, so as to foster the optimal use of their knowledge, skills and experience (Shingai, 2016). Shingai furthermore states that effective interactions of FM specialists and designers during complex building project designs, construction, commissioning and hand-over stages would minimise the possibility of adversarial inter-organisational relations, the occurrence of misunderstandings; and hence, conflicts would be significantly minimised. Hence, this study has aimed at investigating the causes of the overarching conflicts among FM specialists and design teams in early traditional design-development processes and in the commissioning stages thereof in South Africa.

1.3 Conflicts

Due to the unique and complex nature of the construction industry, with various parties involved, conflict is inevitable in most stages of the construction projects (Senaratne & Udawatta, 2012). Furthermore, due to the involvement of the multi-disciplinary participants in construction projects, conflicts are inevitable; and if left unresolved, they could be detrimental to the project (Song, et al., 2017). Construction projects design is undertaken within adversarial environments, involving multi-disciplinary organisations with different objectives; hence, conflict is unavoidable. Designers that share the same values and communicate and interact effectively are more likely to assist and cooperate with each other, making loyal contributions to the project (Hsu, 2017).

Furthermore, designers are loyal to their profession, rather than to the institutions that employ them; and, in order to co-operate with project stakeholders, one must first understand their values, objectives and expectations (Hsu, 2017). According to Sagar, Pandey and Agrawal (2017), many projects are facing major problems, like the occurrence of conflicts, due to increasingly complex and fast-track construction projects. However, where human elements exist to facilitate the achievement of organisational objectives, they frequently engage in conflicts over factors, such as values, interest, views and management styles among the project-team members (Soyebo & Omokayode, 2016).

According to Safarali (2013), there is no ideal definition of conflict that could be accepted in the studies dealing with conflict. However, Wu *et al*. (2017), define conflict as a phenomenon that occurs when two or more individuals have different opinions, ideas and interests; and conflict frequently occurs during the implementation phase of construction projects, because information and knowledge must be relayed among different project teams. In addition, conflict is where the members are aware of task interdependence; but the goals of the members are incompatible with each other (Hsu, 2017).

When citing Putnam and Poole (1987), Montes *et al*. (2012) define conflict as the interaction of interdependent people who perceive the opposition of goals, aims, and values; and who see the other party as potentially interfering with the realisation of these goals. Conflict can be constructive, however, focussing on making a way to creative thinking and innovation; while destructive conflict reduces the trust and respect for one another (Gunarathna *et al*., 2016). According to Gunarathna *et al.* (2016), conflict management can be defined as the process of dealing with or controlling conflicts in such a way that they will not cause any negative effect in the project's success.

However, conflict occurs whenever disagreement exists in a social situation, over issues of substance, or whenever emotional antagonisms create friction between individuals, or groups (Xu & Xu, 2017). According to Nesterkin (2016), task conflict emerges from disagreement on how the team completes its work. However, conflict management in construction projects has focused on disagreement among internal stakeholders, such as owners and contractors, contractors and sub-contractors, employers and employees and joint ventures (Lee *at el*., 2017; Awwad & Barakat, 2016; Leung & Yu, 2014).

However, this study focuses on internal conflicts among FM's specialists and design teams and FM's speacialists and internal project-management teams in early design development, commissioning and the hand-over stages of a completed facility.

These Internal conflicts cause adversarial relationships and the lack of trust among parties in construction projects; and they can have major impacts on the performance of the projects' results in completed projects being handed over to end-users, without being taken over by FM's operational and maintenance team. According to Leung *et al*. (2014), conflicts have significant impacts on a project's added value, because of the combined effects of individual characteristics, communication, structure and the various interests of the participants.

However, Wei & Liu, (2016) cited in Wu *et al*. (2017) suggest that conflicts inevitably occur in major projects; because the various stakeholders express diverse and often conflicting needs and concerns. Failing to address and manage these conflicts often leads to project failure. According to Wu *et al*. (2017), project conflict could be defined as negative interactions among project teams, because of differing perspectives on project objectives, such as quality, local statutory compliance, cost and safety during project design and implementation.

Effective management of conflict is generally defined as the extent to which team members engage in actions aimed at defusing team strife; and it has been shown to enhance the team's performance (Nesterkin, 2016). Aiming to examine the issues among FM's specialists and the design team at an early stage of the project, this study begins by outlining the research problem statement and the objectives.

1.4 Problem Statement

Design-building problems are complex; and they require integrated knowledge, experience and the skills of multi-disciplinary team members, in order to achieve the multiple goals, such as sustainability, occupants' comfort, indoor environmental quality, heating and cooling, reduced operational and maintenance costs, as well as the financial objectives (Awomolo, 2017). Furthermore, FM specialists are faced with a multitude of frequent and costly building-performance problems, which can be attributed to the fragmentation of the design process and the decisions made during the design-developmental stages (Fatayer, 2012). According to Pikaar *et al*. (2017), unsafe, unhealthy, uncomfortable, or inefficient work situations can be avoided, provided the limitations of human beings are taken into account during the design's developmental process. However, the current design processes of complex construction projects are completely different from the traditional individual-oriented decision-making methods and the linear design process (Xie, 2017). With the increasing complexity of construction projects, design optimisation and management are becoming increasingly important (Xiaowei, Huimin, Ojuri and Jiyang, 2018). Furthermore, the complexity of projects and the uncertainty of construction conditions limit the optimisation depth of the preliminary design (Xiaowei *et al.,* 2018).

According to Kalantari *et al.* (2017), FM specialists can be a vital resource during the architectural-design process. However, despite the bennefits of collaboration between FM specialists and the design team, there are significant obstacles that have so far prevented the effective integration of this partnership (Kalantari *et al.,* 2017).

Adversarial relationships often occur among the project-team members due to disagreements relating to poor communication, processes, specifications, compliance, cost overruns and the extension of times. Hence, the integration of FM's specialists into early design development process comes with challenges, such as conflict between the design team and FM's specialists over the specifications, local statutory compliance, commissioning method statements and the hand-over process. Furthermore, conflict creates breakdown of relationships among project participants and results in project delays, claims and disputes. According to Tsai &Chi (2009); Kassab *et al*. (2010); Tazelaar & Snijders (2010) cited in Alshehri (2019) conflicts are a great challenge within the construction industry as they may lead to litigation, project failures, and in severe casesproject abandonment.

Hence, "the problem statement of this study may be stated as follows: The effective involvement of FM specialists in the early design-development process of complex building projects in South Africa is perceived to be causing conflicts between the multi-disciplinary professional design team members."

1.5 The Aim of the Study

According to Knotten *et al*. (2016), improving the design teams helps to close the gap of misalignment between design and construction; and it helps to achieve success. Hence, the aim of this study is to inspire the creation of a co-ordinated collaborative working environment among FM's specialists and design team members, in order to optimise the design in the early stages of the project. Effective collaborative design enables knowledge-sharing; and it reduces unnecessary conflicts among FM specialists and project-design team members during the early stages of the design processes.

In order to achieve the main theme of the research, questionnaires were compiled, distributed to professionals; and interviews were conducted with selected professionals.

1.6 Research Questions and Objectives

Despite the importance of FM specialists' involvement in the early design process of construction projects and the recognised benefits of collaboration with designers, there are significant obstacles, such as conflicts that have so far prevented the widespread implementation of this partnership (Kalantari *et al.*, 2017). Hence, this study sought to identify the stage at which FM speacialists should be involved in the design process, possible causes of conflicts, management strategies necessary to handle such conflicts, and the importance of project manager or design leader's soft skills in co-ordinating the integration and collaboration thereof. In persuance of aiming to investigate the causes of conflicts among FM specialists and design team during design process, the current study attempts to answer the following research questions.

1.6.1 Research Questions

1. When should facilities management specialists be involved in the design process?
2. What are the main causes of conflict among FM's specialists and design teams during the design-development process?

3. What conflict management strategy/style can be applied in an optimal way for collaboration enhancement during the design-development process?
4. How important is the design/project leader's management skills (soft skills) in conflict management among the design-development team members?

1.7 Research Objectives

To address the above problem statement, and to attempt to answer the above research questions, the research was guided by the following objectives:

1. To identify the phase/stage in which FM specialists can be involved early in design process.
2. To identify the causes of conflicts among FM specialists and the design team.
3. To determine conflict management styles suitable for different stages of the design-development process.
4. To identify the soft skills that must be acquired by the design/project leader in design-development conflict situations.

In pursuance of the aims to investigate the causes of conflicts among FM specialists and design team, as well as the implementation of conflict-management strategies, this study attempts to answer the above research questions that are helpful to attain the set purpose and the objectives of this investigation (Maiti & Choi, 2018).

1.8 Significance of the Study

According to Charboneau (2016), organisations care about conflict management within project teams; because the management would want to know the impact of conflict; and whether it is affecting the organisation's successful operations.

The significance of this research study stems from the following:

The study has the potential to inspire both the built environment and property developers in South Africa on the importance of integrating FM specialists early in the design-development process, as well as the occurrence of potential conflicts among FM specialists and design teams.

Early involvement of FM specialists in the design-development process, technical design review and the commissioning of building systems would fast-track the hand-over process and the immediate take-over of the project by operation and maintenance teams. Furthermore, this would reduce the confusion of who should maintain the system after practical completion; and it would clarify the reporting process required, or the reported maintenance. The integration of multi-disciplinary stakeholders early in the design-development stage would enhance collaboration, respect, trust, and communication; and it would also reduce the operational costs during the lifecycle of the facility.

The involvement of FM specialists in the early design-development process would result in reducing the challenges that are attributed to faulty design (Fatayer, 2012). Furthermore, a design/project leader that has a good grasp of conflict management would result in the project team being more productive (Charboneau, 2016). Nevertheless, a review of the state-of-the-art literature in the domain of (Fatayer, 2012) FM specialists revealed the non-availability of detailed investigation pertaining to the timing, constraints, causes of conflicts, conflict-management strategies and management skills in South Africa.

Consequently, there is a need to investigate FM specialists' early involvement in the design development process in South Africa.

Furthermore, it is hoped that this research study will provide FM specialists and construction professionals with insight into the causes of the conflicts, the stage in which FM specialists can be involved in the design-development process, the common problems, barriers that prevent FM specialists from being involved in the design, and the management skills to be implemented by the design/project leader.

1.9 The Research Process

This study is divided into the following five sections:

- The first section includes the introduction, background, problem statement, aim, research objectives and various questions.
- Section two includes an overview of the literature review in relation to the study objectives.
- The third section is about the research methodology.
- The fourth section provides an analysis and a discussion of the results.
- The fifth section of the study is the conclusion thereof.

This research study is further organised, according to Figure 1 below.

Figure 1: Research Framework

In order to address the objectives of this study, a literature review was carried out on the different stages of the project-development process, the causes of conflicts, the constraints that hinder FM specialists' involvement early in the design, a conflict-management strategy and design/project leader's management skills needed to co-ordinate the design-development process. Consequently, the literature review for this study is presented in the following Chapter 2.

1.11 Research Limitations

This study attempts to identify the stage in which FM specialists can be involved in the design-development process, the various types of conflicts, the causes of conflicts, the conflict-management strategies, as well as the appropriate soft skills required for conflict management. The scope of literature was scaled down to a timeframe of 2011 – 2019 in order to capture the establishment and history of the FM and the issues impacting on the integration into early design development process.

The findings of the study are limited to:

- The research methodological design used for the data collection and analysis.

- A selected sample size that can pose impacts on the generalisability of the findings.
- The accessibility and responses from the potential participants.
- Prospective participants' experience, understanding and interest in the selected research topic.
- Prospective participants' response time.

Chapter 2: The Literature Review

2.1 Introduction

In order to achieve the aims of the study, an in-depth literature review was conducted (Caixeta, et al., 2013) in search of secondary knowledge through an intensive comparison of peer-reviewed journals (Mok, 2015) of FM integration early into design development process and causes of conflicts amid FM specialists and design teams. According to Creswell (2014), literature review is the preferred method that map existing knowledge on the given topic. Therefore, the researcher used Google Scholar, Scopus and ProQuest to search academic journals using specific key words relating to the research topic. The list of journals includes, Emerald Insight, Taylor and Francis and International Journals of Facilities Management.

The complexity and uncertainty of today's projects require effective and integrated multi-disciplinary project team members with the management skills necessary to apply in mitigating and managing conflicts among FM specialists and the design team. According to Stark *et al*. (2014), as cited in Wu *et al*. (2017), construction projects are featured with uncertainty, temporality and fragmentation. Thus, construction professionals and FM's professionals need to be capable of co-ordinating the stakeholders' relationships during the entire process of design, construction, commission, and the eventual and-over of the facility.

The exclusion of the FM specialists early in the design-development process causes various conflicts among the design team and FM specialists during the technical review, commissioning and the hand-over of the completed projects. Consequently, conflict is a key concern in inter-organisational relationships (Lumineau *et al.,* 2015; Hua, 2018). Because of these conflicts, project-based organisations experience increasingly negative and adversarial relationships (Wu, 2018). According to Deutsch (1990), as cited in Tabassie *et al*. (2019), team members' perception of the way in which their desired goals may be affected by actions significantly influences both the nature of these interactions and the final results of the conflict management.

According to Lee *et al.,* (2015), there are three types of conflicts: those that are task-related; those that are process-related; and those that are relationship-related, which mostly occur among multi-disciplinary organisations working on temporary projects; and they have an impact on the group's performance and collaboration.

- Task-related conflict: Occurs when there are disagreements regarding a collaborative task (Pelled, 1999 cited in Lee *et al*., 2015).
- Process-related conflict: Occurs when there are disagreements on the collaboration process, the procedures or responsibilities of group members, rather than on collaborative tasks (Jehn, 1997 cited in Lee *et al.,* 2015).
- Relationship-related conflicts: These occur when group members have an interpersonal clash with negative feelings between one another (Pelled, 1999 cited in Lee *et al.*, 2015).

Due to multi-actors' interaction in the design-development process, conflicts emerge from disagreements between the designers and the FM specialists about incompatible and interdependent proposals (Ouertani, 2008). Therefore, a critical element of collaboratve design would be the conflict management, which can be perceived as the succession of mainly four phases (Ouertani, 2008):

- Conflict detection;
- Identification of the conflict-resolution team;
- Conflict -esolution strategies;
- Solution impact assessment

According to Xu & Xu (2017), conflict occurs whenever disagreements exist in a social situation over issues of substance, or whenever emotional antagonisms create friction between individuals or between groups.

Therefore, in addressing the second objective of the study, literature relating to the causes of conflict will be identified.

2.2 Types of Conflicts

A number of researchers have introduced different categorisations of conflicts, such as cognitive (task) conflicts, affective (relationship) conflicts and process conflicts (Gunarathna *et al.*, 2016; Chou & Yeh, 2007; DeCheurch, Hamilton, and Haas, 2007; Desivilya *et al.*, 2010; Huan & Yazdanifard, 2012). Thus, the design-development process is an interdependent task, whereby designers are depending on one another's input; and the lack of communication and co-ordination during such a process would cause conflicts among the design team, including the FM specialists. A construction-project team is a project-based organisation; and it involves a number of different stakeholders from the inception of the project to the hand-over stage.

Adversarial relationships often occur among the project-team members due to disagreements relating to poor communication, processes, specifications, compliance, cost overruns and the extension of times. All these factors lead to conflicts among the project-team members. Therefore, it can be confirmed that construction projects exist within an adversarial environment, in which interpersonal conflicts are unavoidable (Huo, 2015). According to Huo, interpersonal conflict refers to interpersonal clashes unrelated to task issues; and it should be viewed as a dynamic process that occurs between individuals, who are in an interdependent and interactive relationship;and it is more likely to occur when individuals have diverse beliefs and values.

Interpersonal conflict refers to the manifestation of incompatibility, disagreement or differences between two or more interacting individuals (Salleh & Safarali, 2013; Rahim, 2001).

According to (Yuanqiong *et al.* (2014), conflicts are typically distinqushed as being cognitive (labelled as functional, task or constructive conflicts) and affective conflicts (labelled as dysfunctional, relationship or destructive conflict). Cognitive conflict can enhance team performance; while affective conflict does harm to team performance (Yuanqiong *et al.,* 2014). In addition, Kevin & Welbourne (2018) asserted that conflict is inevitable within organisations; and it is important to understand its consequences to both members in the conflict situation and the organisation impacted by the consequences thereof. These authors have further declared that scholars have reached an accord with regard to conflict type, (i.e., cognitive and affective).

2.2.1 Cognitive Conflict

According to Kevin (2018), cognitive conflict focuses on task-related disagreement; and it has been supported for its beneficial organisational effects; and it occurs due to the diversity of perspectives that the individual members bring to the team, as well as the interdepence of team members within an organisation. Cognitive conflict has been found to improve decision-making and organisational performance (Prasad & Junni, 2017).

Co-operative conflict is where conflicting members perceive that their goals are positivevely related. However, positive conflict is where members feel free to disagree over task-related issues; as each work towards a win-win solution that promotes mutual advantages.

2.2.2 Affective Conflict

Affective conflict is also known as relationship conflict; and it is focused on relational agreement and interpersonal differences. However, it has been condemned for its detrimental effects on the organisation as a whole, and on decision-making processes specifically (Kevin, 2018). According to Prasad & Junni (2017), affective conflict involves disagreement, due to interpersonal incompatibilities; and it has been found that it can create tension and animosity amongst the project-team members, impeding co-operation among the team members and reducing decisional commitment.

According to Yu-Chin *et al.* (2011), as cited by Prieto-Remon *et al*. (2014), conflict involving the the project team,as well as groups that are outside the project, can be detrimental to the project's performance. However, project managers often experience interface conflicts that stem from incompatible requirements from different project stakeholders (Prieto-Remon *et al.,* 2014).

The traditional procurement and contracting method within the architectural, engineering and construction industry is often criticised for its fragmentated approach and its isolation of designers from contractors (Franz *at el.,* 2016) and facilities management specialists during early planning and the design process. However, the timing of the integration of the design team and FM specialists is still not clear, and in order to close such a gap, this study aims at determining when such an involvement should take place, based on the different literature reviews. In addition, the success of a complex construction projects depends on early involvement in the design process of the participants, such as FM specialists. According to McAuley *et al.* (2013a) and Hore *et al.* (2013) cited in McAuley (2016), the Facility Manager must play a much more important role within the design and the construction process; since he/she will be held responsible for the operational phase, which incurs approximately five times the initial capital cost.

According to Kelly *et al.* (2005), as cited in McAuley (2016), the Facility Manager should at least play an active role in the briefing process before and during construction; and such involvement would result in operational issues being addressed from the onset. In order for FM to take a more active part in the design, they should strive to understand the procurement process and the point at which their contribution to the decision-making process will be most valuable, so as to justfy their inclusion in the team (ibid).

2.3 Related Literature on Specific Objective

2.3.1 Facilities Management Involvement in the Design-Development Process

Building design team is usually composed of different professionals who have specialised skills, coupled with varying altitudes, behaviours, interests and views of life (Shawa, *et al*., 2018). However, Jensen (2011) asserted that the real estate and construction industries are faced with the challenges of those decisions made without the involvement of the facilities management's O & M in the early design stage of building projects. Furthermore, the real estate and construction industries are characterised, as being fragmented and for working in an adversarial environment, delivering projects with lower standards that result in client dissatisfaction (Dowlatabadi, 2018); and consequently, it is expensive to operate and to maintain. The fragmentation of the construction process has been an issue since 1940; and it was hihglighted in Sir Michael Latham's report of 1994 and Sir John Egan's report of 1998 that this fragmentation has led to the lack of integration, collaboration, co-ordination and communication amongst the parties, as well as to the separation of design from operation (Elmuali, 2010).

The fragmentation of the design team and the FM specialists results in poor specifications and poor performance of the functionality of the building systems; hence, conflicts emanate during the commissioning and the hand-over stages. According to Islam (2018), the fragmentation of the design process raises too many concerns and unprecedented challenges for the project team; since construction projects are getting much more complex and difficult. Furthermore, Islam (2018), states that the lack of considering FM early into the design process has become a potential issue to increase the operation and maintenance budget, premature ageing and earlier dilapidation.

Although it is widely recommended that FM expertise should be integrated into the early design process due to the shortcomings that take place at the early stage of the development process (Tucker, 2018; Masuri, 2015), many FM specialists do not have the necessary competencies to play a constructive role in the planning, design, construction and commissioning stages of the construction projects (Jansen, 2012). Futhermore, it has been claimed that FM encompasses numerous disciplines, either technical or non-technical, and this transition does not provide competent facilities managers; and thus the situation potentially creates conflict amongst other professionals that find it difficult to accept such changes (Tucker, 2016).

According to Gardiner (1993), an understanding of conflict and change in construction projects is more important now than ever before, given the differentiation that now exists in today's project organisations, in which the integration and the co-ordination of different groups within a project can be difficult to maintain. In addition, Dansoh *et al*. (2017) and Rose and Manley (2011) assert that throughout the design and construction processes of a project, conflicts will frequently come about due to an incalculable number of expert, social, methodical and managerial issues.

Construction project's design development process is a concept that comprises various processes starting with the project initiatiation, planning, design, construction, commissioning, handover and operation and maintenance and require an integrated multi-disciplinary approach to have a better final output (Abeydeera and Karunasena, 2017; Chodasova, 2004; Brat, 1996). Moreover, the design-development process lacks communication amid FM's specialist and design teams; and this affects the cost-effective nature, operability and maintainability of the project (Abeydeera *et al.,* 2017; Barrett, 2003).

According to Abeydeera *et al.* (2017), facilities managers' skills and competencies can bring much value addition to projects if they are involved in projects from the very beginning.

According to Azhar (2011), facilities managers have traditionally been included in the building lifecycle in a very limited way, and only at the late phase of facility hand-over to the clients. However, Silva (2011) cited by Abeydeera *et al*. (2017), states that facilities managers are being neglected as potential professionals in the construction sector by the property developers in Sri Lanka. Moreover, Masuri (2015) stated that it is essential for the facilities managers to be integrated with various professionals in the DP, in order to ensure the success of the development project.

According to Kalantari (2017), it is vital that there should be good communication during the design stages between the designers and the FM professionals, who will oversee the daily operation of the building. According to Abeydeera (2017), the lack of communication forces designers and clients to make decisions is based on their experience, rather than on taking into consideration end-users' requirements. In addition, the maitenance of constructed buildings is usually inadequately planned and tackled, due to the lack of communication (Abishuga, 2014) amongst the project-team members and FM's specialists early in the design stage.

Although, the integration of FM in the design-development process has been widely acknowledged by developed and developing countries; and because of questionable contribution, the integration process has been given a low priority, thereby resulting in FM being inadequately integrated into the design process (Tucker, 2018). The increasing complexity of construction-design requirements, the fragmentation of multi-disciplinary organisations, the lack of communication, the insecure collaboration and co-ordination during the design-development process, results in a product that fails to meet the client's requirements, in terms of functionality, operability, maintainability and occupants' safety.

According to the research carried out by Wong (2013), the early involvement of O&M specialists is important for better anticipating obstacles and learning from past experiences; however, design teams and FM specialists generally work indipendently with limitted interaction. Femi (2014) carried out an investigation on the effects of faulty construction on building maintenance and found that the maintenance cost of a building during its functional life could outweigh the initial cost of a new building if maintenance has not been incorporated during the desigh-development stages.

Due to the fragmentation of the building industry, there is a significant performance gap between the design and the actual performance of building services during the post-occupancy stage. According to the study carried out by Cotgrave (2016), FM has been given a low priority in the early design-development process which results in FM being inadequately integrated into the design-development process. However, Fatayer (2012) advocates that the involvement of the maintenance managers would result in reducing the challenges that are attributed to faulty design. In addition, Collins (2017) states that the process of reducing climate gas emissions from the built environment sets a new link and integration of planning, design, construction and FM in a life -ycle perspective.

Based on the research carried out by Meng (2013) in relation to the involvement of facilities, management specialists in building, facilities management are now to be held responsible for looking after the buildings; and therefore, there is a need to encourage greater emphasis on applying their expertise to the building-design process; and the building-construction industry should learn to work with project design and vice versa, so that building systems and the working environment can better satisfy the occupants.

Furthermore, Shaar (2017), carried out an investigation into design- construction interface problems in large building construction projects; and the results revealed the top 10 extreme significant causes, such as unstable client requirements, the lack of proper co-ordination between various disciplines, the lack of skilled and experienced human resources in the design firm, as well as the lack of professional construction management.

Most of the problems experienced during the operation and maintenance of the building originate from poor design (Ahadzie, 2014), which results in FM having to be saddled with the burden of operating and maintaining a poorly designed and inadequately constructed physical facility; while making all the efforts to achieve comfort for the occupants (Olaniyi, 2017). Therefore, in order to address problems, such as the lack of operability, maintainability and serviceability, it is important to integrate FM expertise into the design decision-making process (Meng, 2013).

Meng (2013) further advocates that the involvement of FM in the early-design development process has received increasing attention from the practitioners and researchers, which makes it possible to incorporate FM knowledge and experience into the design process. Further to that, Wang (2013) asserted that the inclusion of FM early into the design stage could potentially reduce the efforts of maintenance during the operational phase of the facilities. In addition, Hamzeh (2016), states that the integration and communication between poject team members enables the design intent to properly flow and to be transformed into value-adding output. However, FM’s inability to translate intangeable services into organisational outcomes has contributed to the slow gain of recognition as a strategic contributor to the organisation’s core objectives (Roberson, 2016). Furthermore, there may be a risk of improper conduct of practice due to the lack of relevant knowledge and training in the rerequired field; and collaboration might collapse because of the lack of FM understanding among project-team members (Kamaruzzama, 2017).

According to Ahadzie (2014), one of the most important reasons behind the complexity of the construction-design process is the increased use of specialist knowledge and experience of the contributors to the design. The statement is further supported by Berg (2018); Swärd

(2016) and Lombardo (2014), when stating that a complex project design demands uniqueness and a higher level of specialisation, yielding a need for interaction and involvement of multi-disciplinary stakeholders on another level than before. Adding to the structural and design complexity, the traditional design process in developed and developing countries is separated from construction, operation, maintenance and services (Meng, 2013).

Similarly, traditional design and construction processes in South Africa are carried out with fragmented design organisations, contractors and sub-contractors with minimal involvement of the client's representatives, and more particularly of FM specialists. Due to the complexity of the design and the increasing integration of design and construction, various research efforts have been made to explore the possibility of integrating the design-development process with operation, maintenance and service provision (Meng, 2013). However, in most cases, the client's representative has no prior knowledge or experience in design-development processes. The challenges of involving a client's representative with less knowledge, experience and the lack of leadership, co-ordination and collaboration skills in the design-development process creates an adversarial relationship among the parties involved in the planning, designing and the technical design processes.

FM is responsible for the provision of new development, operation, maintenance, services and the refurbishment of the existing physical infrastructure, in order to ensure that they continuously support the strategic objectives of the core business with efficient costs (Awang, 2017) and the disposal of such infrastructure/s when reaching its life span. The link between FM and core business was previously advocated by Alhaji (2015), when stating that it is an instrument to support the core business of an organisation, with the aim of making it more efficient and more productive.

According to Olaniyi (2017), buildings generally show poor design for ventilation, natural lighting, energy management, water management, waste management and other building services, which indicates that there is a need for FM specialists' involvement early in the design-development processes, in order to share their knowledge and experience, based on the lessons learned. The importance of integration of FM expertise in the early design-development process seems to be acknowledged by the building industry; although the resent studies indicate that the performance gap has not yet been bridged; and knowledge trasnfer between FM's specialists and design and construction teams is not easily done (Rasmussen, 2017). In addition, it is well recognised that collaboration, mutual trust and mutual objectives among project participants are essential in the delivery of the infrastructure (Ferme, 2018).

Any infrastructure that is initiated has purpose; and the functionality of it should not severely impact on the operation of the core business. Hence, a high quality, operability, maintainability and servicebility infrastructure has to be designed and constructed, in order to support the core business in achieving its objectives. Due to the defficiences that occur during the early stages of the design-development process, the aim of this study is to foster the involvement of FM early into the design-development process. However, this does not mean that FM specialists can lead the design team during the design process (Meng, 2013); but both have to compromise, to learn from each other, and to know how to work. collaboratively throughout the entire project life-cycle. In addition FM should realise that their involvement means constructive comments and suggestions, rather than blame allocation; hence, all the stakeholders need to develop effective technical and soft skills.

According to Deep *et al.* (2016), knowing the core causes and dealing with conflicts among multi-disciplinary organisations in a timely manner is, however, important to maintain a healthy project environment. These authors further state, for the effective resolution of these conflicts, it is indispensable to know the potential factors triggering these conflicts and making them destructive. Despite the claims made by a number of authors, with regard to the early FM involvement in the design stage (McAuley, 2016), little research was evident in investigating the causes of conflicts among FM specialists and design-team members. According to Femi (2014), it is vitually impossible for people with diverse background, skills and norms to work together, make decisive decisions and try to meet project goals and objectives without conflicts. However, to prevent behavioural and technical conflicts between FM specialists and designers, the identification of causes of conflicts need to be realised, in order to enable participants to select the appropriate solution with minimal conflicts (Xiaoling *et al.,* 2017).

2.3.2 Second Objective: Causes of conflicts

FM specialists' involvement in the early design process can be a vital resource in enhancing the quality of the design and the operating lifecycle of the built facility. However, FM specialists are continuously being neglected as potential professionals in the construction industry by property developers (Silva, 2011; Abeydeera, 2017) due to various constraints; and this exclusion causes conflicts during technical reviews, commissioning and hand-over stages, which result in the delay in taking over the responsibilities of maintenance.

Multi-disciplinary team members in the complex construction project-design process are not always willing to reach a compromise; hence, any attempt of reaching irreconcilable goals often leads to conflict during these stages (Slimani *et al.,* 2006). Hence, it is imperative for multi-disciplinary project team members to be aware of the causes and the reasons for conflicts in the early design process; and it is of significant importance to know how to manage them during the life-cycle of the construction project. According to Deep Salleh and Othman (2016), it is indispensable to know the potential factors triggering conflicts and making them destructive.

This study has sought to identify the causes of conflicts due to FM specialists' involvement in the early design-development process of construction projects. Conflicts are an unavoidable part of the organisations; but what is important is how the organisations determine the root cause of such conflicts and manage them accordingly (Maiti & Choi, 2018).

According to Maiti & Choi (2018), conflicts are an unavoidable part of the organisation; but what is important is how the organisation determines the root cause of conflicts and manages them. Ibid further asserted that conflicts may arise from communication breakdown, project activities, work relations, project priorities, differences in technical opinion, and differences in belief, mismatched ambitions and absence of a suitable person in the key position. The following causes of conflict were identified by Ejohwomu, *et al*. (2016):

- Poor financial projection from the client's side

- Lack of funds
- Change of scope of works due client requirements instability
- Cheap design hired instead of quality
- Inexperience of the designer

According to Hall (2002) cited in Al-Sibai & Alashwal (2014), lack of communication is the main causes of dispute and conflict. In addition, Thamhain & Wilemon (1995) cited in Al-Sibai & Alashwal (2014) identified project priorities, administrative procedures, technical opinions and performance, cost, schedule and personalities as the causes of conflicts in construction industry.

In addition, Tanveer *et al.* (2018) assert that conflicts are inevitable in organisations; and they are a significant challenge for frontline managers. However, one school of thought is that conflicts are not good for projects; while for another school of thought conflicts are needed for better relationships and better performance in the projects (Al-Sedairy, 1994; Banner, 1995; Englund & Bucer, 2012; Sudhakar 2015). However, in construction projects, any of the participants can initiate conflict; if they allow their own organisation's goals and priorities to take precedence over those of the project (Gardiner, 1993).

Therefore, the symptoms of conflicts include jealousy, hostility, enforcing norms, regulations and rules, frustration and poor communication (Sudhakar, 2015). According to Gardiner (1993), a designer sitting down with users or work's representatives to discuss the most recent design developments in a project can in itself be a source of further conflict.

FM specialists and design teams are collocated for one common goal, which is to deliver a successful project, in accordance with the plans and specifications, within time, cost and the quality originally prescribed. FM specialists and design teams are expected to effectively communicate and to share significant information, exchange resources, and to share operational, maintenance and design knowledge for the benefit of the project. Through the participation on collaborative design, discussion in technical review meetings, commissioning and the hand-over process, FM's specialists and design team express their convergences in technical specifications, installation methodology, commissioning method statements and the hand-over procedures, which characterise conflicts (Bezerra, 2011).

In order to achieve optimal design, construction professionals are often expected to bear great pressure, due to the client's time constraints, which puts design team at high risk of experiencing job burn-out; and this ultimately causes conflicts among the project-team members (Wu *et al.,* 2018). Coupled with the increasing complex project environment, conflicts in construction projects have become a typical feature of the construction industry (Chen et al., 2014; Wu *et al.,* 2017). However, the characteristic diversities of the participants lead to various conflicts (Wu *et al.,* 2017). Furthermore, construction contracts are incomplete (Demirel *et al.,* 2016) and it is usually a crucial factor that leads to conflict (Consoli, 2006 cited in Wu *et al.,* 2017). The knowledge backgroud, cultural values and benefit demands of each project team vary, which often leads to conflicts (Buvik, 2015; Wu *et al.,* 2017).

Furthermore, poor communication can ferment confrontation between teams and lead to conflicts (Clark & Brennan, 1991; Wu *et al.,* 2017). According to Sudhakar (2015), the high level of conflicts also increases the costs and the schedules of the project. The targets, structures and interests of different project teams are inconsistent with one another, which often leads to the occurrence of conflicts (Ring 1994, Wu *et al.,* 2017). According to Wu *et al.* (2018), the heterogenity of diverse participants inevitably leads to project conflicts. In addition, Wu et al. (2018) state that project conflicts involving project-based organisations occur along with the project life-cycle, from the initial stage to the operational stage. Furthermore, the relationships among FM specialists and design team is often seen as negative or confrontational; because of the different goals; and this could lead to significant conflicts (Wu *et al.,* 2017).

Because of the conflicts project based-organisations experience an increasing negative relationshhip particularly (Wu *et al.,* 2018) among FM's specialists and design team. Liu *et al*. (2009), cited in Wu *et al*. (2017) advocate that previous studies have reported that conflict during the development stage is detrimental to a project's success and cannot be controlled even through effective processes, and negative relationships among project team members also contribute to the lack of trust among project team. According to Terry *et al*. (2012), without throughly analysing and properly managing various stakeholders' concerns and needs severe conflicts and controversies can be expected. Furthermore, when individuals who have different functional expertise work together in a project, conflict is likely to occur (Barczak & Wilemon, 2003; Han & Harms, 2010; Darawong & Igel, 2016). Conflicts can be caused by individuals from different culture due to different communication dimensions (Darawong, 2016).

The study carried out in construction of integrated transportation hub project by Xu (2017) assert that the reason of poor coordination of integrated transportation hub is that the conflict between function design of transportation hub and the use of resources were not tackled properly. Furthermore, the broadening scope of stakeholders leads the conflict amongst different stakeholders to be various and complicated (Xu, 2017). However, project conflict is the opposition or friction caused by the disputes among different objectives and disharmony in the complicated interpersonal relationships (Barnes and Erickson, 2005; Xu, 2017).

The adversarial behaviors among FM's specialists and design team during design development process, technical review meetings, commissioning and handover stages consistently lead to time and cost overruns, and client (end-users) occupying spaces with uncommissioned building systems/services. According to Jokanovic (2017), the most causes of conflict in organisations are:

- Disgreement in differing types of personalities
- Conflicting value systems
- Unclear work assignment
- Limitted resources
- Inadequate communication
- Interdependent work duties
- Unrealistic/confusing rules and norms

- Pending/repressed previous clashes

In addition, Al-Khalil & Al-Ghafly (1999) cited in Alsolaiman (2014), found that slow decision-making throughout the construction project process, especially in the early stage of the project, resulted in a conflict between all the parties in the later stages. In a temporary construction project-design process, multi-disciplinary team members are expected to participate in discussions and negotiations over any disagreements on the specifications and commissioning methodologies. Therefore, conflict management becomes a more complex and crucial task (Slimani *et al*., 2006). Hence, the management of team conflicts during product design, construction and commisioning is an important issue in construction projects (Lefley, 2018; Prasad and Junni, 2017; and Tan, 2016). Based on literature review, 41 commonly known causes of conflicts were identified and listed according to table 2.

According to Xiaoling *et al*. (2017), if the conflicts of stakeholders are not resolved or mitigated, the total costs are generally increased; and the completion time and the hand-over are significantly delayed; and the quality is negatively affected. Therefore, understanding the causes of conflicts during project life cycles will ease the process of conflict management (Ejohwomu, *et al.,* 2016).

2.3.3 Third Objective: Conflict Management Strategies

Conflict management in multi-disciplinary organisations should be brought together to exchange information and knowledge, sharing and communication between team members. This is an unavoidable stage of the collaborative-design process (Slimani *et al*., 2006). Conflict mitigation aims to reduce conflicts among stakeholders (Xiaoling *et al*., 2017), such as FM specialists and design-team members during the design and construction stages. According to Norodha (2018), unmanaged conflicts can be destructive; and these can create harmful effects to the project success by escalating themselves into disputes that require expensive and time-consuming resolution process. However, there is a wealth of knowledge concerning conflict management and its resolution in the workplace; however there is a dearth of information relating (Naismith *et al.,* 2016) to the causes of conflicts and conflict-management strategies in early involvement of FM specialists and design-team members.

Gordon (2003) cited in Safarali (2013) stated that conflict management is the ability to manage conflict effectively; and this refers to the modes used by either or both parties to cope with conflict. Conflict management refers to the process of minimising the negative impact of conflict in an organisation; while enhancing its positive aspects (Maiti & Choi, 2018). According to Gardiner (1993), despite the value and effort of creating a multi-diciplinary interface, such an exercise should not be performed without careful consideration of the risk involved. However, conflict management strategies and skills are in a short supply, more particularly in the construction industry (Maiti & Choi, 2018), which includes the FM environment.

According to Tabassi *et al.* (2019), there are different conflict-handling styles that individuals may employ when interacting with others in interpersonal or business engagements. According to Montes *et al*. (2012), conflict can be managed in a variety of ways. Hence, Rahim & Bonoma (1979), as cited in Prieto-Remon (2014), outlined the most common five styles of dealing with conflicts:

- Confrontation;
- Domination;
- Compromisation;
- Accommodation; and
- Avoidance.

According to Rahim (2001), conflict-management styles, refer to the different styles of conflict, examining the ways in which individuals manage their conflicts; and such strategies are as follows:

- Integrating styles;
- Obliging styles;
- Dominating style;
- Avoidance style; and the
- Compromising style.

However, Maiti & Choi (2018) and Ayoko (2016) identified the following conflict-management strategies:

- Avoidance;
- Accommodation;
- Compromising,
- Collaboration; and
- Confronting.

Tabassi *et al.* (2017) state that different styles of conflict management have different impacts on team effectiveness, some being positive, and some being negative. Therefore, conflict is a natural part of human reciprocal activities, which require different use of conflict-management styles adopted by the project manager to maintain harmony within the organisation (Prieto-Remon *et al*., 2014; Lee, 2008). Consequently, effective styles lead to conflict resolution; they enhance work steadiness, they promote feelings of self-efficacy among team members; they minimise the likelihood of negative conflicts in future work; and they also result in a company's long-term financial growth (Tabassi *et al.,* 2017).

According to Maiti & Choi (2018), the implementation of conflict-management strategies is the present and future requirement of the construction industry. Based on the given conflict management strategies/styles, this study can declare that conflict management among FM specialists and the design team is vital for the well-specified and quality design, and ultimately for the successful and sustainable completed project. However, the design/project leader's technical and soft skills should be up to the level in which it matches the conflict challenges faced in collaborative complex construction project design and construction stages. According to Azim et al. (2010), a successful design/project leader uses hard skills to chalk out the most suitable course of action for the project and then uses management skills to implement the plan and manage the people in order to achieve project success. Hence the fourth objective of the study is about management skills.

2.3.4 Fourth Objective: Design/Project Leader's Management Skills

According to Ijaola & Ogunsanmi (2018), managerial skills are skills required for making business decisions and leading subordinates in an organisation. Sun, (2015) asserted that when people are interacting, misunderstandings, disagreements and tensions are common social phenomena, resulting in interpersonal conflicts; and if managed properly, conflict can be a positive force in organisations. In order to manage conflict effectively, managers and administrators must have conflict-management skills that could help them to face conflict in the organisational environment (Safarali, 2013). According to Daily & Bishop (2003), as cited in Hsu (2017), team co-operation is the ability of members to solve conflicts and to form agreements, when confronting multiple complex problems. In addition, poor communication affects team co-operation; it reduces team performance; and it leads to team conflict (Hsu, 2017). It is important to recognise that, to some extent, conflict between groups in an organisation is inevitable; and that there is a need to acknowledge and plan ahead for project conflicts, to admit openly that change, for whatever reason, is always likely; and to attempt to control it honestly (Bowditch & Buono, 1990; Cornick, 1991; Gardiner, 1993).

The influence of conflicts among FM specialists and design-team members in the design-development process could be destructive or constructive, depending on the variables, such as the conflict-management style of leaders, the nature of the conflict, the perceptions of team members in working with conflict (Wu *et al*., 2017; Tabassie *et al*., 2019). According to Aziz & Munir (2018), conflict management is about limiting and minimising the negative aspects of conflict that occur during project management. Wu et al. (2017) state that in construction projects, a high level of collaboration amid the project-team members is essential, in order to achieve the project success. These authors further state that effective communication enables the project team to clearly understand each other's views, intentions, and to explicitly determine the rights, responsibilities and benefits that facilitate teamwork. Hence design/project leader's core-management skills need to be examined in this study.

According to Wu *et al*. (2018), the critical factor for the behaviour is the lack of conflict-management mechanisms, particularly between FM specialists and design team. These two authors further state that more attention should be paid to the investigation of the occurrence of conflicts and machanisms for managing them. Therefore, the design/project leader is required to possess appropriate management skills during the integration, design, construction, commissioning and hand-over stage, in order to inspire a collaborative working team aimed to achieve one common goal: to complete the project successfully.

According to Sudhakar (2015), properly managed conflicts result in better-quality product, better decision-making, more innovation and enhanced performance. They further state that constructive conflict management comes with mutual respect, co-operation and the intention to learn from each other. Depending on what type of individual differences exist among the stakeholders in the design process, and how they play out in a group, different types of conflict will arise, and each type of conflict will have its own distinct impact on collaboration (Lee, 2015).

According to Wong (2013), increasing physical infrastructure development places the emphasis on sustainable buildings, end-user satisfaction; and designing for maintainability dictates that project team members and FM specialists should work closely together during the design stages, in order to mitigate anticipated problems. Furthermore, Haassanain (2014) states that the involvement of FM's specialists (O & M) in design development and in the technical review stages would provide a potential for reducing the maintainability problem during the functional life of the building. Hassaanain (2014) advocates that the research carried out on the assessment of defects in HVAC systems comprise operation and maintenance problems, which can be attributed to the extent of the decisions made during the design stage of the projects. In addition, this author reveals that the decisions made during planning and design development have a significant impact on the future performance of the building.

According to Omotehinshe, (2015), it is important that the maintenance possibilities of a building are considered at the design stage, which would enhance the ease of maintenance and prevent building failures resulting from design inadequecies. Based on the growing consensus that the input of FM specialists could be vital during the design stages (Saleh 2014), the effective communication between FM and designers during the early design stages should be encouraged, in order to enhance scope design and to mitigate the problems often encountered during the operational and maintenance stages. Therefore, planning for maintenance should start during the design phase and continue through the useful life of the buildings (Hassanain 2014).

However, FM specialists (O & M) are not always involved in the early design-development process; but they are called in during the commissioning and hand-over stages (El-Deeb 2017). In order to inspire property developers to engage FM's specialists early in the design-development process, the key indicators that influence their involvement have to be determined through the literature review.

According to PMI, (2017), as cited in Tabassie *et al*. (2019), in contemporary organisations, co-ordination is a core competency of the team leader. In project management there is often a need to bring together and integrate more than one agenda: the architect pursuing, protecting and defending his/her latest creative design features versus the practical and functional demands of the user-client, which may conflict with these (Gardiner, 1993). In addition, Gardiner (1993) further states that, it is the acting project leader's responsibility to ensure that a system is followed that enables user clients to comment effectively on the various design issues, when asked to do so.

Chapter 3: The Research Design and Methodology

3.1 Introduction

This chapter presents a description of how the study was approached by presenting the plan of research, what instrument was used in collecting the data, from whom the data were collected; and the data analytical techniques that were adopted, in order to generate the findings of the study (Mutole, 2019). Furthermore, it presents information such as research design, targeted population, sample techniques and various methods and techniques used to collect data.

Definition of Research: According to Nega (2008), research is defined as a practical investigation or exploration to find out new facts, or to assemble old facts by scientific ways for the purpose of developing an existing theory, or its application to a real problem. Hence, the purpose of this study was to investigate the industry experts in their perceptions of the causes of conflicts among FM's specialists, and the design-team members in the early design development process, commissioning and the hand-over stage.

3.2 Research Design

A research design is a strategic framework for action that serves as a bridge between the research questions and the execution or implementation of the research (Blanche et al., 2006:34). According to Cooper and Schindler (2014), as cited in Velani (2017), the research design is the plan and structure of investigation, conceived, in order to obtain answers to the research questions, or the objectives. Therefore, the research design applied in this study is descriptive in nature; it is an attempt to answer the questions, such as who, what,when,where and how (Velani, 2017). The study was guided by the specific objects of the research study, such as: to identify the phase/stage in which FM specialists can be involved early in the design process; to identify the causes of conflict among the FM specialists and the design team; to determine conflict-management styles suitable for the different stages of the design-development process; and to identify the soft skills that must be acquired by the design/project leader in the design-development conflict situations. The aim and objectives of this study were addressed by using the data collected through the survey questionnaire and interviews (Alotaibi, 2018). The research design framework was developed and shown in Figure 2 below, which captures all the activities that were undertaken in the research design and the methodology.

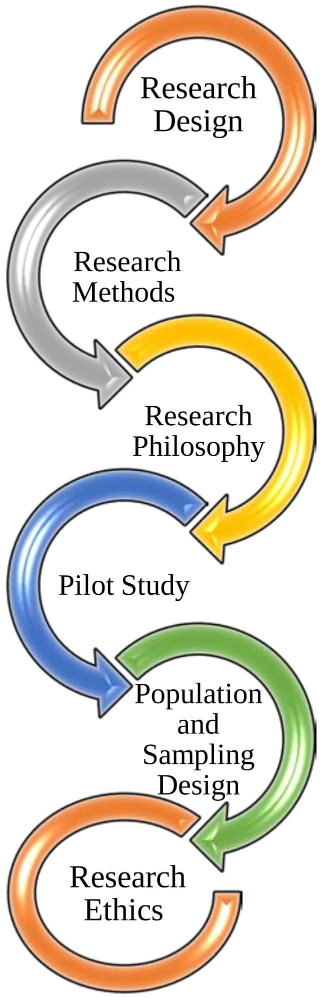

Figure 2: Research Design 1

3.3 The Research Methodology

Memon et al. (2014) refer to the research method as a systematic stepwise process required to carry out any research work. According Mackenzie and Knipe (2006) and Lee, (2017), the research paradigm must be nominated as the first step to substantiate the philosophy of the research. Furthermore, the research paradigm holds ontological, epistemological and methodological beliefs (Levers, 2013; and Lee, 2017).

Therefore, to achieve the objectives of this study, a mixed-method design that combines both the qualitative and the quantitative research approach was adopted to identify the significant causes of conflicts between FM specialists and design team during the early design process of complex construction projects.

3.4 The Research Philosophy

According to Saunders and Thornbill (2009), as cited in Mutole (2019), research philosophy is defined as the development of the research background, research knowledge and its nature.

However, Cohen *et al*. (2007), as cited in Mutole (2019), define research philosophy as the broad framework, which comprises perceptions, beliefs and the understanding of several theories and practices that are used to conduct research.

Before undertaking the main survey, a pilot survey comprising five questions was conducted, in order to identify controversial or potentially misleading questions in the original questionnaire, and to test and optimise the efficiency of the survey (Wei *et al.,* 2016).

3.5 A Pilot Study

According to He *et al.* (2014), research questions are to be pretested to ensure that the respondents would clearly understand every phrase, concept and question. Therefore, to enhance the quality and efficiency of the questionnaire, a pilot study was conducted with industry experts to increase the questionnaire's content validity before the final list of 41 variables was accepted for study. Furthermore, the main reason for piloting the questionnaire was to verify whether the questions were relevant to the objectives of the study, and to avoid ambiguities in the questionnaire (Niazi, 2017).

3.6 Population and Sampling Design

According to Cooper and Schindler (2014), as cited in Adewale (2016) and Ong'ondo (2018), a population is the total collection of elements from which the researcher wishes to draw inferences. Furthermore, Barber and Rigby (2012), as cited in Ong'ondo (2018), define this as a set of all those individuals that are relevant to a study.

The potential participants for this study were construction-projects managers, architects, engineers, quantity Surveyors, property developers, facility managers and development managers. The research questionnaires were sent out through emails and LinkedIn to potential participants; and they were assured that their responses would be totally confidential (He *et al.,* 2014). Through LinkedIn, the researcher could reach potential participants, even those outside of South Africa, and those who are fully involved in facilities management and other related industries.

3.7 Sampling

According to Blumberg *et al*. (2014), as cited in Ong'ondo (2018), a sampling frame is the list of elements from which the sample is truly drawn. The frame for this study was selected from practising architects, quantity surveyors, engineers, facilities managers, project/development managers involved in the early design-development process of complex construction projects. According to Cooper & Schindler (2014), as cited in Velani (2017), a sample is a subset of a particular population; while sampling is the practice concerned with the selection of individual participants intended to yield some knowledge of a particular population of concern, especially for the purpose of statistical inference.

3.8 Sampling Technique

To ensure the usefulness and reliability of the survey findings, different sampling approaches were adopted (Terry *et al*., 2012). Potential participants from construction professionals, property developers and facilities management were selected for purposive sampling (interviews) and snowball (questionnaire survey) sampling. Conflict related issues are deemed negative and are therefore, sensitive by nature, which made snowballing sampling suitable (Wang & Wu, 2020) for part of this study According to Baltar & Brunet (2012), snowball sampling is a useful methodology in exploratory, qualitative and descriptive research, especialy in those studies in which the respondents are few in number, or a high degree of trust is required to initiate the contact. However, the samples tend to be biased towards more co-operative individuals, or those who have s large personal network (Baltar, 2012; Magnani *et al.,* 2005). The key criterion for the selection of respondents was based on the extent to which they possess adequate knowledge of and practical experience (Terry *et al.*, 2012) in integrated FM's specialists and design team early in the design-development process. For the purpose of qualitative data collection, purposive sampling was used; as it is particularly relevant, when it is concerned with exploring the universe and understanding the participants (Mohd *et al.,* 2016).

3.9 Research Ethics

According to the National Statement on Ethical Conduct in Human Research, the nitty-gritty of ethical conduct in human research is to prevent the research activities from hurting the participants; and ensure that the research benefits the individuals and their society (NSECHR, 2007; Alotaibi, 2018).

In accordance with the Faculty (Engineering, Built Environment and Information Technology) Committee for Reseach Ethics and Integrity's (University of Pretoria), guidelines for research involving humans, ethical approval for this research was approved in 2019, after the research proposal was submitted to the committee; and the reference number is EBIT/1122019.

The researcher was governed by the University of Pretoria's Code of Ethics for Research (Rt 429/99) and the researcher's responsibilities were based on the four ethical principles, such as social, justice, benevolence, respect and professionalism, when conducting interviews and questionnaire survey. The researcher first obtained permission from various organisations, giving permission to collect the data from their staff. Invitation letters were distributed to the prospective participants asking whether they would be interested in participating in the interview or the survey.

The ethical aspects of this research were effectively addressed, as proposed by Kimmel (2007), cited in Alotaibi (2018) in the following manner:

- A letter was obtained from various organisations giving permision to collect data from their staff members.
- Invitation letters were sent to prospective participants, asking whether they would be interested in participating in both semi-structured interviews and a survey questionnaire.
- All participants were debriefed about the research topic.
- Participation was voluntary and none of the participants was in any way influenced to take part in the study.
- Honesty was observed throughout the data collection period

- Secrecy, anonymity or privacy of the research participants was maintained, by not collecting personal data that could reveal their identities.
- The researcher safeguard the rights, dignity and welfare of the individuals participating in the study.
- The works that do not belong to the author of this research have been acknowledged.
- The identity and resnses from the participants will remained confidential
- Data storage and safekeeping of data for at leats five years, after which the researcher will destroy the data

3.10 Data Collection and Analysis

Given the importance of understanding the causes of conflicts among FM specialists and design team in multi-disciplinary complex-construction projects in South Africa, the aim of this study was to collect data and analyse them, based on the respondents' perceptions.

According to Maiti & Choi (2018), using both qualitative and quantitative (mixed) methods for the data collection would provide an in-depth insight into the human behaviour and driving forces of the conflict. Furthermore, a questionnaire was used to collect the data that was based on the identified research objectives. According to Sekaran (2012), as cited by Yusuwan & Adnan, (2013), if 25% of a questionnaire is left unanswered, it should be excluded from the analysis; hence this rule was applied in this study.

3.11 The Qualitative Data Collection

According to Creswell (2013), cited in Deep *et al.* (2016), Qualitative research is an instrument that can be used to explore and understand the meaning the individuals and group give to a social or a human problem. Hence, the researcher for this study opted for the semi-structured interview for the primary data collection, due to its suitability for the subject; since it allows the respondents to express their views in their own terms; and because the researcher wanted to explore the topic at some depth (Deep *et al*, 2016). Semi-structured interviews were conducted with selected professionals in South Africa, to collect the data based on the compiled list of objectives. According to Piercy (2015), cited in Deep *et al*. (2016), in a semi-structured interview, the researcher asks a series of open-ended questions with accompanying queries that probe for more detailed and contextual data.

Furthermore, the qualitative data collection was conducted through semi-structured interviews; since it is well-suited for the exploration of the opinions and perceptions of the respondents; and it also facilitates the ability to probe the respondents for more information and clarification of their answers (Naismith *et al*., 2016). According to Naismith *et al.* (2016), the adequacy of the sample size in qualitative reseach is relative; and a sample size of ten in number may be acceptable for homogeneous sampling.

In design/construction project management research, particularly complex construction projects, the process of adoption in selecting appropriate respondents is very crucial; because it determines the reliability and the genuineness of the research findings (Osei-Kyei *et al*., 2018; Osei-Kyei & Chan, 2017a; Naismith *et al*., 2016; Deep *et al.,* 2016; Alotaibi, 2018). However, this study adopted a non-probability sampling method, such as purposive sampling to select qualified and experienced participants to participate in the semi-structured interviews. Participants for the interviews were mostly from Gauteng Province (Johannesburg and Pretoria); and they were actively involved in the built-environment; and they were more familiar with the integrated relationship among FM specialists and the design team in complex-construction projects.

The following predetermined set of questions was developed ahead of the interviews; and these were shared with the prospective interviewees prior to the interview.

- Question 1: When should facilities management specialists become involved in the design process?
- Question 2: What are the main causes of conflicts among FM's specialists and design team during the design development process?
- Question 3: What conflict management strategy/style can be applied in an optimal way for collaboration enhancement during the design-development process?
- Question 4: How important is the design/project leader's management skills (soft skills) in conflict management among the members of the design development team?

The interview took place in a closed meeting room; and the duration of the interview range between 15 and 33 minutes. The aim of the researcher was to conduct the interviews till a saturation point was achieved. However, such saturation was reached after interviewing 7 participants, with no further knowledge that was coming out from the interviewees (Malterud *et al.,* 2016 and Alotaibi, 2018).

3.12 Quantitative Data Collection

Following an extensive review of the previous related research, a set of self-administered questionnaires containing four (4) sections were prepared (Yusuwan & Adnan, 2013). The data collection was conducted through a questionnaire survey that was distributed by emails and LinkedIn to the prospective participants working for facilities management, as well as the professional consultants, such as project managers, architects and engineers involved in the construction industry. To facilitate the participation of the respondents with diverse knowledge, skills and experience in construction design process and facilities management background, the respondents were asked to rate the causes of conflicts, according to the following scale (Ejohwomu *et al*., 2016): 1 is very low, 2 is low, 3 is moderate, 4 is high and 5 is very high. In order to obtain different views on the significant causes of conflicts among FM specialists and designers, survey questionnaires were distributed locally and internationally through emails and LinkedIn. Furthermore, a questionnaire survey was compiled and sent out through emails and LinkedIn to collect large data samples (Meng & Boyd, 2017; Ejohwomu *et al.,* 2016) from experienced professionals and experts within the construction industry and facilities/properties management, such as architects, engineers and project managers/property development managers and facilities managers in South Africa. However, 102 responses were received from industrial experts, such as project managers, architects, quantity surveyors, engineers, facilities managers and development managers. From the 102, only one response was excluded, due to an incomplete answer sheet and 101 were captured and recorded for the data analysis.

The survey endeavour to build a better dataset through a larger sample; hence, a snowballing method was used in collecting the data, whereby the prospective participants were encouraged to ask their colleagues and other experienced and qualified people in their profession who might be interested in participating.

3.13 Objective 1: The Design-Development Stages

The participants were asked to answer the questions, according to the extent to which they identified the content by using a 5-point Likert scale, with scores ranging from 1 (strongly disagree) to 5 (strongly agree) (Hsu, 2017). Design development stages (project life cycle) referred to in this study are based on Professional Client/Consultant Services Agreements (PROCSA).

Question 1: When should facilities management specialists become involved in the design process?

Variables	1= Strongly Disagree	2= Disagree	3= Slightly Agree	4= Agree	5= Strongly Agree
Stage 1: Inception (PLC 1)					
Stage 2: Concept and viability (PLC 2)					
Stage 3: Design development (PLC 3)					
Stage 4: Documentation and Procurement (PLC 4)					
Stage 5: Construction (PLC 5)					
Stage 6: Close out (PLC 6)					

Table 1: Design Stages

3.14 Objective 2: Causes of Conflicts

Question 2: What are the main causes of conflicts among FM's specialists and design team during the design development process?

In order to identify the low and high causes of conflicts in complex construction-projects design, the participants were asked to rate 41 variables identified from previous literature.

Item Number	Variables	1= Very Low	2= Low	3= Moderate	4= High	5= Very High
1. COC1	Differences in technical opinions					
2. COC2	Undefined project goals					
3. COC3	Undefined project priorities					

4. COC4	Professional culture problems					
5. COC5	Slow decision-making					
6. COC6	Inadequate design/design errors					
7. COC7	Unreliable service delivery					
8. COC8	Unfair risk allocation					
9. COC9	Poor risk management					
10. COC10	Differences in attitudes					
11. COC11	Lack of trust					
12. COC12	Personality issues					
13. COC13	Unrealistic client expectations and determination					
14. COC14	Poor technical ability					
15. COC15	Diversity in expertise of project participants					
16. COC16	The absence of team spirit among members of the project					
17. COC17	Inadequate brief					
18. COC18	Lack of client specification					
19. COC19	Lack of team cohesion					
20. COC20	Unhealthy workplace competition					
21. COC21	Poor interpretation of drawings by client					
22. COC22	Internal politics regarding planning and approval					
23. COC23	Fragmentation of design development processes					
24. COC24	Lack of professionalism of project participants					

25. COC25	Budget and time constraints					
26. COC26	Lack of co-ordination					
27. COC27	Lack of collaboration during design development processes					
28. COC28	Poor communication among integrated design-team members					
29. COC29	Undefined channel of communication					
30. COC30	Misinterpretation of South African National Standards (SANS)					
31. COC31	Interdependency of the participants					
32. COC32	Incomplete project information					
33. COC33	Inadequacy of technical specifications					
34. COC34	Lack of project team integration					
35. COC35	Introduction of design innovation					
36. COC36	Lack of continuous improvement					
37. COC37	Lack of shared leadership and accountability					
38. COC38	Misunderstanding of the local statutory compliance					
39. COC39	Conflicting personal values with organisational values					
40. COC40	Failure to utilise building information model (BIM)					
41. COC41	Poor relationship management among					

	integrated design team members					

Table 2: Causes of Conflicts

3.15 Objective 3: Conflict Management Strategies

The majority of construction professionals are unaware of the various conflict-management styles; hence, they use an incorrect conflict-management style when faced with a conflict situation.

Question 3: What conflict management strategy/style can be applied in an optimal way for collaboration enhancement during the design-development process?

According to Gunarathna *et al*. (2016), the degree of successful management of conflicts ranges from 1 (not significant) to 5 (extremely significant). Hence, for this study, a Likert scale of 1 (very low) to 5 (very high), was applied in determining an appropriate conflict-management style. According to Long *et al*. (2008), cited in Gidado (2012), these authors assert that to rank different factors from various groups of causes, the Relative Importance Index I_p is an appropriate index for analysing conflicts. This was further supported by Doloi *et al.* (2012), as cited in Memon *et al*. (2014), when stating that the Relative Importance Index (RII) is the suitable method for the ranking analysis.

In order to determine the level of significantce of conflict management styles, participants were asked to rate the identified conflict-management styles.

Variables	1= No Significant	2= Slightly Significant	3= Moderately Significant	4= Very Significant	5= Extremely Significant
Confronting (CMS1)					
Collaborating (CMS2)					
Compromising (CMS3)					
Avoiding (CMS4)					
Accommodating (CMS5)					

Table 3: Conflict-Management strategies

3.16 Objective 4: Management skills

Question 4: How important is the design/project leader's management skills (soft skills) in conflict management among the members of the design development team?

In order to determine the Relative Importance of the design/project leader's soft skills in complex-construction projects, the participants were requested to rate twelve identified soft skills, according to their perception.

Variables	1= Extremely unimportant	2= Not Important	3= Important	4= Very Important	5= Extremely Important
Communication skills (SS1)					
Coordination skills (SS2)					
Conflict management skills (SS3)					
Collaboration skills (SS4)					
Leadership skills (5)					
Delegation skills (SS6)					
Negotiation skills (SS7)					
Organisational skills (SS8)					
Decision-making skills (SS9)					
Critical thinking and problem-solving skills (SS10)					
Stakeholder management skills (SS11)					
Team integration skills (SS12)					

Table 4: Management Skills

3.17 Chapter Summary

Data collection for the study involved three stages:

- Literature review
- Qualitative
- Quantitative

Secondary data were obtained through literature review while primary data were gathered through qualitative and quantitative survey. A semi-structure interviews were conducted with 8 construction industry experts identified through purposive sampling and the interview was scheduled for 30 minutes. Furthermore, questionnaire survey was administered to project managers, architects, engineers, quantity surveyors, development managers and facilities manager identified through LinkedIn and snowballing sampling method. A list of questionnaire were sent through emails and LinkedIn and 102 participants completed the questionnaire and submitted their responses through emails. All constructs were coded and captured on excel spreadsheet and uploaded to SPSS version 25.

Chapter 4: Data Analysis

4.1 Introduction

Both qualitative and quantitative methods were adopted in analysing the construction professionals' perceptions on the causes of conflicts among FM specialists and design teams in complex construction projects. The outcomes of the analysis are presented in tables and figures.

4.2 Qualitative: Content Analysis

According to Lincoln (2009), as cited in Alotaibi (2018), the semi-structured interview is an instrument that has been identified as commonly used for exploring a wide range of deeply embedded issues in a research subject. Furthermore, the instrument gives informer(s) an opportunity to elaborate their answers and to ask follow-up questions, when necessary (Firing *et al.,* 2016). Based on these recommendations, 7 semi-structured interviews were conducted, according to a qualitative approach (Lohne *et al*., 2015). The interviews were recorded on the acceptance of the interviewees; and they were later were transcribed. The interviews took place in a closed and undisturbed meeting/boardroom; and only the interviwer and the interviwee occupied the boardroom. The interviewees were informed about the informed consent form, which was read to them; and the participants were asked to sign it if he/she would like to participat ein the interview. The reseacher started the interview by reading the interview protocol and question to the participants; and he then reminded the participants of the reseach topic. Furthermore, the interviewer started the proceedings with two general background questions.

Participants' General Background

Questions	IP1	IP2	IP3	IP4	IP5	IP6	IP7
How long Have you been in the construction industry?	13yrs	12yrs	35yrs	40yrs	34yrs	27yrs	54yrs
How long have you been practising?	8yrs	10yrs	30yrs	40yrs	20yrs	22yrs	47yrs

Table 5: Participants' Years of Experience

4.2.1 The Findings

Objective 1: Project Stages/Project-Life Cycles

The aim of this section was to determine qualitatively the stage at which FM specialists should be involved in construction development process in relation to the PROCSA stages, as they are applied in South Africa.

IP1: Agrees that FM specialists should be involved at the inception stage because plenty of information should be obtained from the client, such as the existing services; and only FMs can provide such information.

According to IP2, the consultants built the facility and handed it over to FM to maintain it for the entire life-cycle, while the consultants walked away. Consultants need to ensure that they minimise operational cost and headaches in the long run; because it does not make sense that the building looks beautiful; but it does not function, according to the client's expectations. IP2 suggests that the FM specialists should be involved throughout all six processes; but he has the feeling that the main thrust of this will start talking more about the engineering and technical specialists, in which case most of their involvement should be towards design development, documents and procurement stages, as well as extending to the conception and viability stages, that is stage 2, 3 and 4. IP2 thinks that the inception stage is an administration time; and discussion between the FM specialists and the consultants would be very limited; because it's mainly about administration and about the signing of contracts. In addition, IP2 states that by the time the project has reached the construction stage, in order for the program not to be delayed, it's important to have every specification confimed and signed by the client – before even going out on tender; and that is often quite dificult to do, particularly with complex projects with limitted time and a constrained budget.

However, IP3 states that it depends on the capacity from the client's side right from the start to assist the consultants to streamline the design with regard to the client's requirements about the project and it's FM specialists who will be taking over the project once completed to give early input so that the brief can be defined properly and accurately. That will obviously makes everyone's life easier and it will be the same with the user client or tenant client that everybody be involved early.

However, IP3 was not very clear at which stage(s) should FM specialists be involved in the design development.

Meanwhile, IP4 tates that it depend on the type of the project for example if the project involve the construction of the shopping centre, there is no need for FM specialists to be involved. However, in general they should be involved in stage 3.

IP5 states that it depends on the client(s) how they see and when they want to get the consultants involved. Interviewee further states that according to his opinion it should be as early as possible that the whole team should be involved and that goes down to FM specialists to be part of the team the reason being if you start late at the stage you cant documents absolutely everthing in the meeting and every thing said and the design and decision made. If you are part of that team in the beginning and you are aware of what is going on with the project, it's dangerous to start late; because something small might have been said that is important and the whole professional team should soon be involved in the project.

IP6 first wanted to make it clear that when referring to facilities, managers don't talk about project managers; but they refer to them as technical service specialists. Inception is extremely important because lots of conflicts are caused when the brief is given inappropriately. Therefore, input from FM specialists at this stage would ensure that the brief is very clear; because that is the benchmark and if it's not communicated well, the project will start off on the wrong foot. According to IP6, FM specialists should not be involved in concept and viability stages; because that is where the architect(s) draw(s) up the concept design based on the initial brief. IP6 further states that when you get to stage 3 (design development), the scope of the work and the complexity of the project should be confirmed and the input from FM specialists and other consultants can be incorporated; because it's at this stage where you start pulling input from others, and when you have got your concept design, then you test it once more against your consultants; because you need to test the brief against FM specialists' requirements to enable you to develop this further. Therefore, this stage is a big source of possible conflicts; but what needs to be understood is that the design-development stage is not a linear process; and it's extremely important that FM specialists understand what a design process is all about. However, the input from FM specialists is extremely important at this stage; because the concept is tested; and it reacts to the input from the FM specialists; and it presents the concept to the role players (stakeholders). IP6 further states that if the work at stages 1 and 3 was done properly, then the input would have been received properly from the FM specialists; and the scope was clearly defined; then minimal input would be required at stage 4 (Documentation and Procurement); but this would be necessary to ensure the technical accuracy of the documents, and that compliance and expectation are properly managed.

However, at work Stage 5, minimal involvement of FM specialists is necessary. When new issues are uncovered decisions need to be made; and the FM specialists would have to be involved. The FM specialists need to be clear at this stage what their expectations are at the hand-over stage. Work Stage 6 (Hand-over and Close Out). If the expectations were not well communicated, close-out would not run smoothly.

According to IP7, everyone should be involved from the start; and he believes that everyone should be involved from inception stage, so that everybody can be part of the process and part of the solution.

Generally, all the interviewees agreed that FM specialists should be involved early in the design-development process, in order to give input to the design, based on the knowledge and experience from operation and maintenance and dealing with user clients.

Objective 2: Causes of Conflicts

The aim of this section was to identify qualitatively the causes of the conflicts among FM specialists and the design team, due to the early involvement of FM in the design-development process. Therefore, the findings are as follows:

According to IP1, conflicts are caused by unclear end goals; but if the overall objectives are clearly defined, the design-construction process would be simplified. Furthermore, if everyone pushes their agendas without clear leadership or guidance, conflict would inevitably arise. In addition, if the design teams are uncertain about their design roles, especially if the FM specialists were not involved at the inception stage, the design team would have to start working on something to propose to the client; because that is what the brief was all about. If the brief was unclear by one goal, the design team would not be able to achieve the goals; and hence a conflict would arise.

The causes of conflicts, according to this statement, can be summarised as follows:

- Unclear goals
- Personal agenda

- Uncertainty about team roles
- Unclear brief

According to IP2, IP3, IP4 and IP5, the following issues can cause conflicts among FM specialists and the design team:

- Lack of communication
- Late information
- Personality
- Lack of Leadership
- Lack of teamwork
- Lack of respect
- Lack of integration and team-work

However, IP6 mentioned the following issues:

- Incomplete Brief/Unclear Brief
- Technical issues
- Maintenance issues
- Practical issues
- Attitudes
- Mutual Respect
- Misunderstanding of the design process
- Lack of professional conduct
- Lack of good manners

Lastly, IP7 stated that there must be no conflict among the project team, including the project stakeholders; and if a conflict should arise, this must be sorted out immediately; otherwise there will be a problem with the people around the table.

Objective 3: Conflict-Management Strategies

The aim of this section was to determine the conflict-management strategies that a design/project leader in a complex-construction project should possess, in order to be able to handle possible conflicts.

Based on the interviews, the findings were as follows:

IP1, IP5 and IP6 were not aware of any conflict-management techniques/strategies. While IP3 mentioned personality and applying good leadership skills in handling conflict. IP4 raised the following:

i. Respect
ii. Have a private discussion
iii. It was suggested that is not so much a strategy, but having an approach
iv. The old generation that are on the edge of retiring need to transfer the knowledge to the younger generation.

In addition, the following issues were mentioned by different interviewees:

Not good with confrontation; then swallow the pride and prepare well for the next meeting. Can accommodate it; but cannot confront it. Stay calm, don't raise the voice; and defend the team. Better communication with regard to expectation (expectation management); better communication with regard to the brief, and communication as regards compliance, better communication with what to present to the team, better skills with regard to professional conduct from the design team and FM specialists, good manners, good communication skills, respect, acknowledgement that the registered professionals have special knowledge in their field, self-confidence, Knowledge of the design process, the need to prepare well for the presentation.

In summary, it became clear; and it can be generalised that construction professionals in South Africa are not aware of any conflict strategies; but they rely on applying common sense, when faced with conflict during the design process, construction, commissioning and the project hand-over phases.

Objective 4: The Necessary Soft Skills

The aim of this section was to determine qualitatively essential management skills that a design/project leader should possess in order to be able to handle conflicts that might arise during project life cycles and to steer construction project successfully. However, based on semi-structured interviews, the following soft skills were raised by different interviewees:

Relationship Management Skills was raised by IP1 and suggested that this need to be taken up with the institute of architects to compile a CPD course in soft skills in order to enhance professionals within the architects' environment. Furthermore, interview IP3 state that there is no time or passions for soft skills in engineering construction field, however, suggested that team building exercise could work although soft skills professionals also need to understand the hard skills. IP4 states that in order to pass the knowledge to the next generation, one need to understand the the global picture of where everyone fits into the project team, what is everybody supposed to be doing, respect each other and have a relationship management skills. Furthermore, the interviewee states that facilities managers are not well trained and half of the time they lack necessary knowledge and because of lack of knowledge, they become arrogant and start questioning everything that the project team is designing. IP5 mentioned leadership skills and motivation skills as necessary for the design/project leader in order to keep the team together as one team and to motivate them to work together towards mutual goal(s).

In addition, IP6 mentioned the following soft skills as being significant for design/project leader in complex construction:

- Design/project leader needs communication Skills to communicate clearly the objectives of the project to the team, to communicate clearly in terms of the progress, deadlines and programming of the project.
- The design/project leader needs co-ordination Skills to ensure that different parties are in contact to reach collective goals.
- The design/project leader needs collaboration Skills to communicate with all the stakeholders and inspire them to ensure that they take ownership of the project. Furthermore, to communicate the concept to the stakeholders that this is a

collaborative effort and not a high rocky system; and that it is not a question of who is on the top of the high rocky mountain; it is a team effort.

- Design/project leaders need negotiation skills to negotiate with FM specialists and the project team to ensure that the decisions are made in the interests of the project; and that they are not personal or interpersonal issues. As a design/project leader, you need to bring the team around the table and make them to work together. Other skills mentioned are the skills to manage client's expectations during the design process and the construction stage, in order to control the scope, the grip, the time and the cost over-run.

Design/project leaders need to have common sense, knowledge and to concentrate on positive issues. They would then achieve project success.

4.3 Quantitative Data Analysis

According to Gomm (2004), Aliaga and Gunderson (2003), Kumar (2010) and Flick (2011), as cited by Alotaibi (2018), quantitative research is typically linked to traditional, essentialist, positivist, experimental, empiricist, or deductive approaches. These sources further state that quantitative methods typically involve the collection of quantifiable data to describe a specific situation or occurrence scientifically. Furthermore, Bendat & Piersol (2011), as cited in Alotaibi (2018), state that quantitative data analysis involves inspection, measurement, or counting, and transformation of the data collected by the researcher, in order to present information that could be used to either validate or invalidate positions, and to draw conclusions or recommendations on a phenomenon being studied.The data collected by both qualitative and quantitative studies are designed to answer research questions, hence they must be analysed and interpreted using appropriate techniques that ensure they provide meaning to the research context (Alotaibi, 2018).

Prior to data analysis, a spreadsheet was created; and all the quantitative data collected from various professionals, such as architects, project managers, quantity surveyors, engineers, development managers and facilities managers were captured and transformed, in order to be compatible with Packages for the Social Sciences (SPSS) version 25. A statistical analysis was carried out based on data collected through questionnaire survey distributed through the email and Linked to the construction and property-management professionals (Tucker, 2018; Ramli, 2017).

The study applied descriptive statistical analysis in order to determine the mean values and the standard deviations of each variable, based on the perceptions of the participants; and the results are presented in frequency and mean tables. To measure the data from the questionnaire survey, the ordinal/nominal scale was used (Niazi, 2017). All questionnaire items, unless otherwise stated, were measured according to the Likert scale of five where "1" represents not significant, and "5" represents extremely significant and ordinal/nominal measure. Therefore, the following criteria were applied in decision-making (Terry et al., 2012):

- Mean Score of ≥1 but ≤1.99 Strongly Disagree, Very Low, Extremely insignificant and Extremely unimportant,
- Mean Score of ≥2 but ≤2.99 Disagree, Low, Slightly Significant but unimportant,

- Mean Score of ≥3 but ≤3.99 Slightly Agree, Moderate, Significant and Important,
- Mean Score of ≥3 but ≤4.99 Agree, High, Very Significant, Very important,
- Mean Score of >4.99 but ≤5.00 Strongly Agree, Very High, Extremely Significant and Extremely important.

The mean score of each variable were used to rank its level of importance; while ANOVA and One -ample Tests were carried out to determine the significant differences among the groups (Terry *et al.,* 2012). Moreover, the method of using the mean score of all items, which has been widely used, was employed for this study to operationalise the multi-item constructs (Donghan & Zhongfeng, 2019). The results were further used to determine the ranking levels of the variables. The significance level (α) of this study was set at 0.05, meaning that there was 95% certainly that the results were not to change; and the finding were significant at 0.05 level (Toh, 2014).

According to Ramli, (2017), the descriptive data consist of the nominal scale as a percentage and frequency; hence the mean scores in this study are based on the nominal scale.

Statistical Package for the Social Sciences (IBMSPSS) v. 25 was used to conduct descriptive statistics and exploratory factor analysis, to ensure the accurancy and the throughness of the collected data through a survey. According to Pallant (2010), as cited in Alotaibi (2018), the choice of SPSS is generally based on its efficiency and ability to manage the analysis of large volumes of data with more accurancy and carefulness. Furthermore, Albhaisi (2016) states that SPPS can be applied to conduct the data analysis; hence, this study used the following measurement in conducting the data analysis for all four of the questions:

- Cronbach α Coefficient was used to determine the reliability of the measuring instrument.
- Descriptive Analysis, such as frequencies, mean scores, standard deviations and standard errors.
- Compare means (Group mean): Firstly, the participants were grouped randomly; and SPSS was used to determine and compare the ratings of the variables, according to the perceptions of the groups.
- One-Sample T-Test
- ANOVA
- Measure of association
- Kendall's Coefficient of Concordance (KCC), applied to determine the degree of association of ordinal assessments, based on the perceptions of the participants made at the time of rating the identified research variables.
- Mean scores were further used to determine the mean-ranking levels of the variables
- The Hypothesis Test
- Factor Analysis (Question 2 Only)

4.3.1 Descriptive Statistics

Descriptive statistics of the data were first analysed to gain the knowledge of the collected data; after which the internal consistent reliability of the data was checked using Cronbach's Alpha (George & Mallery, 2003; Alotaibi, 2018).

Research Reliability (Internal Reliability)

Research reliability and validity are widely accepted terms in quantitative research (Alotaibi, 2018); and they are used to describe the quality of the research (Cohen *et al*. 2011 and Alotaibi, 2018). Before conducting the data analysis, the reliability of the varaiables in the surveyed questionnaire was tested, which is in line with the suggestion proposed by Drost (2011), as cited in Alotaibi (2018), when stating that it is essential for the reliability tests of the data to be carried out, so as to ensure that they are free of random errors.

Reliability is the ability of an instrument to measure the attributes of a variable or construct consistently (LoBiondo-Wood & Haber, 2014). These authors further state that the reliability of a research instrument is the extent to which the instrument yields the same results when repeated. However, Wang (2016) defined reliability as an effective analytical method for measuring the stability and the reliability of the measurement scale; and this includes internal and external reality analyses. In order to avoid bias, the reliability of this study was determined by the feedback from the survey questionnaire from a selected sample of participants from various organisations.

Validity

According to Robinson (2002), as cited in Waweru and Omwenga (2015), validity is the degree to which the results obtained from the data analysis actually represent the phenomenon under study. The accuracy of the data collected depends largely on the data collection instrument (Waweru and Omwenga, 2015); hence, this study used both qualitative and quantitative instruments, based on the pre-determined questions and objectives.

The Cronbach Alpha

Before the collected data can be analysed, the data needs to be check on its stability and consistency using Cronbach's Alpha value of reliability test (Rahman & Al-Emad, 2018). According to Sijtsma (2009), Cronbach's Alpha is the most suitable instrument for measuring the reliability of the collected data. However, this study is concerned with the internal reliability of the scale, which answers the question, such as, "Do all the items in the scale measure the same thing (Wang, 2016)?' Ibid further stated that high internal reliability means a high degree of consistency of a set of evaluation items.

According to Pawar *et al*. (2016), it is difficult to return the scouting sample of the questionnaire that is used to measure the questionnaire validity to the same respondents, due to the different working conditions of the sample. Prior to the ranking of the variables a reliability test was carried out, to ensure that the data collected were valid and reliable for further analysis (Memon *et al*., 2014).

According to George and Mallery (2003: p. 231), the following rules provide a guide for the level of acceptance of Cronbach's alpha:

- Questionable ≤ 0.5
- Acceptable ≤ 0.6
- Good ≥ 0.7
- Very Good ≥ 0.8
- Excellent ≥ 0.9

In addition, Nunnally (1978), Martin (2005), and Ling (2011) suggested a Cronbach of 0.70 as a reflection of valid and reliable data that indicate a good level of internal reliability while Cohen *et al.* (2008) suggested that a Cronbach of 0.67 should be accepted. According to to Gliem (2003), the high value of alpha is dependent upon the number of variables in the scale. Therefore, for the purpose of this study, a Cronbach' Alpha of 0.70 and above was accepted as a reflection of valid and reliable data that indicates a good level of internal reliability.

Cronbach's Alpha Test: Objective 1 - 4

Cronbach's alpha was conducted to demonstrate the items reliability in th questionnaire and to examine the scale's internal consistency. However, table 6 below shows the results of Cronbach's alpha test of 0.623, which can be declared to be good, based on the guide provided by Mallery (2003: p. 231) but for the purpose of this study, the achieved Cronbach's alpha did not meet the suggested Cronbach of 0.7; and thus, it might be questionable, according to George and Mallery (2003: p. 231).

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.623	0.639	6

Table 6: Question 1 Cronbach's Alpha

Cronbach's alpha was conducted based on 41 constructs hence, table 7 below shows the results of Cronbach's alpha of 0.950, which can be declared as excellent, based on the guideline provided by Mallery (2003: p. 231).The achieved Alpha value of 0.950 indicates a high level of reliability and internal consistency of the survey data (Osei-Kyei, *et al*., 2018).

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.950	0.950	41

Table 7: Question 2 Cronbach's Alpha

Table 8 below shows the results of Cronbach's alpha of 0.228, which is questionable according to Mallery (2003: p. 231). The obtained Alpha value of this objective indicates a lower level of reliability and consistency of the survey data.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.228	0.213	5

Table 8: Question 3 Cronbach's Alpha

Table 9 below shows the results of Cronbach's alpha of 0.842, which can be declared as very good, according to Mallery (2003: p. 231). The Alpha value for this objective indicate a high level of reliability and internal consistency of the survey data.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.842	0.841	12

Table 9: Cronbach's Alpha

Overall Cronbach's Alpha

However, Table 10 below shows the overall results of Cronbach's alpha, which can be declared as excellent, according to the guideline provided by Mallery (2003: p. 231) and indicate a high level of reliability and internal consistency of the survey data (Zhao, *et al.,* 2016).

.Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.941	0.940	64

Table 10: Overall Cronbach's Alpha

Descriptive Analysis: Objective1

The question sought to establish the level at which the respondents agreed or disagreed on the stage at which FM specialists should be involved in the design-development process of the complex-construction projects. Furthermore, the mean score and the standard deviation methods were adopted to establish the level of agreement in terms of the project stage, in which FM specialists should be involved early in the project life cycles; and the results are indicated in Table 11. According to Terry *et al*. (2012), the mean score of each variable is used to rank its level of agreement; hence, the scale interval in Table 11 below was intepreted as follows:

Strongly disagree (mean score of ≥1 but ≤1.99), Disagree (mean score of ≥2 but ≤2.99), Slightly agree (mean score≥3 but ≤ 3.99), Agree (mean score of ≥4 but ≤4.99) and Strongly agree (mean score of >4.99 but ≤5.0).

Frequencies

Statistics							
		PLC 1	PLC 2	PLC 3	PLC 4	PLC 5	PLC 6
N	Valid	100	100	100	99	99	99
	Missing	2	2	2	3	3	3
Mean		3.21	3.71	4.19	3.56	3.56	4.29
Std. Error of Mean		0.151	0.137	0.086	0.120	0.120	0.112
Std. Deviation		1.513	1.373	.861	1.197	1.197	1.118
Minimum		1	1	1	1	1	1
Maximum		5	5	5	5	5	5

Table 11: Frequency Table

Table 11 indicates that standard errors are closer to zero, meaning that the sample chosen is a reflection of the population (Field, 2005; Dick-Sagoe & Arthur, 2016). Secondly, standard deviations are greater than one, which is an indication that the respondents did not agree much on the various stages at which FM specialists should be involved in the project life-cycle.

Mean Scores (MS)

According to Isa *et al*. (2019), it is important to note that traditionally, construction project design phases are segregated from construction, operation, maintenance and subsequent provision of services. Meng (2013), as cited in Isa *et al*. (2019) declaired that this segregation can lead to several issues, in regard to the designed facilities, which lack constructability, functionality, operability, maintainability and serviceability. Hence, the objective was to identify through the participants' perceptions the stage(s) at which FM specialists should be involved in the project life-cycle (stages), in order to give input to the design and the specifications thereof.

From an observation of the descriptive statistics in table 12, it is evident that the mean scores are greater than the midpoint (2.5). A midpoint score means that the participants' perceptions disagree with that of the FM specialists' early involvement in any of the project life-cycle stages. However, according to the mean scores in Table 12, stage 3 (MS =4.29), stage 6 (MS = 4.19) received mean scores that are above 4, meaning that the participants' perceptions agree with the involvement of FM specialists early In PLC3 and PLC6; while they slightly agreed in PLC4 and PLC5, which received MS of 3.56 and PLC, respectively; and PLC2 received a mean score of 3.71, which are all below 4, but above 3.

Based on the results in the descriptive statistics table 12, it can be generalised and inferred that the participants' perceptions agreed with the involvement of FM's specialists in the early design development of complex--construction projects.

Furthermore, the standard error associated with the various MS are closer to zero, thereby indicating that the sample chosen was a reflection of the population (Dick-Segoe and Arthur, 2016). In addition, the various variables had standard deviations greater than one, which indicates that the respondents did not agree much on the various (Dick-Segoe & Arthur,

2016) variables, indicating in which FM specialists should be involved early in the design process. However, the standard deviation on project life cycle 3 (design development stage) is lower than 1 indicating that respondents fully agreed that FM specialist should be involved in early design development stage.

Descriptive Statistics Table

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
PLC 6: Stage 6 – Close Out	99	1	5	4.29	0.112	1.118
PLC 3: Stage 3 – Design Development	100	1	5	4.19	0.086	0.861
PLC 2: Stage 2 – Concept and Viability	100	1	5	3.71	0.137	1.373
PLC 5: Stage 5 - Construction	99	1	5	3.56	0.120	1.197
PLC 4: Stage 4 – Documentation and Procurement	99	1	5	3.56	0.120	1.197
PLC 1: Stage 1 - Inception	100	1	5	3.21	0.151	1.513
Valid N (listwise)	97					

Table 12: Question 1 Descriptive Statistics

One – Sample T- Test

This study further adopted a one – sample t – test to check whether the respondents significantly agreed on FM specialists' involvement during the 6 stages of the construction project life-cycles. According to Liu *et al.* (2017), the purpose of the one sample t-test is to determine whether the null hypothesis should be rejected, given the sample data. Table 13 below indicates the t-test results, with all variables having achieved p-values < 0.05. The p-value (Significant) helps in making a statistical decision as to whether or not the population's mean and sample mean are equal (Dick-Sgoe & Arthur, 2016; Field, 2005). Therefore, project life-cycle (project-design processes) were statistically significant with "significant" values of less than the p- value (0.05). Furthermore, this indicates that there is a strong homogeneity of responses furnished by respondents and reaffirms the validity and reliability of the survey data for further comparative analysis (Osei-Kyei, *et al.,* 2018).

One-Sample Test

	Test Value = 6					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
PLC 1	-18.442	99	0.000	-2.790	-3.09	-2.49
PLC 2	-16.680	99	0.000	-2.290	-2.56	-2.02
PLC 3	-21.022	99	0.000	-1.810	-1.98	-1.64
PLC 4	-20.317	98	0.000	-2.444	-2.68	-2.21
PLC 5	-20.317	98	0.000	-2.444	-2.68	-2.21
PLC 6	-15.192	98	0.000	-1.707	-1.93	-1.48

Table 13: Question 1 One-Sample T-Test

Group Compare Mean

Furthermore, four groups were established, whereby each group consists of an average of 25 respondents. SPSS version 25 was further applied to determine the level of agreement among the groups in determining the construction-project stage at which FM specialists should be involved; hence, the comparison-mean table was created to indicate the level of agreement per group.

According to the observation of the group mean Table 14 below, the participants' perceptions achieved the following mean scores:

Group 1:

- Stages 1, 4 and 5 received mean scores above 3, but below 4, meaning that the participants' perceptions slightly agreed with those of the FM specialists' early involvement in the inception, documentation and construction stages.
- Stages 2, 3 and 6 received mean scores of 4 and above, but less than 5, meaning that the participants' perceptions agreed with those of the FM specialists' early involvement in concept and viability, design development and close-out stages.

Group 2:

- Stage 1(Inception) received a mean score of 2.42, meaning that the participants' perceptions disagreed with those of the FM specialists' involvement;
- Stage 2 (Concept and Viability) received a mean score of 3.08, meaning that the participants' perceptions slightly agreed with those of the FM specialists' early involvement in the project life-cycles;
- Stage 3 (Design and Development) received a mean score of 4.08, meaning that the participants' perceptions agreed with those of the FM specialists' involvement in the project life-cycles;
- Stage 4 – 6 (Documentation and Procurement, Construction and Close-out) received mean scores of above 3, but below 4, meaning that the participants in this group sligtly agreed with those of the FM specialists' involvement in each of the project life-cycles.

Group 3:

Stage 1 (Inception) and 5 (Construction) received mean scores above 3, but below 4, meaning that the participants' perceptions slightly agreed with those of the FM specialists' early involvement in each of the project life-cycles.

Stage 2 (Concept and Viability) and stage 4 (Documentation and Procurement) received mean scores above 3.50, but below 4, meaning that the participants' perceptions slightly agreed with those of the FM specialists' early involvement in each of the project life-cycles.

Stage 3 (Design and Development) and 6 (Close-Out) received mean scores above 4, but below 4.99, meaning that the participants' perceptions agreed with those of the FM specialists' early involvement in each of the project life-cycles.

Group 4:

- Stage 1 (Inception) and 5 (Construction) received mean scores of above 3, but below 3.99, meaning that the participants' perceptions slightly agreed with those of the FM specialists' early involvement in each of the project life-cycles.
- Stage 2 (Concept and Viability) and 4 (Documentation and Procurement) received mean scores above 4, but below 4.99, meaning that the participants' perceptions agreed with those of the FM specialists' early involvement in each of the project life-cycles.

Group Compare Mean Table

QUESTION 1		PLC 1	PLC 2	PLC 3	PLC 4	PLC 5	PLC 6
Group 1	Mean	3.71	4.00	4.28	3.48	3.79	4.54
	N	24	25	25	25	24	24
	Std. Deviation	1.517	1.190	0.792	1.327	1.021	0.884
	Std. Error of Mean	0.310	0.238	0.158	0.265	0.208	0.180
	Minimum	1	1	3	1	2	2
	Maximum	5	5	5	5	5	5
Group 2	Mean	2.42	3.08	4.08	3.67	3.79	3.96
	N	24	24	24	24	24	24
	Std. Deviation	1.316	1.530	.929	1.090	1.179	1.268
	Std. Error of Mean	0.269	0.312	0.190	0.223	0.241	0.259
	Minimum	1	1	2	1	1	1
	Maximum	5	5	5	5	5	5
Group 3	Mean	3.35	3.82	4.32	3.55	3.41	4.50
	N	23	22	22	22	22	22
	Std. Deviation	1.555	1.332	0.839	1.262	1.221	0.859
	Std. Error of Mean	0.324	0.284	0.179	0.269	0.260	0.183
	Minimum	1	1	2	1	1	2
	Maximum	5	5	5	5	5	5

Group 4	Mean	3.34	3.90	4.10	3.54	3.28	4.21
	N	29	29	29	28	29	29
	Std. Deviation	1.446	1.319	0.900	1.170	1.306	1.292
	Std. Error of Mean	0.269	0.245	0.167	0.221	0.243	0.240
	Minimum	1	1	1	1	1	1
	Maximum	5	5	5	5	5	5
Total	Mean	3.21	3.71	4.19	3.56	3.56	4.29
	No.	100	100	100	99	99	99
	Std. Deviation	1.513	1.373	0.861	1.197	1.197	1.118
	Std. Error of Mean	0.151	0.137	0.086	0.120	0.120	0.112
	Minimum	1	1	1	1	1	1
	Maximum	5	5	5	5	5	5

Table 14: Question 1 Group Mean

One-way ANOVA

A one-way analysis of variance ANOVA was conducted among the means of the responses from the four groups, in order to check for any significant differences among the groups' perceptions regarding (Assbeihat, 2016) FM specialists' early involvement in different construction project life-cycles; and the results are indicated in Table 15 below. The mean square values under the four groups, F statistics and the P values at which the hypothesis of equality of mean values across different groups could be rejected (Ibid) or accepted; if it were calculated.

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
PLC 1: Stage 1 - Inception	Between Groups	(Combined)	22.029	3	7.343	3.446	0.020
	Within Groups		204.561	96	2.131		
	Total		226.590	99			
PLC 2: Stage 2 - Concept and Viability	Between Groups	(Combined)	12.794	3	4.265	2.356	0.077
	Within Groups		173.796	96	1.810		
	Total		186.590	99			
PLC 3: Stage 3 – Design Development	Between Groups	(Combined)	1.054	3	0.351	0.466	0.706
	Within Groups		72.336	96	0.753		
	Total		73.390	99			
PLC 4: Stage 4 – Documentation and Procurement	Between Groups	(Combined)	0.452	3	0.151	0.102	0.959
	Within Groups		139.992	95	1.474		
	Total		140.444	98			

PLC 5: Stage 5 – Construction	Between Groups	(Combined)	5.416	3	1.805	1.270	0.289
	Within Groups		135.028	95	1.421		
	Total		140.444	98			
PLC 6: Stage 6 – Close Out	Between Groups	(Combined)	5.330	3	1.777	1.440	0.236
	Within Groups		117.175	95	1.233		
	Total		122.505	98			

Table 15: Question 1 - ANOVA Table

According to Bryman and Creamer (1999. p:150), the F test or ratio tells us only whether there are significant differences between one and more of the groups. However, from the above table (15), it was found that PLC1 has the highest F value (3.446), which indicates a very strong agreement between the respondents from the four groups on the FM specialists' early involvement in the first stage of the project life-cycles. Furthermore, from the analysis, it was found that there were statistically non-significant differences among the respondent groups over the following project stages:

- PLC2 (F =2.356, P = 0.077)
- PLC 3 (F = 0.466, P = 0.706)
- PLC4 (F =0.102, P = 0.959)
- PLC5 (F = 1.270, P = 0.289)
- PLC6 (F = 1.440, P = 0.236)

Kendall's W Test

In order to determine the extent of consitency of participants in rating the variables, Kendall's coefficient of concordance was applied to the data (Holland, Chait and Barbara 1989). According to Yang *et al*. (2011), if Kendall's coefficients of concordance is significant at the 1% level, this indicates a general agreement among the repondendents. However, Stabryla *et al*. (2005), as cited by Lesniak (2015), suggested that the degree of consistency of Kendal's coefficient of concordance W should be described by the following hierarchy:

- Fair agreement: between 0.21 to 0.40,
- Moderate agreement: between 0.41 to 0.60,
- Good agreement: between 0.61 to 0.80,
- Very good agreement: between 0.81 to 0.95,
- Extremely good agreement: between 0.96 to 1.00.

However, if the W is between 0 and 0.20, it means that there is no agreement among the respondents.The above suggested values will allow the researcher to formulate a conclusion regarding the consistency of the perceptions of the different groups of participants that participated in the survey. Therefore, the collected data for this study were tested, and according to Table 16, Kendall's coefficient is 0.124. However, in reference to the above decision-making hierarchy, 0.124 is outside or lower than the proposed hierarchy; and this can be declared to in poor agreement.Furthermore the results indicate a significant value of 0.000, thus the null hypothesis is rejected. However, this indicate a strong homogeneity of responses given by the respondents and reaffirms the validity and reliability of the survey data for further investigation (Osei-Kyei, *et al.*, 2018).

Kendall's Coefficient of Concordance Results

N			97
Kendall's W[a]			0.124
Chi-Square			60.160
Df			5
Asymp. Sig.			0.000
Monte Carlo Sig.	Sig.		0.000[b]
	95% Confidence Interval	Lower Bound	0.000
		Upper Bound	0.000
a. Kendall's Coefficient of Concordance			
b. Based on 10000 sampled tables with starting seed 2000000.			

Table 16: Question 1 Kendall's Coefficient

Ranking of Variables based on Perceptions of Participants

SPSS version 25 was used to determine the Mean Ranks of the different variables, where the higher the mean rank score indicates the higher ithe ranking to be; and these are indicated in Table 17 below. It can be observed that project closed out is ranked high followed by design development, concept and viability , documentationand procurement, construction stage and lastly inception stage.

Ranks

	Mean Rank	Ranking Level
PLC 1: Stage 1 – Inception	2.81	6
PLC 2: Stage 2 – Concept and Viability	3.44	3
PLC 3: Stage 3 – Design Development	4.05	2
PLC 4: Stage 4 – Documentation and Procurement	3.22	4
PLC 5: Construction	3.15	5
PLC 6: Stage 6 - Close Out	4.32	1

Table 17: Question 1 Mean Rank

Null and Alternative Hypothesis Test

According to Liun *et al.* (2017), there are two kinds of hypothesis for one sample t-test:

- Null hypothesis, which assumes that no difference exists between the true mean and the comparison value,
- Alternative hypothesis, which assumes that some differences exists,

However, for the purpose of this study, the Kruskal Wallis test was performed, in order to determine the null hypotheses that are rejected, and those that are accepted. Table 18 indicates that the null hypothesis (early involvement of FM specialists in project life cycle 1) has been rejected, according to the perceptions of the participants. However, the rest of the null hypotheses in question 1 have been accepted.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of PLC 1 is the same across categories of QUESTION 1.	Independent-Samples Kruskal-Wallis Test	.021	Reject the null hypothesis.
2	The distribution of PLC 2 is the same across categories of QUESTION 1.	Independent-Samples Kruskal-Wallis Test	.102	Retain the null hypothesis.
3	The distribution of PLC 3 is the same across categories of QUESTION 1.	Independent-Samples Kruskal-Wallis Test	.706	Retain the null hypothesis.
4	The distribution of PLC 4 is the same across categories of QUESTION 1.	Independent-Samples Kruskal-Wallis Test	.976	Retain the null hypothesis.
5	The distribution of PLC 5 is the same across categories of QUESTION 1.	Independent-Samples Kruskal-Wallis Test	.332	Retain the null hypothesis.
6	The distribution of PLC 6 is the same across categories of QUESTION 1.	Independent-Samples Kruskal-Wallis Test	.208	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 18: Question 1 - Testing of hypotheses

Descriptive Analysis: Objective 2

From literature review, 41 constructs were identified and subjected to the respondents' views. Responses were rated using a 5-point Likert scale: 5 = strongly agree, 4 = agree, 3 = slightly agree, 2 = disagree and 1 = strongly disagree. Furthermore, the mean score and the standard deviation method were used to determine the key causes of conflicts among FM specialists and the design-team design and those of the construction process of complex construction projects. The mean and standard deviation of the identified causes of conflicts were calculated and the outcome thereof are indicated in Table 19.

According to Terry *et al*. (2012), the mean scores of each variable are used to rank the level of agreement; hence, the scale interval in Table 19 can be intepreted as follows:

Very low (mean score of ≥1 but ≤ 1.99), Low (mean score of ≥2 but ≤ 2.99), Moderate (mean score of ≥3 but ≤3.99), High (mean score of ≥4 but ≤4.99) and Very high (mean score of >4.99 but ≤5).

Frequency Test

Variables	N		Mean	Std. Error of Mean	Std. Deviation	Minimum	Maximum
	Valid	Missing					
COC 1	100	2	3.52	0.102	1.020	1	5
COC 2	100	2	3.68	0.104	1.043	1	5
COC 3	100	2	3.81	0.098	0.982	1	5
COC 4	100	2	2.97	0.122	1.218	1	5
COC 5	100	2	3.72	0.104	1.036	1	5
COC 6	97	5	3.14	0.111	1.090	1	5
COC 7	99	3	3.12	0.114	1.136	1	5
COC 8	99	3	3.23	0.116	1.159	1	5
COC 9	98	4	3.29	0.115	1.140	1	5
COC 10	100	2	3.22	0.128	1.276	1	5
COC 11	99	3	3.16	0.135	1.345	1	5
COC 12	100	2	2.92	0.129	1.292	1	5
COC 13	100	2	3.70	0.086	0.859	2	5
COC 14	100	2	3.12	0.110	1.104	1	5
COC 15	101	1	3.15	0.092	0.921	1	5
COC 16	100	2	3.02	0.119	1.189	1	5
COC 17	101	1	3.84	0.105	1.056	1	5
COC 18	101	1	3.95	0.106	1.062	1	5
COC 19	101	1	3.15	0.108	1.081	1	5
COC 20	101	1	2.66	0.130	1.306	1	5
COC 21	101	1	3.05	0.112	1.126	1	5
COC 22	101	1	3.25	0.129	1.299	1	5
COC 23	101	1	3.39	0.098	0.990	1	5
COC 24	101	1	2.82	0.119	1.195	1	5
COC 25	100	2	3.97	0.103	1.029	1	5
COC 26	98	4	3.65	0.104	1.026	1	5
COC 27	100	2	3.76	0.097	0.965	1	5
COC 28	100	2	3.67	0.095	0.954	1	5
COC 29	101	1	3.33	0.112	1.123	1	5
COC 30	101	1	2.97	0.123	1.237	1	5
COC 31	101	1	2.92	0.108	1.083	1	5
COC 32	101	1	3.51	0.107	1.073	1	5
COC 33	101	1	3.56	0.101	1.014	2	5

COC 34	101	1	3.12	0.105	1.052	1	5
COC 35	101	1	3.08	0.099	0.997	1	5
COC 36	99	3	2.94	0.102	1.018	1	5
COC 37	101	1	3.30	0.112	1.127	1	5
COC 38	100	2	3.00	0.119	1.189	1	5
COC 39	101	1	2.72	0.125	1.258	1	5
COC 40	101	1	2.93	0.110	1.107	1	5
COC 41	101	1	2.96	0.114	1.148	1	5

Table 19: Question 2 Frequency Test

Table 19 indicates the standard errors that are closer to zero, thereby meaning that the sample chosen is a reflection of the population (Field, 2005; Dick-Sagoe & Arthur, 2016). Secondly, standard deviations are greater than one, which indicate that the respondents did not agree much on the various stages in which FM specialists should be involved in the project's life cycle except COC 3, COC13,COC15,COC23, COC27,COC28,COC35 which achieved standard deviations of smaller than one which indicate that there was no agreements among the respondents.

Mean Scores

The aim of question 2 was to identify the causes of conflicts among FM specialists and the design team during the six construction-project's life-cycles (stages).

From the observation of the descriptive statistics in Table 20, it can be declared that participants' perceptions on 12 variables (COC1, COC2, COC3, COC5, COC13, COC17, COC18, COC25, COC26, COC27, COC28 and COC33) had received mean scores above 3.51, but less than 4, meaning that the chances of these variables causing conflicts during the project life cycles are moderately high. However, 18 variables (COC6, COC7, COC8, COC9, COC10, COC11, COC14, COC15, COC16, COC19, COC21, COC22, COC23, COC29, COC34, COC35, COC37 and COC38) received mean scores above 3, but less than 3.50, meaning that the chances of them causing conflict in any project life-cycles are moderate. Lastly, 10 variables (COC4, COC12, COC20, COC24, COC30, COC31, COC36, COC39, COC40 and COC41) received mean scores higher than 2.50, but less than 3, meaning that the chances of causing conflicts are moderately low.

These data analysis results can be used to determine the degree in which they would cause conflicts among FM specialists and the design team during early design development stages of the construction projects. Furthermore, the standard error associated with various MS values were closer to zero, thereby indicating that the sample chosen is a reflection of the population (Dick-Segoe & Arthur, 2016; Field, 2005). In addition, the standard deviations of 34 variables were greater than one, indicating that respondents did not agree much on the various causes of conflicts among FM specialits and the design team during the project life cycle; while 7 variables had standard deviations closer to one, thereby indicating that the respondents did agree on the various causes of conflicts.

Descriptive Analysis Table

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
COC 25	100	1	5	3.97	0.103	1.029
COC 18	101	1	5	3.95	0.106	1.062
COC 17	101	1	5	3.84	0.105	1.056
COC 3	100	1	5	3.81	0.098	0.982
COC 27	100	1	5	3.76	0.097	0.965
COC 5	100	1	5	3.72	0.104	1.036
COC 13	100	2	5	3.70	0.086	0.859
COC 2	100	1	5	3.68	0.104	1.043
COC 28	100	1	5	3.67	0.095	0.954
COC 26	98	1	5	3.65	0.104	1.026
COC 33	101	2	5	3.56	0.101	1.014
COC 1	100	1	5	3.52	0.102	1.020
COC 32	101	1	5	3.51	0.107	1.073
COC 23	101	1	5	3.39	0.098	0.990
COC 29	101	1	5	3.33	0.112	1.123
COC 37	101	1	5	3.30	0.112	1.127
COC 9	98	1	5	3.29	0.115	1.140
COC 22	101	1	5	3.25	0.129	1.299
COC 8	99	1	5	3.23	0.116	1.159
COC 10	100	1	5	3.22	0.128	1.276
COC 11	99	1	5	3.16	0.135	1.345
COC 15	101	1	5	3.15	0.092	0.921
COC 19	101	1	5	3.15	0.108	1.081
COC 6	97	1	5	3.14	0.111	1.090
COC 7	99	1	5	3.12	0.114	1.136
COC 14	100	1	5	3.12	0.110	1.104
COC 34	101	1	5	3.12	0.105	1.052
COC 35	101	1	5	3.08	0.099	0.997
COC 21	101	1	5	3.05	0.112	1.126
COC 16	100	1	5	3.02	0.119	1.189
COC 38	100	1	5	3.00	0.119	1.189
COC 30	101	1	5	2.97	0.123	1.237
COC 4	100	1	5	2.97	0.122	1.218
COC 41	101	1	5	2.96	0.114	1.148
COC 36	99	1	5	2.94	0.102	1.018
COC 40	101	1	5	2.93	0.110	1.107
COC 31	101	1	5	2.92	0.108	1.083

COC 12	100	1	5	2.92	0.129	1.292
COC 24	101	1	5	2.82	0.119	1.195
COC 39	101	1	5	2.72	0.125	1.258
COC 20	101	1	5	2.66	0.130	1.306
Valid N (listwise)	88					

Table 20: Question 2 Descriptive Statistics

One – Sample T – Test

According to the perceptions of the respondents and in reference to Table 21, all 41 variables received p-values of less than 0.05; and hence they are significant. This further means that the null hypothesis is rejected. According to Osei-Kyei *et al*. (2018), this indicates that that there is a strong homogeneity of responses furnished by the respondents and also reaffirms the validity and realibility of the survey data for further comperative analysis.Furthermore, the one sample t – test was used to determinethe severity of the causes of conflicts among FM specialists and design team. Based on the p – value (2-tailed) indicated on table 21, all 41 causes can be declared moderate.Furthermore, this research outcome reaffirms assertion that different organisations and professionals have similar views and perceptions regarding causes of conflicts among FM specialists and design team during project life cycles.

	Test Value = 41					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
COC 1	-367.522	99	0.000	-37.480	-37.68	-37.28
COC 2	-357.709	99	0.000	-37.320	-37.53	-37.11
COC 3	-378.872	99	0.000	-37.190	-37.38	-37.00
COC 4	-312.189	99	0.000	-38.030	-38.27	-37.79
COC 5	-360.009	99	0.000	-37.280	-37.49	-37.07
COC 6	-342.168	96	0.000	-37.856	-38.08	-37.64
COC 7	-331.668	98	0.000	-37.879	-38.11	-37.65
COC 8	-324.212	98	0.000	-37.768	-38.00	-37.54
COC 9	-327.582	97	0.000	-37.714	-37.94	-37.49
COC 10	-296.109	99	0.000	-37.780	-38.03	-37.53
COC 11	-279.814	98	0.000	-37.838	-38.11	-37.57
COC 12	-294.645	99	0.000	-38.080	-38.34	-37.82
COC 13	-434.375	99	0.000	-37.300	-37.47	-37.13
COC 14	-343.262	99	0.000	-37.880	-38.10	-37.66
COC 15	-413.158	100	0.000	-37.851	-38.03	-37.67
COC 16	-319.426	99	0.000	-37.980	-38.22	-37.74
COC 17	-353.710	100	0.000	-37.158	-37.37	-36.95
COC 18	-350.655	100	0.000	-37.050	-37.26	-36.84

COC 19	-352.025	100	0.000	-37.851	-38.06	-37.64
COC 20	-295.014	100	0.000	-38.337	-38.59	-38.08
COC 21	-338.766	100	0.000	-37.950	-38.17	-37.73
COC 22	-292.015	100	0.000	-37.752	-38.01	-37.50
COC 23	-381.968	100	0.000	-37.614	-37.81	-37.42
COC 24	-321.088	100	0.000	-38.178	-38.41	-37.94
COC 25	-359.719	99	0.000	-37.030	-37.23	-36.83
COC 26	-360.180	97	0.000	-37.347	-37.55	-37.14
COC 27	-385.805	99	0.000	-37.240	-37.43	-37.05
COC 28	-391.281	99	0.000	-37.330	-37.52	-37.14
COC 29	-337.003	100	0.000	-37.673	-37.90	-37.45
COC 30	-309.075	100	0.000	-38.030	-38.27	-37.79
COC 31	-353.246	100	0.000	-38.079	-38.29	-37.87
COC 32	-350.947	100	0.000	-37.485	-37.70	-37.27
COC 33	-371.007	100	0.000	-37.436	-37.64	-37.24
COC 34	-362.041	100	0.000	-37.881	-38.09	-37.67
COC 35	-382.312	100	0.000	-37.921	-38.12	-37.72
COC 36	-371.862	98	0.000	-38.061	-38.26	-37.86
COC 37	-336.111	100	0.000	-37.703	-37.93	-37.48
COC 38	-319.549	99	0.000	-38.000	-38.24	-37.76
COC 39	-305.806	100	0.000	-38.277	-38.53	-38.03
COC 40	-345.654	100	0.000	-38.069	-38.29	-37.85
COC 41	-332.943	100	0.000	-38.040	-38.27	-37.81

Table 21: Question 2 - One-Sample T-Test

Group Compare Means

Group 1:

- From the observations of group compared with the means Table 22, the results of data analysis are as follows:
- According to the participants' rating scores, 7 variables received mean scores of above 2 ,but less than 2.99, meaning that the chances of them causing conflicts in during project life-cycles are low.
- According to the participants' rating scores, 15 varaiables received mean scores of above 3, but less than 3.99, meaning that the chances of them causing conflicts in project life-cycles are moderate.
- According to the participants' rating scores, 15 variables received mean scores of above 3.51 but less than 4, meaning that the chances of causing conflicts during project life-cycles is moderately high.
- Lastly, as per participants' rating, 4 variables received mean scores of above 4 but less than 4.99, meaning that the chances of causing conflicts during the project life-cycles are high.

Group 2:

- According to Table 22 and the group participants' rating scores, 5 variables received mean scores of above 2 but less than 3, meaning that the chances of causing conflicts during project life-cycles is low.
- In reference to Table 22, and according to group participants' rating scores, 35 variables received a mean scores of 3 and above but less than 3.99, meaning that the chances of causing conflicts during project life-cycles is moderate.
- Lastly, according to Table 22 and as per group participants' rating scores, 1 variable received a mean score of 4.26, meaning that the chances of it causing conflicts during project life-cycles is high.

Group 3:

- From Table 22 and as per group participants' rating scores, 3 variables received mean scores of above 2 but less than 3, meaning that the chances of them causing conflicts during project life-cycles is low.
- From Table 22 below, and as per group participants' rating scores, it can be observed that 35 variables received mean scors of above 3, but less than 3.99, meaning that the chances of causing connflicts during project life-cycles is moderate.
- From Table 22 and as per group participants' rating, it can be observed that 3 variables received mean scores of above 4 but less than 4.99, meaning that the chances of causing conflicts during project life-cycles among FM specialists and design teams is high.

Group 4:

- From the group comparison mean Table 22, and as per group participants' rating scores, it can be observed that 10 variables received mean scores above 2 but less than 2.99, meaning that the chances of causing conflicts during project life-cycles is moderately low.
- From group comparison mean Table 22 below, and as per group, the participants' rating scores, it can be observed that 31 variables received mean scores of above 3 but less than 3.99, meaning that the chances of causing conflicts during the project life cycles is moderate.

Group Comparison Mean Table

QUESTION 2	Group 1						Group 2						Group 3						Group 4						Total					
	Mean	N	Std. Deviation	Minimum	Maximum	Std. Error of Mean	Mean	N	Std. Deviation	Minimum	Maximum	Std. Error of Mean	Mean	N	Std. Deviation	Minimum	Maximum	Std. Error of Mean	Mean	N	Std. Deviation	Minimum	Maximum	Std. Error of Mean	Mean	N	Std. Deviation	Minimum	Maximum	Std. Error of Mean
COC 1	3.83	24	0.917	2	5	0.187	3.71	24	0.999	2	5	0.204	3.43	23	1.199	1	5	0.250	3.17	29	0.889	2	5	0.165	3.52	100	1.020	1	5	0.102
COC 2	3.88	24	1.076	1	5	0.220	3.63	24	1.013	2	5	0.207	3.70	23	1.063	1	5	0.222	3.55	29	1.055	1	5	0.196	3.68	100	1.043	1	5	0.104
COC 3	4.08	24	0.974	1	5	0.199	3.71	24	0.999	2	5	0.204	3.83	23	0.887	2	5	0.185	3.66	29	1.045	1	5	0.194	3.81	100	0.982	1	5	0.098
COC 4	3.46	24	1.179	1	5	0.241	3.00	24	1.103	1	5	0.225	2.78	23	1.166	1	5	0.243	2.69	29	1.312	1	5	0.244	2.97	100	1.218	1	5	0.122
COC 5	3.79	24	1.062	1	5	0.217	3.46	24	1.250	1	5	0.255	3.96	23	0.976	1	5	0.204	3.69	29	0.850	2	5	0.158	3.72	100	1.036	1	5	0.104
COC 6	3.32	22	1.086	2	5	0.232	3.21	24	1.062	1	5	0.217	3.23	22	1.270	1	5	0.271	2.90	29	0.976	1	5	0.181	3.14	97	1.090	1	5	0.111
COC 7	3.22	23	0.951	2	5	0.198	2.88	24	1.191	1	5	0.243	3.35	23	1.027	1	5	0.214	3.07	29	1.307	1	5	0.243	3.12	99	1.136	1	5	0.114
COC 8	3.65	23	1.112	1	5	0.232	3.21	24	1.062	1	5	0.217	3.22	23	1.166	1	5	0.243	2.93	29	1.223	1	5	0.227	3.23	99	1.159	1	5	0.116
COC 9	3.70	23	0.822	3	5	0.171	3.17	24	0.868	1	4	0.177	3.70	23	1.222	1	5	0.255	2.71	28	1.272	1	5	0.240	3.29	98	1.140	1	5	0.115
COC 10	3.71	24	1.160	2	5	0.237	3.54	24	1.103	1	5	0.225	3.17	23	1.267	1	5	0.264	2.59	29	1.296	1	5	0.241	3.22	100	1.276	1	5	0.128
COC 11	3.79	24	1.062	2	5	0.217	3.25	24	1.260	1	5	0.257	3.26	23	1.484	1	5	0.309	2.46	28	1.261	1	5	0.238	3.16	99	1.345	1	5	0.135
COC 12	3.54	24	0.977	2	5	0.199	3.13	24	1.296	1	5	0.265	3.04	23	1.296	1	5	0.270	2.14	29	1.187	1	5	0.220	2.92	100	1.292	1	5	0.129
COC 13	4.04	25	0.735	3	5	0.147	3.58	24	1.018	2	5	0.208	3.82	22	0.795	2	5	0.169	3.41	29	0.780	2	5	0.145	3.70	100	0.859	2	5	0.086
COC 14	2.84	25	1.028	1	5	0.206	3.29	24	1.042	1	5	0.213	3.52	23	1.123	2	5	0.234	2.89	28	1.133	1	5	0.214	3.12	100	1.104	1	5	0.110
COC 15	2.88	25	0.881	2	5	0.176	3.38	24	0.924	2	5	0.189	3.52	23	0.846	2	5	0.176	2.90	29	0.900	1	4	0.167	3.15	101	0.921	1	5	0.092
COC 16	3.46	24	1.103	1	5	0.225	3.08	24	1.100	1	5	0.225	3.04	23	1.261	1	5	0.263	2.59	29	1.181	1	5	0.219	3.02	100	1.189	1	5	0.119
COC 17	4.16	25	0.898	2	5	0.180	3.58	24	1.176	1	5	0.240	4.22	23	0.795	2	5	0.166	3.48	29	1.122	1	5	0.208	3.84	101	1.056	1	5	0.105
COC 18	4.16	25	0.688	3	5	0.138	3.75	24	1.260	1	5	0.257	4.22	23	1.043	2	5	0.217	3.72	29	1.131	1	5	0.210	3.95	101	1.062	1	5	0.106
COC 19	3.32	25	1.108	1	5	0.222	3.29	24	0.806	2	5	0.165	3.43	23	1.199	1	5	0.250	2.66	29	1.045	1	5	0.194	3.15	101	1.081	1	5	0.108
COC 20	2.88	25	1.394	1	5	0.279	2.79	24	1.318	1	5	0.269	2.83	23	1.267	1	5	0.264	2.24	29	1.215	1	5	0.226	2.66	101	1.306	1	5	0.130
COC 21	3.28	25	1.137	1	5	0.227	2.96	24	1.083	1	5	0.221	3.48	23	1.039	1	5	0.217	2.59	29	1.086	1	5	0.202	3.05	101	1.126	1	5	0.112
COC 22	3.44	25	1.387	1	5	0.277	3.21	24	1.250	1	5	0.255	3.04	23	1.224	1	5	0.255	3.28	29	1.360	1	5	0.253	3.25	101	1.299	1	5	0.129
COC 23	3.44	25	1.044	2	5	0.209	3.33	24	0.917	2	5	0.187	3.70	23	0.974	2	5	0.203	3.14	29	0.990	1	5	0.184	3.39	101	0.990	1	5	0.098
COC 24	2.96	25	1.098	2	5	0.220	2.67	24	1.204	1	5	0.246	3.26	23	1.287	1	5	0.268	2.48	29	1.122	1	5	0.208	2.82	101	1.195	1	5	0.119
COC 25	3.56	25	1.261	1	5	0.252	4.22	23	0.902	2	5	0.188	4.26	23	0.964	2	5	0.201	3.90	29	0.860	2	5	0.160	3.97	100	1.029	1	5	0.103
COC 26	3.56	25	1.044	2	5	0.209	3.87	23	1.058	1	5	0.221	3.76	21	0.889	2	5	0.194	3.48	29	1.090	1	5	0.202	3.65	98	1.026	1	5	0.104
COC 27	3.92	25	1.187	2	7	0.237	3.83	23	0.717	2	5	0.149	3.83	23	0.887	2	5	0.185	3.59	29	1.150	1	5	0.214	3.78	100	1.011	1	7	0.101
COC 28	3.88	25	0.971	1	5	0.194	3.48	23	0.898	2	5	0.187	3.96	23	0.825	2	5	0.172	3.41	29	1.018	2	5	0.189	3.67	100	0.954	1	5	0.095
COC 29	3.40	25	1.225	1	5	0.245	3.38	24	1.135	1	5	0.232	3.65	23	0.982	2	5	0.205	2.97	29	1.085	1	5	0.201	3.33	101	1.123	1	5	0.112
COC 30	3.12	25	1.333	1	5	0.267	3.00	24	1.216	1	5	0.248	3.35	23	1.335	1	5	0.278	2.52	29	0.986	1	4	0.183	2.97	101	1.237	1	5	0.123
COC 31	3.12	25	1.269	1	5	0.254	2.71	24	0.859	1	4	0.175	3.13	23	0.869	1	5	0.181	2.76	29	1.215	1	5	0.226	2.92	101	1.083	1	5	0.108
COC 32	3.84	25	1.106	1	5	0.221	3.46	24	0.884	2	5	0.180	3.87	23	0.968	2	5	0.202	3.00	29	1.102	1	5	0.205	3.51	101	1.073	1	5	0.107
COC 33	3.84	25	0.987	2	5	0.197	3.54	24	1.021	2	5	0.208	3.70	23	1.063	2	5	0.222	3.24	29	0.951	2	5	0.177	3.56	101	1.014	2	5	0.101
COC 34	3.44	25	1.121	2	5	0.224	3.04	24	0.859	1	4	0.175	3.22	23	1.126	1	5	0.235	2.83	29	1.037	1	5	0.193	3.12	101	1.052	1	5	0.105
COC 35	3.16	25	0.850	2	5	0.170	3.13	24	1.076	1	5	0.220	3.09	23	1.083	2	5	0.226	2.97	29	1.017	1	5	0.189	3.08	101	0.997	1	5	0.099
COC 36	2.96	24	1.042	1	5	0.213	3.04	24	1.042	1	5	0.213	3.18	22	1.053	1	5	0.224	2.66	29	0.936	1	4	0.174	2.94	99	1.018	1	5	0.102
COC 37	3.76	25	1.052	1	5	0.210	3.25	24	1.073	1	5	0.219	3.57	23	0.896	2	5	0.187	2.72	29	1.192	1	5	0.221	3.30	101	1.127	1	5	0.112
COC 38	2.96	25	1.172	1	5	0.234	3.04	24	1.301	1	5	0.266	3.18	22	1.259	1	5	0.268	2.86	29	1.093	1	5	0.203	3.00	100	1.189	1	5	0.119
COC 39	3.12	25	1.301	1	5	0.260	3.21	24	1.062	1	5	0.217	2.65	23	1.265	1	5	0.264	2.03	29	1.085	1	5	0.201	2.72	101	1.258	1	5	0.125
COC 40	2.84	25	1.028	1	5	0.206	3.17	24	1.007	2	5	0.206	3.17	23	1.230	1	5	0.257	2.62	29	1.115	1	5	0.207	2.93	101	1.107	1	5	0.110
COC 41	3.44	25	1.193	1	5	0.239	3.08	24	0.974	1	5	0.199	3.17	23	1.072	1	5	0.224	2.28	29	1.032	1	5	0.192	2.96	101	1.148	1	5	0.114

Table 22: Question 2 Group Mean

ANOVA Analysis

One-way of analysis of variance (ANOVA) was used to test the differences in mean values among the four groups, in order to determine their significance.

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
COC 1	Between Groups	(Combined)	6.878	3	2.293	2.291	0.083
	Within Groups		96.082	96	1.001		
	Total		102.960	99			
COC	Between Groups	(Combined)	1.468	3	0.489	0.442	0.724
	Within Groups		106.292	96	1.107		
	Total		107.760	99			

COC 3	Between Groups	(Combined)	2.742	3	0.914	0.947	0.421
	Within Groups		92.648	96	0.965		
	Total		95.390	99			
COC 4	Between Groups	(Combined)	8.832	3	2.944	2.047	0.112
	Within Groups		138.078	96	1.438		
	Total		146.910	99			
COC 5	Between Groups	(Combined)	3.080	3	1.027	0.956	0.417
	Within Groups		103.080	96	1.074		
	Total		106.160	99			
COC 6	Between Groups	(Combined)	2.695	3	0.898	0.751	0.525
	Within Groups		111.284	93	1.197		
	Total		113.979	96			
COC 7	Between Groups	(Combined)	2.928	3	0.976	0.750	0.525
	Within Groups		123.618	95	1.301		
	Total		126.545	98			
COC 8	Between Groups	(Combined)	6.706	3	2.235	1.699	0.172
	Within Groups		124.951	95	1.315		
	Total		131.657	98			
COC 9	Between Groups	(Combined)	17.213	3	5.738	4.958	0.003
	Within Groups		108.787	94	1.157		
	Total		126.000	97			
COC 10	Between Groups	(Combined)	19.905	3	6.635	4.509	0.005
	Within Groups		141.255	96	1.471		
	Total		161.160	99			
COC 11	Between Groups	(Combined)	23.557	3	7.852	4.848	0.003
	Within Groups		153.857	95	1.620		
	Total		177.414	98			
COC 12	Between Groups	(Combined)	28.372	3	9.457	6.628	0.000
	Within Groups		136.988	96	1.427		
	Total		165.360	99			
COC 13	Between Groups	(Combined)	5.899	3	1.966	2.813	0.043
	Within Groups		67.101	96	0.699		
	Total		73.000	99			

COC 14	Between Groups	(Combined)	7.824	3	2.608	2.221	0.091
	Within Groups		112.736	96	1.174		
	Total		120.560	99			
COC 15	Between Groups	(Combined)	8.078	3	2.693	3.406	0.021
	Within Groups		76.694	97	0.791		
	Total		84.772	100			
COC 16	Between Groups	(Combined)	10.177	3	3.392	2.509	0.063
	Within Groups		129.783	96	1.352		
	Total		139.960	99			
COC 17	Between Groups	(Combined)	11.118	3	3.706	3.582	0.017
	Within Groups		100.348	97	1.035		
	Total		111.465	100			
COC 18	Between Groups	(Combined)	5.186	3	1.729	1.559	0.204
	Within Groups		107.566	97	1.109		
	Total		112.752	100			
COC 19	Between Groups	(Combined)	10.170	3	3.390	3.085	0.031
	Within Groups		106.602	97	1.099		
	Total		116.772	100			
COC 20	Between Groups	(Combined)	7.341	3	2.447	1.454	0.232
	Within Groups		163.213	97	1.683		
	Total		170.554	100			
COC 21	Between Groups	(Combined)	11.981	3	3.994	3.375	0.021
	Within Groups		114.772	97	1.183		
	Total		126.752	100			
COC 22	Between Groups	(Combined)	1.944	3	0.648	0.377	0.770
	Within Groups		166.868	97	1.720		
	Total		168.812	100			
COC 23	Between Groups	(Combined)	4.129	3	1.376	1.423	0.241
	Within Groups		93.811	97	0.967		
	Total		97.941	100			
COC 24	Between Groups	(Combined)	8.823	3	2.941	2.129	0.101
	Within Groups		133.969	97	1.381		
	Total		142.792	100			

COC 25	Between Groups	(Combined)	7.713	3	2.571	2.539	0.061
	Within Groups		97.197	96	1.012		
	Total		104.910	99			
COC 26	Between Groups	(Combined)	2.384	3	0.795	0.748	0.526
	Within Groups		99.820	94	1.062		
	Total		102.204	97			
COC 27	Between Groups	(Combined)	1.677	3	0.559	0.539	0.656
	Within Groups		99.483	96	1.036		
	Total		101.160	99			
COC 28	Between Groups	(Combined)	5.740	3	1.913	2.177	0.096
	Within Groups		84.370	96	0.879		
	Total		90.110	99			
COC 29	Between Groups	(Combined)	6.410	3	2.137	1.730	0.166
	Within Groups		119.808	97	1.235		
	Total		126.218	100			
COC 30	Between Groups	(Combined)	9.812	3	3.271	2.217	0.091
	Within Groups		143.099	97	1.475		
	Total		152.911	100			
COC 31	Between Groups	(Combined)	3.849	3	1.283	1.096	0.355
	Within Groups		113.517	97	1.170		
	Total		117.366	100			
COC 32	Between Groups	(Combined)	13.301	3	4.434	4.219	0.008
	Within Groups		101.927	97	1.051		
	Total		115.228	100			
COC 33	Between Groups	(Combined)	5.333	3	1.778	1.769	0.158
	Within Groups		97.498	97	1.005		
	Total		102.832	100			
COC 34	Between Groups	(Combined)	5.405	3	1.802	1.662	0.180
	Within Groups		105.169	97	1.084		
	Total		110.574	100			
COC 35	Between Groups	(Combined)	.590	3	0 0.0197	0.193	0.901
	Within Groups		98.777	97	1.018		
	Total		99.366	100			

COC 36	Between Groups	(Combined)	3.895	3	1.298	1.262	0.292
	Within Groups		97.741	95	1.029		
	Total		101.636	98			
COC 37	Between Groups	(Combined)	16.584	3	5.528	4.852	0.003
	Within Groups		110.505	97	1.139		
	Total		127.089	100			
COC 38	Between Groups	(Combined)	1.361	3	0.454	0.314	0.815
	Within Groups		138.639	96	1.444		
	Total		140.000	99			
COC 39	Between Groups	(Combined)	23.456	3	7.819	5.627	0.001
	Within Groups		134.781	97	1.389		
	Total		158.238	100			
COC 40	Between Groups	(Combined)	5.690	3	1.897	1.575	0.200
	Within Groups		116.825	97	1.204		
	Total		122.515	100			
COC 41	Between Groups	(Combined)	20.751	3	6.917	6.040	0.001
	Within Groups		111.091	97	1.145		
	Total		131.842	100			

Table 23: Question 2 - ANOVA Table

According to Bryman & Creamer (1999. p:150), the F test or ratio tells us only whether there are significant differences between one and more of the groups. However, from Table 23, it can be observed that 13 variables have recorded the highest F value, which indicates a very strong agreement between the respondents from the four groups on FM specialists' early involvement in Project life-cycles (stages). Based on the F-test and the p-values, the following 13 variables were considered significant:

- COC9 (F4.958, P.003)
- COC10 (F 4.509, P.005)
- COC11 (F 4.848, P.003)
- COC12 (F 6.628, P.000)
- COC13 (F 2.813, P. 043)
- COC15 (F 3.406, P.021)
- COC17 (F 3.582, P.017)
- COC19 (F 3.085, P. 031)
- COC21 (F 3.375, P.021)
- COC32 (F 4.219, P.008)
- COC37 (F 4.852, P.003)
- COC39 (F 5.627, P.001)
- COC41 (F 6.040, P.001)

However, according to the groups' rating scores, 28 variables have received small F values and high P. values, meaning that there is a strong disagreement between the respondents from the four groups on FM specialists' early involvement in Project life-cycles (stages).

Kendal's W Test

Table 24 indicates the results of the Kendal's Coefficient of Concordance test. The computed Kendal's W, is 0.126 with Chi-Square of 442.842 and a p-value of 0.000 which indicates that there is a strong homogeneity of responses furnished by the respondents and also reaffirms that the validity and reliability of the survey data for further comparative analysis (Osei-Kyei, *et al*., 2018).

Kendal's W Test Statistics

N	88
Kendall's W[a]	0.126
Chi-Square	442.842
df	40
Asymp. Sig.	0.000
a. Kendall's Coefficient of Concordance	

Table 24: Question 2 Kendall's W Table

Kendal's W Ranking

Furthermore, Kendall's W Test was used to determine the Mean Ranks of the different variables; and these are indicated in Table 25. The highest ranked causes of conflicts were classified into the first ten groups which are:

- Lack of client specification (COC 18)
- Budget and time constraints (COC25)
- Inadequate brief (COC 17)
- Undefined project priorities (COC 3)
- Lack of collaboration during design development process (COC 27)
- Slow decision making (COC 5)
- Unrealistic client expectations and determination (COC 13)
- Poor communication among integrated design team members (COC 28)
- Lack of coordination (COC 26)
- Undefined project goals (COC 2)

However, differences in technical opinions (COC 1) which is one of the main causes of conflicts among FM specialists and design team has been ranked 13 and falls under the second group of 10 causes of conficts. According to Maiti & Choi (2018), differences in technical opinions refers to disagreements on technical issues, technical aspects and performance specification.

Variables	Mean Rank	Rank
COC 18	28.71	1
COC 25	28.55	2
COC 17	27.20	3
COC 3	27.15	4
COC 27	26.59	5
COC 5	26.13	6
COC 13	25.92	7
COC 28	25.61	8
COC 26	25.59	9
COC 2	25.45	10
COC 33	24.61	11
COC 32	23.52	12
COC 1	23.45	13
COC 29	21.70	14
COC 23	21.63	15
COC 22	21.42	16
COC 9	21.11	17
COC 8	21.05	18
COC 10	20.94	19
COC 11	20.55	20
COC 37	20.43	21
COC 6	19.68	22
COC 15	19.28	23
COC 19	19.19	24
COC 34	19.10	25
COC 7	19.00	26
COC 35	18.51	27
COC 16	18.30	28
COC 4	18.26	29
COC 21	18.11	30
COC 14	18.09	31
COC 41	17.72	32
COC 40	17.61	33
COC 38	17.47	34
COC 12	17.28	35
COC 30	17.19	36
COC 31	17.11	37
COC 36	16.70	38
COC 24	15.96	39
COC 39	15.06	40
COC 20	14.07	41

Table 25: Question 2 - Variables Ranking

Null and Alternative Hypothesis Test

The Kruskal-Wallis Test was conducted at a significant level of 0.05, however, a significant value of factor less than 0.05 indicates that respondents had varying views on the criticality of that factor(s) (Sholanke *et al.,* 2019).

According to Table 26, the null hypothesis of 13 variables (COC9 with p-values of .003, COC10 with a p-value of .010, COC11 with p-value of .005, COC12 with p-value of 0.001, COC13 with p-value of 0.049, COC15 with p-value of 0.025, COC17 with p-value of 0.027, COC19 with p-value of 0.046, COC21 with p-value of 0.023, COC32 with p-value of 0.012, COC37 with p-value of0 .005, COC39 with p-value of 0.001 and COC41 with p-value of .001) had been rejected.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 1 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.083	Retain the null hypothesis.
2	The distribution of COC 2 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.666	Retain the null hypothesis.
3	The distribution of COC 3 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.347	Retain the null hypothesis.
4	The distribution of COC 4 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.137	Retain the null hypothesis.
5	The distribution of COC 5 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.363	Retain the null hypothesis.
6	The distribution of COC 6 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.509	Retain the null hypothesis.
7	The distribution of COC 7 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.414	Retain the null hypothesis.
8	The distribution of COC 8 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.185	Retain the null hypothesis.
9	The distribution of COC 9 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.003	Reject the null hypothesis.
10	The distribution of COC 10 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.010	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
11	The distribution of COC 11 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.005	Reject the null hypothesis.
12	The distribution of COC 12 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.
13	The distribution of COC 13 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.049	Reject the null hypothesis.
14	The distribution of COC 14 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.098	Retain the null hypothesis.
15	The distribution of COC 15 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.025	Reject the null hypothesis.
16	The distribution of COC 16 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.057	Retain the null hypothesis.
17	The distribution of COC 17 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.027	Reject the null hypothesis.
18	The distribution of COC 18 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.281	Retain the null hypothesis.
19	The distribution of COC 19 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.046	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
20	The distribution of COC 20 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.206	Retain the null hypothesis.
21	The distribution of COC 21 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.023	Reject the null hypothesis.
22	The distribution of COC 22 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.712	Retain the null hypothesis.
23	The distribution of COC 23 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.284	Retain the null hypothesis.
24	The distribution of COC 24 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.134	Retain the null hypothesis.
25	The distribution of COC 25 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.083	Retain the null hypothesis.
26	The distribution of COC 26 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.521	Retain the null hypothesis.
27	The distribution of COC 27 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.843	Retain the null hypothesis.
28	The distribution of COC 28 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.079	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
29	The distribution of COC 29 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.167	Retain the null hypothesis.
30	The distribution of COC 30 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.112	Retain the null hypothesis.
31	The distribution of COC 31 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.310	Retain the null hypothesis.
32	The distribution of COC 32 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.012	Reject the null hypothesis.
33	The distribution of COC 33 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.160	Retain the null hypothesis.
34	The distribution of COC 34 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.190	Retain the null hypothesis.
35	The distribution of COC 35 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.870	Retain the null hypothesis.
36	The distribution of COC 36 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.327	Retain the null hypothesis.
37	The distribution of COC 37 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.005	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
38	The distribution of COC 38 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.859	Retain the null hypothesis.
39	The distribution of COC 39 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.
40	The distribution of COC 40 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.246	Retain the null hypothesis.
41	The distribution of COC 41 is the same across categories of QUESTION 2.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 26: Question 2 Hypothesis Testing

According to null hypothesis table 26, the following variables recorded P. values that are smaller than the recommended P. values of 0.05 and were rejected:

- COC10 (P values = 0.010)
- COC11 (P values = 0.005)
- COC12 (P values = 0.001)
- COC13 (P value = 0.049)
- COC15 (P values = 0.025)
- COC17 (P values = 0.027)
- COC19 (P values = 0.046)
- COC21 (P values = 0.023)
- COC32 (P values = 0.012)
- COC37 (P values = 0.005)
- COC39 (P values = 0.001)
- COC41 (P values = 0,.001)

Exploratory Factor Analysis

The objective of this section was to classify 41 causes of conflicts into lesser groupings through the application of Principal Component Analysis (PCA). Factor analysis with Varimax rotation established the grouping of the causes of conflicts. From 41 causes of conflicts, 10 components were identified. However, components 7 to 10 contained one factor each hence were combined and the final list consisted of 7 components. **Refer to Appendix A.**

Objective 3

The study sought to establish the level at which the respondents agreed or disagreed on the significance of conflict-management styles that can be applied optimally in enhancing collaboration during the design-development processes of complex-construction projects. However, the mean score method was adopted to determine the conflict-management startegies that can be applied in an optimal way in enhancing collaboration during the design-development process or the project life-cycle stage (s). Data from participants were used to determine the mean score of each variable.

Frequency Statistics

From frequency Table 27, it can be observed that the standard errors are closer to zero, meaning that the sample chosen is a reflection of the population (Field, 2005; Dick-Sagoe & Arthur, 2016). However, standard deviations are greater and smaller than one, which is an indication that the respondents did not agree much on the various conflict-management styles.

Frequency Statistics

		CMS 1	CMS 2	CMS 3	CMS 4	CMS 5
N	Valid	101	101	101	101	101
	Missing	1	1	1	1	1
Mean		2.38	4.50	3.37	1.64	3.71
Std. Error of Mean		.114	0.065	0.094	0.113	0.104
Median		2.00	5.00	3.00	1.00	4.00
Std. Deviation		1.148	0.658	0.946	1.137	1.042
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

Table 27: Question 3 - Frequency Table

Mean Scores

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
CMS 2	101	2	5	4.50	0.065	0.658
CMS 5	101	1	5	3.71	0.104	1.042
CMS 3	101	1	5	3.37	0.094	0.946
CMS 1	101	1	5	2.38	0.114	1.148
CMS 4	101	1	5	1.64	0.113	1.137
Valid N (listwise)	101					

Table 28: Question 3 Mean Scores

From table 28 above, it can be observed that:

- CMS4 is slightly significant with a mean score of 1.64
- CMS1 is slightly significant with a mean score of 2.38

- CMS3 is significant with a mean score of 3.37
- CMS5 is very significant with a mean score of 3.71
- CMS2 is very significant with a mean score of 4.50

One-Sample Test

In reference to table 29, it can be observed that all p-values are less than the recommended value of 0.05 indicating that they are significant.

One-Sample Test						
	Test Value = 5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
CMS 1	-22.977	100	0.000	-2.624	-2.85	-2.40
CMS 2	-7.717	100	0.000	-.505	-.63	-0.38
CMS 3	-17.360	100	0.000	-1.634	-1.82	-1.45
CMS 4	-29.680	100	0.000	-3.356	-3.58	-3.13
CMS 5	-12.409	100	0.000	-1.287	-1.49	-1.08

Table 29: Question3 One-Sample Test

Compare Group Mean Table

QUESTION 3		CMS 1	CMS 2	CMS 3	CMS 4	CMS 5
Group 1	Mean	2.36	4.60	3.64	1.68	3.64
	N	25	25	25	25	25
	Std. Deviation	1.186	0.577	0.995	1.314	0.995
	Std. Error of Mean	0.237	0.115	0.199	0.263	0.199
	Minimum	1	3	1	1	2
	Maximum	5	5	5	5	5
Group 2	Mean	2.46	4.29	3.46	1.92	3.71
	N	24	24	24	24	24
	Std. Deviation	1.062	0.751	0.884	1.248	0.908
	Std. Error of Mean	0.217	0.153	0.180	0.255	0.185
	Minimum	1	3	2	1	2
	Maximum	4	5	5	5	5
Group 3	Mean	2.43	4.65	3.22	1.30	3.65
	N	23	23	23	23	23
	Std. Deviation	1.080	0.487	0.998	0.876	1.191
	Std. Error of Mean	0.225	0.102	0.208	0.183	0.248
	Minimum	1	4	1	1	1
	Maximum	4	5	5	5	5
Group 4	Mean	2.28	4.45	3.17	1.66	3.83

	N	29	29	29	29	29
	Std. Deviation	1.279	0.736	0.889	1.045	1.104
	Std. Error of Mean	0.237	0.137	0.165	0.194	0.205
	Minimum	1	2	1	1	1
	Maximum	5	5	5	4	5
Total	Mean	2.38	4.50	3.37	1.64	3.71
	N	101	101	101	101	101
	Std. Deviation	1.148	0.658	0.946	1.137	1.042
	Std. Error of Mean	0.114	0.065	0.094	0.113	0.104
	Minimum	1	2	1	1	1
	Maximum	5	5	5	5	5

Table 30: Question 3 – Group Descriptive Statistics

In reference to group mean Table 30 above, the following can be observed:

Group 1:

- According to the group's perceptions, CMS4 received mean scores of greater than 1 but less than (1.68) meaning that it's extremely not important in conflict management.
- CMS 1 received mean score of greater than 2, but less than 3, meaning that it's only slightly significant in conflict management.
- Secondly, CMS3 and CMS5 both have achieved mean scores of 3.64, meaning that they are both very significant.
- Lastly, CMS2 achieved a mean score of 4.60 meaning that it is extremely significant in conflict management.

Group 2:

- According to the group's perceptions and the rating scores, CMS1 received a mean score greater than 1 (1.92), but less than 2, meaning that it's extremely insignificant.
- CMS4 has achieved mean score of greater than 2 (2.46), but less than 3, meaning that it's slightly significant in conflict management.
- CMS3 and CMS5 are significant with a mean score of 3.46 and 3.71
- CMS 2 is very significant, with a mean score of 4.29.

Group 3:

- According to the group's perceptions and the mean rating scores, CMS 4 received a mean score of 1.30, indicating that it's extremely insignificant in conflict-management
- CMS1 received mean score of 2.43, meaning that it's slightly significant in conflict management.
- Both CMS3 CMS5 received mean scores of greater than 3 (3.22 and 3.65), but less than 4, meaning that they are both significant in conflict-management.
- However, CMS2 received mean score of greater than 4 (4.65), but less than 5 meaning that it's very significant in conflict management.

Group 4:

- According to the group's perceptions and the rating scores, CMS 4 received a mean score of greater than 1 (1.66), but less than 2, indicating that it's extremely insignificant in conflict management.
- CMS1 received mean score of greater than 2 (2.28) but less than 3, meaning that it's slightly significant in conflict management.
- Both CMS 3 and CMS 5 received mean scores greater than 3 (3.17 and 3.83) meaning that they are significant in conflict management.
- However, CMS2 received mean score of greater than 4 (4.45), but less than 5 meaning that it's very significant in conflict management.

ANOVA Analysis

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
CMS 1	Between Groups	(Combined)	0.539	3	0.180	0.133	0.940
	Within Groups		131.164	97	1.352		
	Total		131.703	100			
CMS 2	Between Groups	(Combined)	1.899	3	0.633	1.485	0.223
	Within Groups		41.348	97	00.426		
	Total		43.248	100			
CMS 3	Between Groups	(Combined)	3.676	3	1.225	1.386	0.252
	Within Groups		85.769	97	0.884		
	Total		89.446	100			
CMS 4	Between Groups	(Combined)	4.474	3	1.491	1.160	0.329
	Within Groups		124.695	97	1.286		
	Total		129.168	100			
CMS 5	Between Groups	(Combined)	0.600	3	0.200	0.179	0.910
	Within Groups		108.074	97	1.114		
	Total		108.673	100			

Table 31: Question 3 - ANOVA Table

From the analysis on table 31, it was found that there were statistically insignificant differences among the respondent groups over the following conflict management strategies:

CMS1 ($F = 0.133$, $P = 0.940$)

CMS2 ($F = 1.485$, $P = 0.223$)

CMS3 (F = 1.386, P = 0.252)

CMS4 (F = 1.160, P = 0.329)

CMS5 (F = 0.179, P = 0.910)

Kendall's W Test Statistics

N	101
Kendall's W[a]	0.554
Chi-Square	223.955
df	4
Asymp. Sig.	0.000
a. Kendall's Coefficient of Concordance	

Table 32: Question 3 - Kendall's W Test

Kendall's W Test was used to determine the Mean Ranks of the different variables

The aim of applying Kendall's W Test was to determine the ranking level of the variables according to the perceptions and feedbacks from the participants; hence, Table 33 was created.

Kendal's Mean Ranking

	Mean Rank		Mean Ranking Level
CMS 1	2.28		4
CMS 2	4.40		1
CMS 3	3.17		3
CMS 4	1.57		5
CMS 5	3.58		2

Table 33: Question 3 - Mean Ranking Table

Objective 4

The aim of this section was to uncover essential management skills to be acquired by design/project leader in complex construction projects. Questionnaire survey was conducted to uncover the perception of construction professionals towards the important of management skills that should be possessed by design/project leaders. The mean score method was adopted to identify essential management skills that are crucial in enhancing the the design/project leaders' abilities in steering complex construction project successfully. It can be perceived from the frequency table (34) that 101 participants participated in the survey and according to the analysis of the feedback, the mean scores range from 3.89 to 4.79.

Frequency Statistics

		SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12
N	Valid	101	101	101	101	101	101	101	101	101	101	101	101
	Missing	1	1	1	1	1	1	1	1	1	1	1	1
Mean		4.79	4.49	4.18	4.32	4.47	3.97	3.89	4.06	4.63	4.52	4.14	4.26
Std. Error of Mean		0.043	0.067	0.080	0.066	0.070	0.093	0.090	0.088	0.056	0.067	0.084	0.079
Std. Deviation		0.432	0.673	0.805	0.662	0.701	0.932	0.904	0.881	0.561	0.672	0.849	0.796
Minimum		3	3	2	3	3	1	2	2	3	3	2	2
Maximum		5	5	5	5	5	5	5	5	5	5	5	5

Table 34: Question 4 - Frequency Table

Mean Score

Table 35 indicates 10 management skills that should be possessed by design/project leaders in construction industry with mean scores ranging from 4.06 to 4.79 meaning that these skills are very important in conflict-management situations and complex-construction projects. However, communication skill has been rated the highest most important skill that should be possessed by design/project leaders with mean score of 4.79. Furthermore, two management skills, Delegation (Skills SS6) and Negotiation Skills (SS7) received mean score of greater than three, but less than 4, meaning that these skills are significant in conflict management.

These results are in line with the findings by Seetha (2014), who asserted that the critical skills for workplace success should include good communication, in order to be able to maintain a positive attitude, the ability to get along with the next person, to work in teams and to analyse and think critically, in order to solve problems and to be able to lead.

Descriptive Statistics Table

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
SS 1: Communication Skills	101	3	5	4.79	0.043	0.432
SS 9: Decision – Making Skills	101	3	5	4.63	0.056	0.561
SS 10: Critical Thinking and Problem Solving Skills	101	3	5	4.52	0.067	0.672
SS 2: Coordination Skills	101	3	5	4.49	0.067	0.673

SS 5: Leadership Skills	101	3	5	4.47	0.070	0.701
SS 4: Collaboration Skills	101	3	5	4.32	0.066	0.662
SS 12Team Integration Skills	101	2	5	4.26	0.079	0.796
SS 3: Conflict Management Skills	101	2	5	4.18	0.080	0.805
SS 11: Stakeholder Management Skills	101	2	5	4.14	0.084	0.849
SS 8: Organisational Skills	101	2	5	4.06	0.088	0.881
SS 6: Delegation Skills	101	1	5	3.97	0.093	0.932
SS 7: Negotiation Skills	101	2	5	3.89	0.090	0.904
Valid N (listwise)	101					

Table 35: Objective 4 – Mean Scores

One-Sample T Test

With reference to Table 36, it can be observed that all the variables in this question are significant, with p-values that are less than the recommended 0.05.

One-Sample T Test Table

One-Sample Test						
	Test Value = 12					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
SS 1	-167.811	100	0.000	-7.208	-7.29	-7.12
SS 2	-112.300	100	0.000	-7.515	-7.65	-7.38
SS 3	-97.657	100	0.000	-7.822	-7.98	-7.66
SS 4	-116.590	100	0.000	-7.683	-7.81	-7.55
SS 5	-108.033	100	0.000	-7.535	-7.67	-7.40
SS 6	-86.561	100	0.000	-8.030	-8.21	-7.85
SS 7	-90.103	100	0.000	-8.109	-8.29	-7.93
SS 8	-90.565	100	0.000	-7.941	-8.11	-7.77
SS 9	-132.018	100	0.000	-7.366	-7.48	-7.26
SS 10	-111.757	100	0.000	-7.475	-7.61	-7.34
SS 11	-93.071	100	0.000	-7.861	-8.03	-7.69
SS 12	-97.796	100	0.000	-7.743	-7.90	-7.59

Table 36: Question 4 - One-Sample T-Test

Group Mean

Group Mean Report Table

QUESTION 4		SS 1	SS 2	SS 3	SS 4	SS 5	SS 6	SS 7	SS 8	SS 9	SS 10	SS 11	SS 12
Group 1	Mean	4.72	4.44	4.16	4.44	4.56	3.92	4.12	4.16	4.80	4.52	4.16	4.16
	N	25	25	25	25	25	25	25	25	25	25	25	25
	Std. Deviation	0.458	0.583	0.746	0.651	0.768	0.812	0.726	0.850	0.408	0.653	0.850	0.850
	Grouped Median	4.72	4.46	4.20	4.48	4.67	3.94	4.15	4.25	4.80	4.57	4.22	4.25
	Std. Error of Mean	0.092	0.117	0.149	0.130	0.154	0.162	0.145	0.170	0.082	0.131	0.170	0.170
	Minimum	4	3	3	3	3	2	3	2	4	3	3	2
	Maximum	5	5	5	5	5	5	5	5	5	5	5	5
Group 2	Mean	4.75	4.58	4.00	4.13	4.25	3.67	3.54	3.87	4.67	4.50	4.37	4.33
	N	24	24	24	24	24	24	24	24	24	24	24	24
	Std. Deviation	0.532	0.717	0.834	0.741	0.794	1.049	1.062	0.947	0.565	0.659	0.875	0.816
	Grouped Median	4.78	4.67	4.00	4.16	4.32	3.75	3.50	4.00	4.70	4.55	4.50	4.43
	Std. Error of Mean	0.109	0.146	0.170	0.151	0.162	0.214	0.217	0.193	0.115	0.135	0.179	0.167
	Minimum	3	3	3	3	3	1	2	2	3	3	2	2
	Maximum	5	5	5	5	5	5	5	5	5	5	5	5
Group 3	Mean	4.91	4.48	4.22	4.48	4.52	4.09	3.61	4.04	4.43	4.52	3.83	4.30
	N	23	23	23	23	23	23	23	23	23	23	23	23
	Std. Deviation	0.288	0.730	0.795	0.665	0.593	0.949	0.988	0.976	0.590	0.665	0.887	0.822
	Grouped Median	4.91	4.55	4.28	4.52	4.55	4.19	3.60	4.13	4.45	4.57	3.81	4.39

	Std. Error of Mean	0.060	0.152	0.166	0.139	0.124	0.198	0.206	0.204	0.123	0.139	0.185	0.171
	Minimum	4	3	3	3	3	2	2	2	3	3	2	3
	Maximum	5	5	5	5	5	5	5	5	5	5	5	5
Group 4	Mean	4.79	4.45	4.31	4.24	4.52	4.17	4.21	4.14	4.62	4.55	4.17	4.24
	N	29	29	29	29	29	29	29	29	29	29	29	29
	Std. Deviation	0.412	0.686	0.850	00.577	0.634	0.889	0.675	0.789	0.622	0.736	0.759	0.739
	Grouped Median	4.79	4.50	4.42	4.26	4.56	4.27	4.24	4.21	4.67	4.64	4.24	4.29
	Std. Error of Mean	.077	.127	.158	.107	.118	.165	.125	.147	.115	.137	.141	.137
	Minimum	4	3	2	3	3	2	3	2	3	3	2	3
	Maximum	5	5	5	5	5	5	5	5	5	5	5	5
Total	Mean	4.79	4.49	4.18	4.32	4.47	3.97	3.89	4.06	4.63	4.52	4.14	4.26
	N	101	101	101	101	101	101	101	101	101	101	101	101
	Std. Deviation	0.432	0.673	0.805	0.662	0.701	0.932	0.904	0.881	0.561	0.672	0.849	0.796
	Grouped Median	4.80	4.54	4.24	4.36	4.53	4.06	3.94	4.16	4.66	4.58	4.22	4.34
	Std. Error of Mean	.043	.067	.080	.066	.070	.093	.090	.088	.056	.067	.084	.079
	Minimum	3	3	2	3	3	1	2	2	3	3	2	2
	Maximum	5	5	5	5	5	5	5	5	5	5	5	5

Table 37: Objective 4 - Group Mean

Group 1: In reference to participants' perceptions on table 37, it can be observed that the mean score of the group for variable SS6 (Delegation Skills) is 3.92 meaning that it is important that design/project leader possess such skill in order to be able to delegate and coordinate individual's responsibilities in complex projects. However, the mean scores of other variables range from 4.12 to 4.80.

Group 2: In reference to participants' perceptions on table 37, it can be observed that the mean scores of the group for variables SS6 (Delegation Skills), SS7 (Negotiation Skills) and SS8 (Organisation Skills) ranges from 3.54 to 3.87 meaning that these skills are important to be possessed by design/project leader in conflict management environment. However, the remaining variables have received mean scores ranging from 4.00 to 4.75 meaning that these skills are very important for conflict management.

Group 3: In reference to participants' perceptions on table 37, it can be observed that the mean scores of the group for variables SS7 (Negotiation Skills) and SS11 (Stakeholder Management) range from 3.61 to 3.83 meaning that these variables are important for conflict management. However, the mean scores of the remaining variables, range from 4.04 to 4.91 meaning that these variables are very important in conflict management environment

Group 4: In reference to participants' perceptions on table 37, it can be observed that the mean scores of the group range from 4.17 (SS6 and SS11) to 4.79 (SS1). Therefore, it can be inferred that these variables are very important in conflict management environment.

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
SS 1: Communication Skills	Between Groups	(Combined)	0.509	3	0.170	0.908	0.440
	Within Groups		18.125	97	0.187		
	Total		18.634	100			
SS 2: Coordination Skills	Between Groups	(Combined)	0.323	3	0.108	0.232	0.874
	Within Groups		44.905	97	0.463		
	Total		45.228	100			
SS 3: Conflict Management Skills	Between Groups	(Combined)	1.312	3	0.437	0.668	0.574
	Within Groups		63.480	97	0.654		
	Total		64.792	100			
SS 4: Collaboration Skills	Between Groups	(Combined)	2.027	3	0.676	1.567	0.202
	Within Groups		41.834	97	0.431		
	Total		43.861	100			
SS 5: Leadership Skills	Between Groups	(Combined)	1.488	3	0.496	1.010	0.392
	Within Groups		47.641	97	0.491		
	Total		49.129	100			
SS 6: Delegation Skills	Between Groups	(Combined)	3.774	3	1.258	1.468	0.228
	Within Groups		83.137	97	.857		
	Total		86.911	100			
	Between Groups	(Combined)	8.967	3	2.989	3.981	0.010

SS 7: Negotiation Skills	Within Groups		72.835	97	0.751		
	Total		81.802	100			
SS 8 4: Organisational Skills	Between Groups	(Combined)	1.254	3	0.418	0.531	0.662
	Within Groups		76.390	97	0.788		
	Total		77.644	100			
SS 9: Decision-making Skills	Between Groups	(Combined)	1.632	3	0.544	1.770	0.158
	Within Groups		29.813	97	0.307		
	Total		31.446	100			
SS 10: Critical Thinking and Problem Solving Skills	Between Groups	(Combined)	0.037	3	0.012	0.026	0.994
	Within Groups		45.152	97	0.465		
	Total		45.188	100			
SS 11: Stakeholder Management Skills	Between Groups	(Combined)	3.632	3	1.211	1.716	0.169
	Within Groups		68.427	97	.705		
	Total		72.059	100			
SS 12: Team Integration Skills	Between Groups	(Combined)	.434	3	0.145	0.223	0.880
	Within Groups		62.873	97	0.648		
	Total		63.307	100			

Table 38: Objective 4 - ANOVA Table

According to table 38, the mean values under the four groups, F statistics and the P values at which the null hypothesis of equality of mean values across different groups could be rejected or retained were calculated. From the analysis on table 38, it was found that there were statistically non-significant differences among the respondent groups over the following soft skills:

SS1 (F = 0.908, P = 0.440); SS2 (F = 0.232, P = 0.874); SS3 (F = 0.668, P = 0.574); SS4 (F = 1.567, P = 0.202); SS5 (F = 1.010, P = 0.392); SS6 (F = 1.468, P = 0.228); SS8 (F = 0.531, P = 0.662); SS9 (F = 1.770, P = 0.158); SS10 (F = 0.012, P = 0.994); SS11 (F = 1.716, P = 0.169); SS12 (F = 0.223, P = 0.880).

However, the following soft skill has the highest F value which indicates a very strong agreement between the respondents from the four groups over the soft skill that is essential in conflict management:

SS7 (F = 3.981, P = 0.010)

Kendal's W Test Statistics

Kendall's W Test was used to determine the Mean Ranks of the different variables. The results of the data analysis were used to determine the important soft skills essential to be acquired by the construction design leader or construction project manager.

Kendall’s W Test Statistics

N	101
Kendall's W[a]	0.162
Chi-Square	179.956
df	11
Asymp. Sig.	0.000
a. Kendall's Coefficient of Concordance	

Table 39: Question 4 - Kendall's W Table

Hypothesis Test

The Kruskal-Wallis Test was conducted at a significance level of 0.05; however, a significant value of factor, less than 0.05, indicates that the respondents had varying views on the criticality and the authenticity of the factor(s) (Sholanke *et al.,* 2019). Therefore, Table 40 indicates the rejected null hypotheses.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of SS 1 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.421	Retain the null hypothesis.
2	The distribution of SS 2 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.676	Retain the null hypothesis.
3	The distribution of SS 3 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.496	Retain the null hypothesis.
4	The distribution of SS 4 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.184	Retain the null hypothesis.
5	The distribution of SS 5 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.375	Retain the null hypothesis.
6	The distribution of SS 6 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.268	Retain the null hypothesis.
7	The distribution of SS 7 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.023	Reject the null hypothesis.
8	The distribution of SS 8 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.730	Retain the null hypothesis.
9	The distribution of SS 9 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.125	Retain the null hypothesis.
10	The distribution of SS 10 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.950	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
11	The distribution of SS 11 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.135	Retain the null hypothesis.
12	The distribution of SS 12 is the same across categories of QUESTION 4.	Independent-Samples Kruskal-Wallis Test	.845	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 40: Objective 4 – The Hypothesis Test

Chapter Summary

Objective 1

Due to the traditional procurement system, FM specialists have been excluded in early design development process and only involved in commissioning and handover stage. The increase in complexity of construction projects necessitate the need for a collaborative practice among FM specialists and design team and foster effective communication among the parties involved in the design development process. The benefits of involving FM specialist in early design process include addressing sophistication in modern buildings and reducing complexity, improve design out and increase design efficiency, achieve cost savings throughout the facility lifecycle, increase accessibility to various equipment for maintenance and replacement and better selection of equipment and materials (Isa, et al., 2017). However, despite the recognised benefits of collaboration between FM specialists and design there are significant obstacles that have so far prevented the widespread implementation of this partnership (Saleh, et al., 2017). Hence, the aim of this section was to determine the early stage that FM specialists should be involved in design development according to the traditional procurement method. According to participants' perceptions and descriptive analysis, FM specialists should be involved during project close out (MS of 4.29) and design development (MS of 4.19) while slightly agreed on the remaining 4 stages with mean scores ranging from 3.21 to 3.71.

Objective 2

The main aim of this objective was to identify constructs that causes conflicts among FM specialists and design team during design development process. According to participants' perceptions and descriptive analysis, the following 7 constructs were identified as possible cause of conflicts and were rated moderate with mean scores ranging from 3.70 to 3.97.

- Budget and time constraints (COC25) with mean score of 3.97
- Lack of client specification (COC18) with mean score of 3.95
- Inadequate brief (COC17) with mean score of 3.84
- Undefined project priorities (COC3) with mean score of 3.81
- Lack of collaboration during design development processes (COC27) with mean score of 3.76
- Slow decision-making (COC5) with mean score of 3.72
- Unrealistic client expectations and determination (COC13) with mean score of 3.70

Objective 3

The aim of this objective was to identify conflict management strategy that can be applied when faced with conflict situation among FM specialists and design team in complex construction projects. According to participants' perceptions and descriptive analysis, the following strategies were identified as significant:

- Very significant: Collaborating strategy (CMS2) with mean score of 4.50
- Significant: Accommodating (CMS5) with mean score of 3.71
- Significant: Compromising (CMS3) with mean score of 3.37

Objective 4

According to Ijaola & Ogunsanmi (2018), management skills are skills required for making business decisions and leading subordinates in an organisation. Hence, the success of complex construction projects largely depend on the construction leader's management skills and performance. Therefore, construction project leader should be equipped with wide variety of management skills that would enhance his/her abilities in steering construction project successfully. In addition, FM specialists have to possess specific competencies to perform the distinct roles expected of them in all project life cycles. The aim of this section was to identify important management skills to be possess by design/project leaders responsible for leading integrated project team throughout the project life cycles.

According to the perception of participants and descriptive analysis, this study uncovered the following 10 management skills that are very important and 2 important management skills that should be possessed by design/project leaders in handling conflicts during the design and construction stages:
Very important:

- Communication skills (SS1) with mean score of 4.79
- Decision making skills (SS9) with mean score of 4.63
- Critical thinking and problem solving skills (SS10) with mean score of 4.52
- Coordination skills (SS2) with mean score of 4.49
- Leadership skills (SS5) with mean score of 4.47
- Collaboration skills (SS4) with mean score of 4.32
- Team integration skills (SS12) with mean score of 4.26
- Conflict management skills (SS3) with mean score of 4.18
- Stakeholder management skills (SS11) with mean score of 4.14
- Organisation skills (SS8) with mean score of 4.06

Important:

- Delegation skills (SS6) with mean score of 3.97
- Negotiation skills (SS7) with mean score of 3.89

However, this objective failed to identify extremely important management skills that necessary to be possessed by design /project leader in complex construction projects. These findings are considered valuable contributions to FM specialists and design/project leaders involved early in design process and construction stage to handle conflict professionally and diligently in order to discharging their duties effectively and efficiently.

Chapter 5: Discussion, Conclusion and Recommendation

5.1 Introduction

The traditional procurement and contracting method within the construction industry is often criticised for its fragmentation approach and isolation of design from construction and FM specialists from the early design-development process. This fragmentation impedes the aim of constructability; and it further results in maintainability issues. According to De Dreu & Weingart (2003.p741), as cited in Puck & Pregernig (2014), conflict is defined as a “process resulting from the tension between team members because of real or perceived differences; and it is an inevitable part of teamwork. There has been a large amount of research on different types of conflict, such as team conflict, intra-organisational conflict, task conflict, cognitive conflict, co-operative conflict, competitive conflict and affective conflict.

However, there is a dearth of research on the causes of conflicts among FM specialists and design teams in complex-construction projects. Hence, this study set out to investigate the early involvement of FM specialists in the traditional design-development process with the focus of identifying and analysing the possible causes of conflicts among FM experts and the design team in complex-construction projects. Therefore, this chapter sought to discuss the study of the findings by comparing and contrasting the results obtained with the previous literature related to the causes of conflicts in the design and the development of complex-construction projects

5.2 Discussion

5.2.1 Objective 1

According to Herrera *et al.* (2019), construction projects are complex at every stage; however, the design phase requires primary attention; since it is at this phase that the project can be influenced to a greater extent and at a lower cost. Lack of considering FM specialists at an early design stage has become a potential issue to increase the operation and maintenance budget, premature ageing and dilapidation (Islam *et al.,* 2017). Conversly, early consideration of maintability issues during the early design and review stages offers a high level of comfort to FM specialists and end-users, due to decreasing the maitainability of the budgets plans, and in the end, the life-cycle expences of the building project (ibid). However, it has been argued that FM specialists should be involved in an early stage of the design-development process of complex-construction projects.

FM specialists have an important role to play at the early stage of the project (Pilanawitana & Sandanayake, 2017), such as:

- To reduce the cost of procurement;
- To minimise the design alteration and the rework;
- To provide a facility that is better suited to the needs of the occupants;
- To create a facility that is easy to run, maintain, control and manage.

Previous research critically highlighted the importance of FM in early design development through the RIBA Plan of Work 2013, which consists of eight stages. Secondly, previous studies focused mostly on the Facilities Manager; while this study is focusing on FM specialists reporting to the Facilities Manager. Furthermore, this study focuses on six project life-cycles, as stipulated in PROCSA and applied in South Africa. Hence, the objective of this section was to identify the project stage in which FM specialists should be involved, in order to enhance the quality of the design that would best optimise building performance.

According to descriptive statistics and participants' perceptions, stage 6 (Hand-over and Close-Out) received the highest mean score of 4.29, followed by stage 3 (Design Development) with a mean score of 4.19. This means that a total of 99 participants agreed that FM specialists should be involved during the project hand-over and close-out stages; while 100 participants agreed that FM specialists should be involved in the design-development stage; although it received a mean score of 4.19, which is lower than 4.29.

Furthermore, the following design-development stages received mean scores that were less than 4, but higher than 3. In terms of ranking level, Stage 6 was ranked 1; while Stage 3 was ranked 2.

- Stage 2 (Concept and Viability) received a mean score of 3.71 from 100 participants. Based on the decision-making rules, this means that participants' perceptions agreed that FM specialists should be involved in the concept and viability stage. The concept and Viability Stage was ranked 3.
- Both Stage 4 (Documentation and Procurement) and stage 5 (Construction) received a mean score of 3.56, from 99 participants; and both these stages were ranked 4 (Documentation and Procurement) and 5 (construction). Based on the decision-making rules, this means that participants agreed that FM specialists should be involved in both documentation and procurement, as well as the construction stages.
- Stage 1 (Inception) received the lowest mean score of 3.21 from 100 participants. Based on the decision-making rules, this means that participants' perceptions slightly agreed that FM specialists should be involved in the Inception Stage. In terms of ranking level, this stage was ranked at level six (6).

According to *Wu et al.* (2018), project conflicts involving project-based organisations occur along with the project life-cycles from the initial stage to the operational stage. However, a Kruskal Wallis was performed to determine which null hypothesis should be retained or rejected. However, it was found out that the null hypothesis (FM specialists should be involved early in the project-development stage 1 (Inception) was rejected; while the null hypothesis, in the other five stages, was accepted.

According to Abeydeera *et al.* (2017), the following challenges have restricted FM specialists from participating actively in the design-development process:

- Lack of understanding about FM's potential role in the design-development process;
- Stakeholders reluctance to involve FM specialists in the design-development process;
- The Limitted authority that FM has during the project-development process;
- Competition among similar professions in obtaining the position;
- Lack of funds provided for the FM during the development process.

However, based on the findings of this study, it can be inferred that participants' perceptions in both qualitative and quantitative agreed on the importance of the early involvement of FM specialists in five stages of the design-development processes; and they slightly agreed on Stage 1 (Inception). Nevertheless, problems emerging during the technical review stage confirm that the involvement of FM specialists in the early design development of complex projects is a major cause of conflicts. In contrast, the study conducted by Bascoul *et al.* (2018) states that if FM is involved late in design of the high-end facilities, conflicts are likely to arise between FM's requirements and the developed design, causing design iteration or FM's dissatisfaction. Ibid further states that if FM specialists are involved early, they can better understand the programmatic requirements of a project.

5.2.2 Objective 2

Conflict is inevitable in complex-construction projects, due to the multi-disciplinary organisations' involvement in the design and construction processes. However, a thorough understanding of the possible root causes of conflicts (Osei-Kyei et *al.,* 2018) among FM specialits and the design team beforehand would help to reduce such conflict's occurrence. According to the literature review, a number of studies have revealed the importance of FM being involved in the early stages of the design. However, this comes with positive and negative conflicts, which have to be identified during the establishment of the project team and the initiation of the project.

Lam *et al*. (2007), as cited in Sudhakar (2015), confirmed that the complexity of the product development leads to difficulties in crdination, co-operation and communication, resulting in conflicts in the teams. Therefore, the objective of this section of the study was to identify the possible causes of conflicts among FM specialists and the design team that can hinder the success of early involvement in the design stage(s) of complex-construction projects in South Africa. Jensen (2009), as cited in Isa *et al.* (2019) identified that a design review by FM managers is necessary before the final approval of the construction. Furthermore, Femi (2014), as cited in *Isa et al*. (2019), pointed out that the need for maintenance experts should not be overlooked in the planning stages of complex-construction projects.

According to descriptive statistics, 13 causes received mean scores that were above 3.50, but less than 4. Based on the decision-making rules, the 13 causes of conflict each had a number of possibilities of causing conflicts among the FM specialists and the design team during the early design-development processes of complex projects in South Africa. However, 18 causes of conflicts received mean scores that were less than 3.50, but above 2.99. Based on the decision-making rules, the 18 causes of conflicts have moderate possibilities of causing conflicts among FM's specialists and the design team during the early design-development process of construction projects. Furthermore, 10 causes of conflicts received mean scores of above 2.50, but less than 3. Based on the decision-making rules, the 10 causes of conflicts also have moderate possibilities of causing conflicts among FM specialists and the design team during the design-development processes of complex-construction projects. According to the ranking level, the 13 causes of conflicts that had received mean scores of above 3.50 were ranked from 1 – 13, with COC18 (Lack of Client Specification) being ranked 1, followed by COC25 (Budget and time constraints) and COC17 (Inadequate Brief) being ranked 3.

Hypothesis Test: According to Dogbegan *et al.* (2013), the rule for the acceptance or rejection of a hypothesis is that if a p-value of >0.05 is achieved, the hypothesis is accepted; but if the p-value of ≤0.05 is achieved, the hypothesis is rejected. Hence, the hypothesis test was conducted through the Kruskal-Wallis, in order to determine the null hypotheses that are to be rejected, or accepted. Therefore, it was found that 13 null hypotheses relating to COC9, COC10, COC11, COC12, COC13, COC15, COC17, COC19, COC21, COC32, COC37, COC39 and COC41 were rejected due to p-values of ≤0.05.

This signals that the null hypotheses, which were postulated on the premise that the involvement of FM specialists in the early design-development processes causes conflicts in South Africa were not supported; and therefore, they were rejected. Furthermore, this signals the importance of FM specialists' involvement in the early design-development processes of complex-construction projects.

However, the remaining null hypothesises were accepted, due to p-values of >0.05. Based on the participants' perceptions and the descriptive analysis, it is therefore inferred that 13 causes of conflicts have high possibilities of causing conflicts among FM specialists and the design team in the early design-development processes; while 28 causes of conflicts have moderate possibilities of causing conflicts among FM specialists and the design team in the early design-development process of complex projects.

Furthermore, Analysis of Variance (ANOVA) was conducted on the mean scores of the participants from the established four groups, to check for any significant differences among the groups' perceptions regarding the various causes of conflicts. According to the groups' perceptions and ANOVA analysis (Table 21), 13 (31.71%), the causes of conflicts were identified as being significant, due to the low F- statistics test and p-values of ≤0.05; hence the null hypotheses were rejected. However, 28 (68.29%) causes were identified as non-significant, due to high F-statistics and p-values >0.05; and they were accepted. Based on the percentages of the significance and non-significance, it may be inferred that out of 100%, 31.71% causes of the identified conflicts have high possibilities of causing conflicts; while 68.29% have moderate possibilities of causing conflicts among FM specialits and the design team.

Due to the high numbers of identified causes of conflicts, exploratory factor analysis was necessary, in order to reduce the number of variables to a manageable size. Based on the principle component analysis, 7 components were identified and renamed, according to their commonalities. The first component consists of 7 causes of conflicts; and it was renamed Lack of Motivation. Therefore, this new factor was further associated with the different project life-cycles to determine the participants' perceptions. However, the findings are as follows:

- In PLC1, Lack of Motivation achieved a MS of 3.21 as the highest score, indicating that the participants' perceptions agreed that this factor causes conflicts among FM specialists and the design team during the early design development.
- In PLC2, Lack of Motivation achieved a MS of 3.19, as the highest score, indicating that the participants' perceptions disagreed that this factor causes conflict among FM specialists and the design team.

- In PLC3, Lack of Motivation received a MS of 3.56, as the highest score, thereby indicating that the participants' perceptions strongly agreed that this factor causes conflict among the FM specialists and the design team.
- In PLC4, Lack of Motivation received a MS of 3.31 as the highest score, indicating that participants' perceptions disagreed that this factor does not cause conflict among FM specialists and the design team.
- In PLC5, Lack of Motivation received a MS of 3.27, as the highest score, indicating that participants' perceptions agreed that this factor causes conflict among the FM specialists and the design team.
- In PLC6, Lack of Motivation received a MS of 3.31 as the highest score, indicating that participants' perceptions disagreed that this factor causes conflict among FM specialists and the design team.

This process was implemented on all 7 components; and the results are presented in tables and histograms as part of the report.

As declared by Hsu (2017), team conflict and team relationship are interpersonal problems; hence design/project leader should always pay more attention to prevent team conflict from occuring during project life cycles, by using appropriate opportunities to encourage communication among the project team and to improve relationship quality. Ibid further stated that transforming team conflict to co-operative conflict enables project-team members to adopt other people's views with an open heart, and ultimately to enhance the team's performance. However, minimising the impact of possible causes of conflicts in complex-construction projects could increase the possibility of the project's success.

5.2.3 Objective 3

This study sought to investigate the causes of conflicts among FM specialists and the design team in complex-construction projects. Therefore, the purposes of this section was to determine the manner in which these conflicts can be effectively managed, in such a way that it would not cause harmful effects to the project and the project team. Tabassie *et al.* (2019), stated that the influence of conflicts among team members on project performance in the industry could be destructive or constructive, relying on plenty of variables, such as the conflict-management style of the design/project leader, the nature of the conflict, the perceptions of team members in working with conflict. Thomas (2009), as cited in Sudhakar (2015), stated that choosing the best conflict-resolution style is the most fundamental skill of the project manager. Therefore, the objective of this section of the study was to identify the conflict management style(s) suitable for different stages of the design-development processes of complex-construction projects.

According to the participants' perceptions and the descriptive analysis, CMS2 (Collaboration Style) received mean scores of 4.50, meaning that it is very significant in mitigating possible causes of conflict, thereby enhancing collaboration among the FM specialists and the design team. However, CMS5 (Accommodating Style) received mean scores of 3.71, which can be classified as very significant, according to the decision-making rules; while CMS3 (Compromising) received mean scores of 3.37; and it was classified as significant. CMS4 (Avoiding) received mean score of 2.38 and was classified as slightly significant; while CMS1

(Confronting) received mean scores of 1.64; and it was classified as extremely insignificant. These findings are in support to the findings of the study conducted by Aalazemi & Mohiuddin (2019), in which collaboration and compromising were found to be the most suitable strategies in resolving conflict on the construction site.

According to the mean-ranking level, CMS2 (Collaboration), with a mean rank of 4.40, was ranked number 1, followed by CMS5 (Accommodating) with a mean rank of 3.58. CMS3 (Compromising) was ranked 3, with a mean rank of 3.17. CMS1 was ranked 4, with a mean rank of 2.28; while CMS4 was ranked 5, with a mean rank of 1.57.

Based on the mean scores and the mean-ranking level, it can be inferred that CMS2 and CMS5 are very significant and essential for the design leader, or the project manager in complex-construction projects. These conflict-management styles are very significant in enhancing the design leader or project manager's ability in handling causes of conflicts among FM specialists and the design team early in design-development processes. However, design/project leader's incompetency in managing conflicts in complex-construction projects could lead to individual, group and multi-disciplinary organisations' ineffectiveness (Liu *et al.,* 2011).

According to Harmon (2003), as cited in Osei-Kyei *et al*. (2018), If conflict arises; and it is not resolved with proper resolution mechanism within a specific timeframe, it grows larger into a full-scale dispute. Therefore, it is proposed in this study that the design/project leader prepares an effective strategic plan on how to deal with conflicts that might develop during any design phase, due to the early involvement of FM specialists in the design development. This strategic plan would enable the design/project leader to monitor and evaluate the effectiveness of the adopted conflict-management strategy.

5.2.4 Objective 4

FM specialists' requirements analysis during the technical review process is another inevitable and critical activity of complex-construction projects; and it leads to interpersonal conflict among (Liu *et al.,* 2011) FM specialists and the design team. Moreover, interpersonal conflicts can lead to a lack of collaborative decision-making, ultimately causing disagreement among the FM specialists and the design team. The objective of this study section was to identify those soft skills that must be acquired by design/project leader in design development-conflict situations.

However, Jena & Satpathy (2015), assert that a design/project leader, after acquiring technical skills needs also to possess managerial skills, which can be referred to as soft skills, which have considerable importance in all the phases of the complex-construction projects. Ibid further states that soft skills play a very vital role in the professional life of an individual; and the basics of it starts from the foundation of ethics, integrity and values. Complex-construction projects involve multi-disciplinary organisations with different objectives and responsibilities. During the various design-development stages, design meetings with all the stakeholders have to be arranged, whereby the project objectives have to be communicated, implemented and co-ordinated. However, conflicts among these multi-disciplinary organisations tend to emerge during different stages of the projects.

These conflicts often hinder the success of the project. As stated by Meng (2013), cited in Isa *et al.* (2019), the exclusion of FM specialits early in design development can lead to several problems in regard to the designed facilities, which include lack of constructability, functionality, operability, maintainability, accessibility and serviceability. However, FM specialists' involvement in the early design development is perceived to be the cause of conflicts during the early stages of complex-construction projects; and this requires a design/project leader with both technical and soft skills, to be able to communicate, co-ordinate, organise, delegate, make informed decision, negotiate possible solutions, solve problems critically, and to be able to lead the project team to a collaborative working environment that would achieve the objective of the project's success.

However, Isa *et al.* (2019) assert that it is important to manage FM's requirements, and to conduct a prior checking amid design approval, in order to enable an organisation to accomplish its objectives better after occupying a newly built facility.

Therefore, the results of this study indicate that of the 12 identified soft skills, two soft skills (Delegation and Negotiation) have received MS of greater than 3, but less than 4, thereby indicating that these soft skills are significant and essential for design/project leaders in complex projects; while 10 soft skills received MS of greater than 4, but less than 5, thereby indicating that these soft skills are very significant and essential; and they should be applied by the design/project leader in complex projects.

Communication Skills: According to Aalazemi & Mohiuddin (2019), every project starts and ends with communication; hence, communication is the livewire of all construction projects. The findings of this study indicate that communication skills emerged, as the signicant management skills for design/project leader with MS of 4.79. Similarly, the research conducted by Aalazemi & Mohiuddin (2019) in construction projects in Kuwait Airport Cargo City, where the focus was on the issue of conflict management, it was found that inadequate communication and contracting instructions were the leading causes of conflict.

However, design/project leader's poor communication in complex-construction projects would affect team co-operation, reduce team performance, and lead to team conflicts. Traditionally, design, construction and operation and maintenance were separated, which made communication among designers, contractors, user clients and facilities management impossible (Khoury, 2019). Ibid further states that due to the introduction of complex-construction projects, more experts had to be involved in the process, which made communication more difficult. Further, client requirements uncertainty causes communication breakdown, if not clrearly communicated and properly managed. Therefore, the need for communication system or framework in complex-construction projects was essential. The introduction and use of information technology in design, construction and FM had a major impact on how the participants communicate together, thereby changing the traditional way of communication, which was based on oral and face-to-face co-ordination (Khoury, 2019).

According to Khoury (2019), the importance of team communication in the design of building is attracting the attention of many researchers, due to the increase in the complexity of the technical and organisational structure of any construction project. Furthermore, a clear communication plan can effectively assist design/project leader in dictating the communication requirements, format, and frequency of communication required for the success of the project (Liu *et at.,* 2011). Ibid further state that effective communication among project stakeholders can minimise the negative impacts of instability requirements and reduce interpersonal conflict.

The design/project leader needs to have the ability that can harmonise the interpretation, responses and minimise the behaviour that provokes interpersonal conflicts (Liu *et al.,* 2011) among FM specialists and the design team.

The complexity of today's design and clients' requirements requires effective communication and collaborative work among multi-disciplinary project members. However, collaboration, communication, co-operation, professionalism and respect among integrated multi-disciplinary design team during the design stages is significant for the success of the project. The design/project leader's leadership skills during such integrated design stages play a crucial roles in ensuring that a healthy relationship is maintained throughout the life-cycle of the project.

According to Charboneau (2016), communication skills are cnsidered a key competence for any kind of management; and it is the basic responsibilty of any leader to ensure that appropriate communication is shared with the project team members, as well as building trust and inspiring the project team members. Furthermore, Rahman & Latif (2012), as cited in Mohammed; Mohammed & Asimiyu (2019) investigated communication in the construction organisation; and they found that by adopting effective communication during project delivery, it would help in meeting the predetermined cost and time of the project. However, Park & Lee (2014), as cited in Mohammed, Mohammed & Asimiyu (2019), acknowledge that if there is an effective communication among the project team, accurate information could be quickly disseminated and consensus decisions could be achieved.

Osei-Kyei *et al.* (2018), assert that communication plays a major role in conflict prevention; and therefore, it is important that training and education in communication is provided to practitioners to enhance their communication skills in complex-construction projects. Ibid further state that a well-defined communication system is necessary to enhance communication and the effective exchange of ideas and views among FM specialists and the design team. However, Abeydeera *et al.* (2017) declared that the lack of communication forces designers and clients to take decisions, based on their experience, rather than looking at the end-user's requirements. Hence, Charvat (2003), as cited in Taleb *et al.* (2017), states that communication is the backbone of project success; and the lack of it causes unpleasant consequences or delays that lead to project failure.

Decision-Making Skills with MS of 4.63, emerged as the second essential soft skill for the design/project leader in mediating conflicts resolution in complex-construction projects. The MS of this study is 0.38 higher than the findings by Sholanke et al. (2019). As stated by Liu *et al*. (2011), interpersonal conflicts could lead to lack of collaborative decision-making, thereby causing disagreement on the design requirements among FM specialists and the design team. Furthermore, ibid asserts that the presence of interpersonal conflict creates symptoms, such as poor communication and decrease in the team's decision-making effectiveness.

In addition, Hassanain *et al*. (2014), asserted that the effects of the decisions made during the design stage have far-reaching implications on the future maintainability of the physical structure. The problems encountered by FM operational and maintenance (O & M) specialists during the post-occupancy stage and throughout the life-cycle of the constructed facilities foster the integration of multi-disciplinary design team with FM specialists during the design stage, in order to mitigate such problems. According to the study conducted by Hwang & Jian (2012), when investigating project managerment's knowledge and skills for green construction (Overcoming Challenges), decision-making received a MS of 4.57, on traditional; and it ranked fifth, where the list consisted of 10 management skills.

However, it can be generalised that the quality of Decision-Making would be affected due to unmanaged conflicts during the design-development process.

Critical Thinking and Problem-Solving Skills with MS of 4.52 emerged as the third most significant soft skills necessary to be acquired by design/project leader in complex projects. Complex-construction projects require more time in detailing design, interpreting design and correlating design, with client requirements and the functionality of the completed facility; hence, the design/project leader needs to possess such skills. According to the findings by Sholanke *et al.* (2019), problem-solving skills were ranked 2nd with a MS of 4.67, which is 0.15 higher than the findings in the current study.

Findings further indicate that co-ordination skills with MS of 4.49 emerged as the fourth essential skill for design/project leader; since all information and design need to be co-ordinated throughout the entire project, in order to avoid project delay, due to lacking information, cost overrun due to late information or incorrect information, and to avoid different disciplines' services overlapping or clashing. Poor co-ordination of information during design and construction results in work needing to be re-done, change order(s), cost overruns and project delay.

Leadership Skills: According to Addy & Cofie (2014), in order to achieve project success, it is essential that the project manager possesses the appropriate leadership skills. Hence, leadership skills with MS of 4.47 emerged as the fifth skills necessary for design/project leader in complex projects; while in Hwang & Jian's report (2012), leadership received a mean score of 4.83 on traditional issues and ranked 2. According to Charboneau (2016), the most important element to conflict resolution is to have a leader who demonstrates transformational leadership theory skills that are important for leading dispersed teams, such as communication, credibility, care and enabling.

With reference to the research conducted by Sholanke *et al.* (2019) in relation to the effects and resolution guidelines of land-use conflict in construction management in Lagos, it was found that leadership skills were ranked 5th with a mean score of 4.25, which is close to the findings of the current study and 0.58 less than the findings of Hwang & Jian (2012). Addy & Cofie (2014) asserted that to ensure the success of the project-management process, leaders with the necessary expertise are required to handle effectively and efficiently various aspects of resources, such as money, human resources, machines and equipment and materials, in order to attain the desired results.

Collaboration/co-operation skills with MS of 4.32 emerged as the sixth most important skills essential in complex-construction projects. According to Puck & Pregernig (2014), collaboration or co-operation has been frequently identified as a process or dimension of teamwork behaviour; and it can be defined as the degree to which individual members of the project work together towards the complishment of team-level goals. As stated by Poirier *et al.* (2016), collaboration is the key for the successful delivery of complex-construction projects in the architecture, engineering and construction sectors (AEC). Moreover, team co-operation is the ability of project team members to resolve conflicts and form agreements when confronting multiple complex problems (Hsu, 2017).

However, traditional silo-type, linear and fragmented design (Design –Bid-Build) methods create a significant barrier to collaboration and innovation in construction (Leoto & Lizarralde, 2019). Unmanaged task conflict can hamper collaboration among FM specialists and design team, based on the following reasoning (Puck and Pregernig 2014):

- If team members are constantly questioning and challenging each other's opinions regarding design, team co-operation is negatively affected and less co-operation will be observed; because such behaviour impairs the positive attitudes and perceptions they have towards each other.
- The willingness of project-team members to collaborate could be impeded when continuous questions are raised about the quality of the design and the proposed specification of materials and equipment.
- The team's motivation to share creative knowledge and ideas could be constrained; since the team members do not then feel recognised and understood by the other team members.

Task conflict leads not only to tension among project-team members, but also to team members wanting to isolate their involvement in the project (Puck and Pregernig, 2014; Langfred, 2007,p.889). However, it was argued by Kozlowski & Bell (2002), as cited in Puck and Pregernig (2014) that co-operation is an essential mechanism that affects a team's performance. Team collaboration requires mutual trust and an agreement on goals among project team members. Furthermore, the collaborative work of the integrated design team is to be bound by the mutual goal of the client and the expected sustainability of the proposed facility.

Although collaboration received a MS of 4.32 (very important); it nevertheless remains essential for design/project leader in complex projects; as it was concluded in an article by Kalishman *et al*. (2012), as cited in Charboneau (2016), that there are benefits if project team resolves task-based conflicts with collaboration. Therefore, the lack of collaboration among FM specialists and the design team lead to inefficient knowledge transfer from operational and maintenance teams to the project-design team.

However, negotiation skills emerged as the lowest item, with an Ms of 3.89; although seen as one of the key skills to conflict resolution by Lee *et al*. (2017). The design/project leader is required to possess negotiation skills, which would enable him/her to enter into negotiation with contractors, sub-contractors, suppliers and the client in relation to the project's duration, project cost, professional fees and the instability of client requirements.

Furthermore, negotiation is significant in conflict resolution; and it is highlighted by Osei-Kyei *et al.* (2018) as the first step in resolving conflict in PPS; and it is preferred; because it offers the opportunity for a peaceful resolution to the conflict.

5.3 Conclusion

According to Pilanawithana & Sandanayake (2017), FM is an approach which integrates people, places process and technology to maintain, improve, adapt and ensure the functionality of the building, in order to create a conducive environment that supports the primary objectives of the organisation. Furthermore, early involvement of FM specialists at the design development and review stage is essential for reducing the number of O&M defects encountered in the operational stages of the facilities. Hence, the purpose of this study was to investigate the causes of conflicts among FM specialists and design team due to early involvement in the traditional design-development process. Therefore, the first objective of the study was to determine the earliest stage/s of the project life cycles at which FM specialist should be integrated into the design team.

The findings of the study indicate that participants' perceptions agreed with the involvement of FM specialists during project close out with mean score of 4.29 and design development stage with mean score of 4.19. However, the results of the results of the study further indicate that participants' perceptions slightly agreed with FM specialists being involved early in the other stages with the mean score ranging from 3.21 to 3.71. Based on the findings of this section, it can be inferred that FM specialists should be integrated into design team at the early stage of the project to assist in determining the availability of the infrastructure required for the project and the possibility of an upgrade or a complete new installation.

However, the involvement of FM specialists in the early design-development process leads to difficulties in co-ordination, co-operation and communication, resulting in conflicts among the project teams. Complex-construction projects involve various multi-disciplinary organisations and the characteristic diversity of these organisations inevitably leads to various conflicts, which could have detrimental effects on the project if left unresolved. In addition, conflicts often occur during the implementation phase of construction projects; because information and knowledge must be relayed among different project teams. Hence, the second objective of the study was to investigate causes of conflicts among FM specialists and design team during the traditional design development process of complex construction projects in South Africa. The primary findings of this section focussed on the causes of conflicts and once identified, corrective steps can be taken to manage and minimise the effects. Therefore, to achieve this objective, 41 causes of conflicts among FM specialists and the design team were identified; and the findings from the study indicate that participants' perceptions agreed that 10 variables have low possibilities of causing conflicts with mean scores above 2, but less than 3. However, 31 causes of conflicts received mean scores of above 3, but less than 4, indicating that they have moderate possibilities of causing conflicts. Based on the findings, it can be declared that conflict is inevitable in any construction project due to the involvement of multidisciplinary team, however, it has to be planned and managed accordingly in order to ensure that the effects thereof do not impede the success of the project.

Conflict is inevitable in construction projects, due to the involvement of many people with different backgrounds, attitudes, characteristics, education and skills. Therefore, it is obvious that humans are behind the creation of conflicts, as well as the management thereof. The failure to address and manage possible causes of conflicts among FM specialists and the design team in complex-construction projects is seen as the major barrier to commissioning and handing over of the completed facility to the operation and maintenance team. Furthermore, addressing and managing the causes of conflicts at the planning, designing and construction stages is recognised as being crucial to the success of complex-construction projects. Hence, the third objective of the study was to determine conflict management strategies required to be possessed by design/project leader in multidisciplinary complex projects. According to the findings of this study, a collaborating strategy with a mean score of 4.50, was found to be significant and the preferred strategy for conflict management in complex projects followed by accommodating strategy with a mean score of 3.71 and compromising strategy with mean score of 3.37 while avoiding strategy with a mean score of 1.64 indicates that it is extremely insignificant for conflict management in complex-construction projects. Based on the findings of the analysis, it's inferred that collaborating strategy is the most significant strategy for conflict management.

Many construction projects have failed due to the design/project leader's lack of management skills or soft skills and the exclusion of FM specialists early in the design development; although they possess accumulative knowledge and experience in operation and maintenance of the completed facilities. The exclusion of such key role players in the industry also delays the commissioning of building services and the hand-over of the completed facilities, resulting in user clients occupying the facility that has not been handed over to FM operation and the maintenance team. Furthermore, these results in impacting on user clients' effective use of the facility tends to pose an effect on capital investment, efficiency, maintenance costs, sales, staffs and profit. Hence, the main aim of objective four was to identify important management skills needed to be possessed by design/project leaders who are involved in coordinating multidisciplinary team in design development of complex construction projects. Therefore, the results of the study highlighted the following 12 important management skills that are essential for design/project leaders involved in integrated design development processes:

- Communication skills (SS1) with mean score of 4.79
- Decision making skills (SS9) with mean score of 4.63
- Critical thinking and problem solving skills (SS10) with mean score of 4.52
- Coordination skills (SS2) with mean score of 4.49
- Leadership skills (SS5) with mean score of 4.47
- Collaboration skills (SS4) with mean score of 4.32
- Team integration skills (SS12) with mean score of 4.26
- Conflict management skills (SS3) with mean score of 4.18
- Stakeholder management skills (SS11) with mean score of 4.14
- Organisation skills (SS8) with mean score of 4.06
- Delegation skills (SS6) with mean score of 3.97
- Negotiation skills (SS7) with mean score of 3.89

The early identification of the possible causes of conflicts and the application of proper conflict-management strategies, conflicts among project team members can be managed and directed to the advantage of the multi-disciplinary organisations. The results of this study concur with the notion of collaborative work among multidisciplinary teams with common objectives of achieving project success. Based on collaborative work, the likelihood of organisational conflicts would decreased when multidisciplinary team members share the same or similar values.

In reference to the highlighted management skills, design/project leaders in a complext construction projects, have to understand and be able to judge the strength of the technical and soft skills of the team members and be able to communicate effectively, motivate, make decisive decision and enhance the sense of achievement and be able to appreciate what is being accomplished by the team. The design/project leaders have to realise the significance of managing people and the importance of management skills required in complex construction projects. Furthermore, effective design/project leaders should understand the interaction of multidisciplinary team members in complex projects and be able to foster a climate of active participation, accountability and result-orientation.

5.4 Recommendations

FM specialists play a significant role in ensuring that the constructed facility is well maintained, functional, provide a conducive environment and support the organisation in achieving its goals. Hence, it is important that FM specialists are recommended to be involved in early design development process to provide input in design and technical specifications.

Complex construction projects involved multidisciplinary project team members with different knowledge, skills and experience hence, conflict is inevitable. Therefore, it is recommended that the design/project leader appointed for such project understands different types of conflicts and possible cause of conflicts among project team members. Furthermore, it is important that the design/project leader possess knowledge and skills in conflict management strategy.

Human skills such as communication skills are of the most acknowledged facilitators for the success of projects and utmost significance in multidisciplinary projects hence it is recommended that the design/project leaders are well equipped not with hard skills only but with soft skills as well. Most projects failed due to poor of communication, poor collaboration, lack of coordination, lack of teamwork and lack of motivation during the project life cycles. Therefore, more studies should be performed to examine the relationship between the identified seven causes of conflicts developed through this study.

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Appendix A

Exploratory Factor Analysis

Introduction

The aim of this study was to investigate the causes of conflicts among FM specialists and design team, due to FM early involvement in the design process. However, owing to the large number of variables in question 2 (41 causes of conflicts), involved in this study, there was a need to reduce the items to form a smaller coherent and manageable number of inter-related variables (Kissi *et al.,* 2016 and Zhao *et al.,* 2016); hence, the use of factor analysis, which is a data-reduction tenchnique was performed (Dansoh et al., 2017; Pallant,2012).

According to Kumaraswamy *et al.* (2005), factor analysis in statistics is used to determine the number of "broader" factors shared in common by variables in the study. Ibid refers to these broader factors as "components", which are uncorrelated after extraction. In addition, Norusis (1992 and Li *et al.* (2005b) cited by Dansoh *et al.* (2017), asserted that factor analysis identifies a small number of factor grouping that is used in representing sets of many inter-related variables. Furthermore, Field (2005a, b) and Dogbegah *et al.* (2011) cited by Dansoh *et al.* (2017) state that factor analysis is also used to identify clusters of related variables making it ideal to reduce variables that have a large number to an easily understood framework.

According to Hair *et at*. (1998) cited in Dansoh *et al*. (2017), opines that 20-50 variables are suitable for factor analysis,;but, if the number of variables exceeds this range in a study, the extraction of common factors becomes inaccurate. According to MacCallum *et al*. (1999), as cited in Zhao *et al.* (2016), factor analysis can produce correct solutions even with samples that would traditionally have been determined to be too small for meaningful factor analysis. Therefore, this study used exploratory factor analysis to categorise the 41 causes of conflicts that received significant agreement from the surveyed participants. Prior to the use of factor analysis, preliminary tests were undertaken to ascertain the appropriateness of the sample size for the study and reliability of the factor analysis (Yevu & Nani, 2018). Therefore, this study used Kaiser Meyer Olkin (KMO) and Bartlett's test of Sphericity in measuring the sampling adequacy for appropriateness of the said technique (Dansoh *et al.,* 2017; Norusis, 1992; Field, 2005a, b) and Cronbach 's Alpha were performed the through SPSS version 25, in order to check the internal reliability of the collected data.

KMO and Bartlett's Test

According to Zhao *et al.* (2016), the appropriateness of the factor analysis for factor extraction was assessed in various ways.In measuring the sampling adequacy for the appropriateness of the said technique (Dansoh *et al*., 2017; Norusis, 1992; Field 2005a,b) this study conducted a Kaiser (1960)-Meyer Olkin (KMO) test and the Bartlett (1954)'s test of sphericity. According to Child (1990) and Field (2005), as cited in Yevu & Nani (2018), a KMO value greater than 0.50 supports the proposition that an adequate sample size was used. However, values between 0.7 – 0.8 are acceptable and values above 0.9 are superb.

According to the observation in Table 41, the KMO measure is 0.795, which is relatively higher than 0.5 thresholds and thereby indicating an acceptable degree of common variance amongst the variables. Furthermore, the results of the Bartlett's test, which helps in obtaining correlation matrix between the variables, is 2489.390 (Chi-Square) with degree of freedom (DoF) F = 820 and an important p - value = 0.000. This satisfy the appropriateness of fit and the chi-Square/DoF (Park, *et al*., 2017). Based on the outcome of the KMO test and Bartlett's test of sphericity, it can be inferred that the dataset in question 2 is suitable for factor analysis. These results also mean that the significance is small enough to reject the null hypothesis. Furthermore, this confirmed that the correlation matrix is an identity matrix.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.795
Bartlett's Test of Sphericity	Approx. Chi-Square	2489.390
	df	820
	Sig.	0.000

Table 41: Kaiser-Meyer-Olkin

Communalities

The sample size of this study approximated 102 samples, meaning that all communalities above 0.50 could be accepted for factor analysis (Kim *et al.,* 2016). The principal component analysis was performed to collapse 41 variables. Table 42 shows the communalities of variables with an extracted average of 0.729; and this value is above the conventional rule about extraction values (eigenvalue) should be more than 0.50 at the initial iteration, which is an indication that the variable is significant; and it also indicates that these variable should be included in the data for further studies (Yevu &Nani, 2018; Field, 2005). Communalities of the 41 variables found to be greater than 0.50 that signify that the factor model is reliable in this study (Kim *et al.,* 2016). The variable with the lowest communality was COC15 (diversity in expertise of project participants) with 0.552% and the highest communality was COC26 (lack of co-ordination) with 0.826%.

Communalities		
	Initial	Extraction
COC 1	1.000	0.657
COC 2	1.000	0.776
COC 3	1.000	0.763
COC 4	1.000	0.675
COC 5	1.000	0.815
COC 6	1.000	0.753

COC 7	1.000	0.779
COC 8	1.000	0.734
COC 9	1.000	0.770
COC 10	1.000	0.823
COC 11	1.000	0.724
COC 12	1.000	0.826
COC 13	1.000	0.717
COC 14	1.000	0.704
COC 15	1.000	0.552
COC 16	1.000	0.780
COC 17	1.000	0.798
COC 18	1.000	0.740
COC 19	1.000	0.750
COC 20	1.000	0.710
COC 21	1.000	0.684
COC 22	1.000	0.715
COC 23	1.000	0.637
COC 24	1.000	0.721
COC 25	1.000	0.729
COC 26	1.000	0.826
COC 27	1.000	0.731
COC 28	1.000	0.728
COC 29	1.000	0.661
COC 30	1.000	0.709
COC 31	1.000	0.581
COC 32	1.000	0.711
COC 33	1.000	0.734
COC 34	1.000	0.700
COC 35	1.000	0.793

COC 36	1.000	0.747
COC 37	1.000	0.730
COC 38	1.000	0.756
COC 39	1.000	0.722
COC 40	1.000	0.666
COC 41	1.000	0.759

Extraction Method: Principal

Table 42: Communalities

Total Variance Explained

According to Kim *et al.* (2016), there are many criteria available to assist in determining how many components to extract. However, this study used eigenvalue criteria, known as the Kaiser criteria. The results of the principal component analysis to determine the number of components to be retained are shown (Kim *et al.,* 2016) in Table 43 below; and these are supported by the screen plot in Figure 3. According to Kaiser's criteria, 10 components were extracted, when using the factor loading of 0.50 as the cut-off point (Dogbegah *et al.,* 2011) with eigenvalues greater than 1.0, which is the suggested number of components to be retained (Kim *et al.,* 2016 and Field, 2009).

To define the number of factors, the researcher considered eigenvalues, total variance explained and the variance explained by each factor (Alvarenga, et al., 2020). The rotation procedure used in this analysis was the Varimax with Kaizer Normalisation and 10 components emerged from this analysis, and together they account for 72.892% of the total explained variations (Kumaraswamy *et al.,* 2005). Table 43 shows the initial eigenvalues and factors extraction before and after the Varimax rotation. The eigenvalues and the factor loadings were set at 1 and 0.50, respectively (Yevu & Nani, 2018). The percentage variation explained by the 10 components are, 35.021, 7.975, 5.646, 4.652, 4.061, 3.756, 3.336, 3.083, 2.81490 and 2.549. Furthermore, component 1 (differences in technical opinions accounts for 35.02 per cent of the total variance of the causes of conflicts. This finding indicate that differences in opinions among FM specialists and design team is a major cause of conflict during design development of complex construction projects.

Total Variance Explained							
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	14.359	35.021	35.021	14.359	35.021	35.021	6.037

2	3.270	7.975	42.996	3.270	7.975	42.996	3.871
3	2.315	5.646	48.641	2.315	5.646	48.641	3.752
4	1.907	4.652	53.293	1.907	4.652	53.293	3.551
5	1.665	4.061	57.353	1.665	4.061	57.353	3.193
6	1.540	3.756	61.109	1.540	3.756	61.109	2.787
7	1.368	3.336	64.446	1.368	3.336	64.446	2.300
8	1.264	3.083	67.529	1.264	3.083	67.529	1.562
9	1.154	2.814	70.342	1.154	2.814	70.342	1.419
10	1.045	2.549	72.892	1.045	2.549	72.892	1.414
Extraction Method: Principal Component Analysis.							
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.							

Table 43: Eigenvalue Table

Screen Plot

The screen plot as illustrated in figure 3 below, indicates ten factor groupings on the left of the point of inflection (*Kim et al.,* 2016) that are retained because of their suitability in explaining the underlying relationship of the set of 41 causes of conflict.

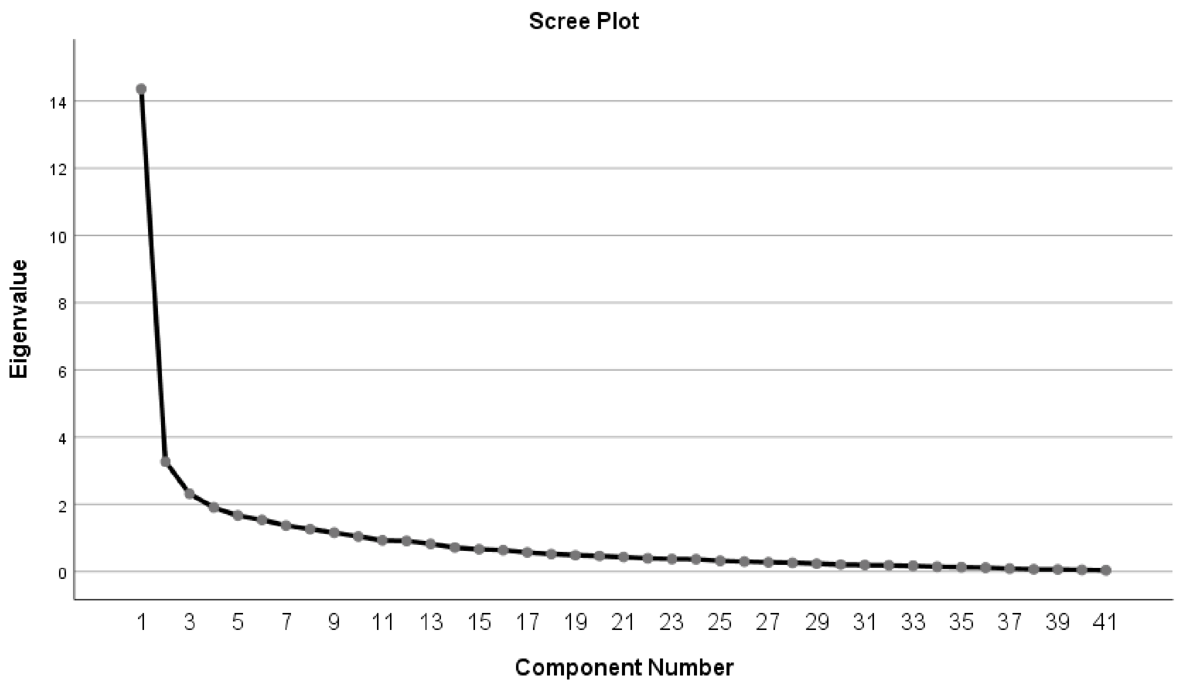

Figure 3: Screen Plot

Rotated Component Matrix

The rotated component matrix along the factor loadings of the causes of conflicts among FM specialists and design team during early involvement on these ten components after Varimax rotation are presented in Table 44. Factor loadings indicate how much a variable explains a factor component (Osei-Kyei, *et al.,* 2019). Therefore, forty-one causes of conflicts were further analysed using principal component analysis with Kaiser Normalisation and Varimax rotation. Hence, thirty five causes of conflicts were extracted from the original 41 causes of conflicts. The thirty five causes of conflicts were further classified under seven causes of conflicts. According to Hair *et al.* (2010), as cited in Kim et al. (2016), factors with loadings greater than 0.50 are considered significant in contributing to the interpretation of the component; and otherwise they are considered insignificant. The results of the rotated factors shown in Table 44 below, and all factor loadings, are greater than 0.50. According to Field (2005) in Ijaola & Ogunsanmi (2018), a factor loading is significant when it is greater tha 0.512 for a sample size of hundred.

However, Dogbegah (2011) cite in Wai *et al.* (2013) recommended checking for two strange situations, namely complex structures among variables and components that have one variable loading on them. Wai *et al.* (2013) asserted that complex variables may have higher loadings on more than one factor; and they may render the interpretation of the output difficult. As for the complex structure, COC41 (poor relationship management among integrated design team members) is found to be complex, as it is presented in component (Wai *et al.,* 2013)1 and 4.

For the sake of interpretability, COC41 is retained in component 1; as it possesses the higher loading. Secondly, visual checks identified that components 8, 9 and 10 each have only one variable loading on them; thus three of these components were eliminated from further data interpretation (Wai *et al.,* 2013). Therefore, only seven (7) components that account for 64.446% of the total variance, were considered for futher analysis.

Rotated Component Matrix[a]										
	Component									
	1	2	3	4	5	6	7	8	9	10
COC 12	0.857									
COC 10	0.747									
COC 39	0.727									
COC 11	0.726									

COC 16	0.660									
COC 19	0.647									
COC 41	0.602			0.539						
COC 37	0.545									
COC 30										
COC 34										
COC 2		0.864								
COC 3		0.828								
COC 33		0.618								
COC 17		0.615								
COC 32		0.603								
COC 18		0.564								
COC 8			0.815							
COC 9			0.680							
COC 29			0.543							
COC 13			0.538							
COC 7			0.528							
COC 21			0.518							
COC 14										
COC 26				0.782						

COC 28				0.717						
COC 27				0.601						
COC 6				0.542						
COC 15					0.652					
COC 31					0.536					
COC 4					0.510					
COC 23										
COC 38						0.773				
COC 20						0.546				
COC 24										
COC 22										
COC 25							0.747			
COC 35							0.677			
COC 36							0.567			
COC 1								0.729		
COC 40									0.643	
COC 5										0.855
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation.[a]										
a. Rotation converged in 63 iterations.										

Table 44: Rotated Component Matrix

For the sake of further discussion, it was necessary to allocate a new name to each of the components (Kim *et al.,* 2016). In reference to the extracted components in Table 44, the 10 components could be interpreted as follows:

- Lack of Motivation
- Incomplete Brief
- Project Risk Management
- Lack of Communication
- Professional Diversity
- Conflicting Interest
- Project Cost

These sub-factors were used to re-measure the variables in questions 1, 3 and 4 to determine the participants' perceptions in rating the level of agreement and the importance of the different variables during the early stages of the project and their significant level in conflict management. More analyses were conducted on these groups, in order to determine their reliabilities.

Reliability Test

According to Wai *et al.* (2013), Cronbach's alpha is commonly used as a measure of the internal consistency for how well the items in the set are correlated to each other. The Cronbach's alpha of 0.937 was achieved, which is greater than the recommended 0.70. The recorded Cronbach's alpha suggests that the reliability of the research instrument used was acceptable (Afolabi & Oyeyipo, 2017).

Reliability Statistics	
Cronbach's Alpha	No. of Items
0.937	35

Table 45: Cronbach's Alpha Test

Based on the new sub-objectives; and the following statistical analyses are presented:

- Descriptive Analysis
- Group Mean
- ANOVA
- Test of Normality
- Histogram
- Hypothesis Table

Descriptive Analysis

Table 46 below indicates the mean rating, standard deviation and the total number of participants that provided feedback on the reduced variables after exploratory analysis was performed. Based on the information provided on the table, 101 participants provided feedbacks and it can be observed that the mean scores range from 2.84 to 3.73. According to the perceptions of the participants, the possible cause of conflicts of the six variables (lack of motivation, incomplete brief, and project risk management, lack of communication, professional diversity and project cost) among FM specialists and design team is moderate while conflicting interpretation achieved a mean score of 2.84 meaning that its severity in terms of causing conflict was rated low.

Descriptive Statistics Table

	Mean	Std. Deviation	Analysis N
Lack of Motivation	3.05	.93010	101
Incomplete Brief	3.73	.78235	101
Project Risk Management	3.29	.78224	101
Lack of Communication	3.56	.79478	101
Professional Diversity	3.01	.84796	101
Conflicting Interpretation	2.84	1.09341	101
Project Cost	3.33	.76685	101

Objective 2 - Descriptive Table 46

In addition, the results of descriptive analysis was presented in figures as can be observed from figure 4 – 10.

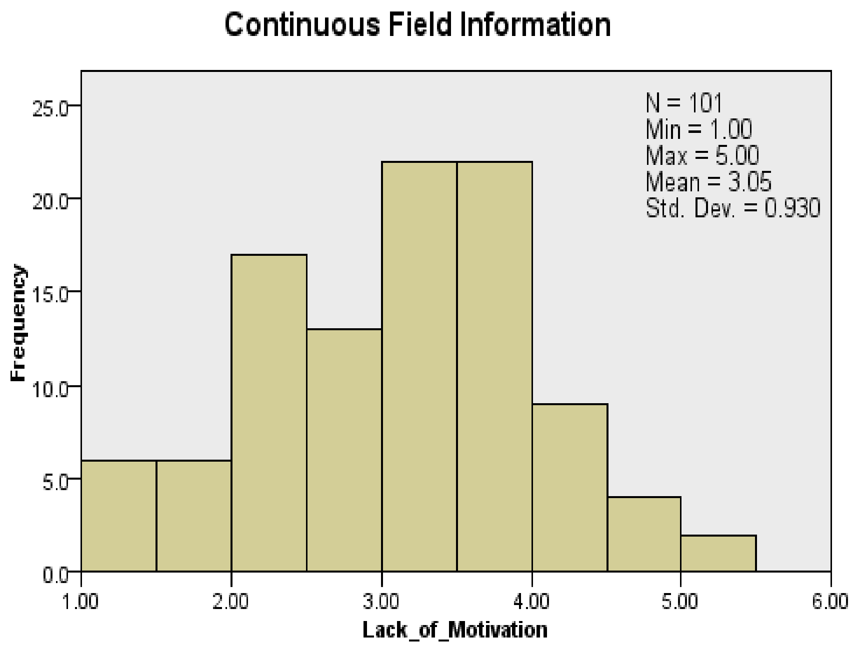

Figure 4: Lack of Motivation

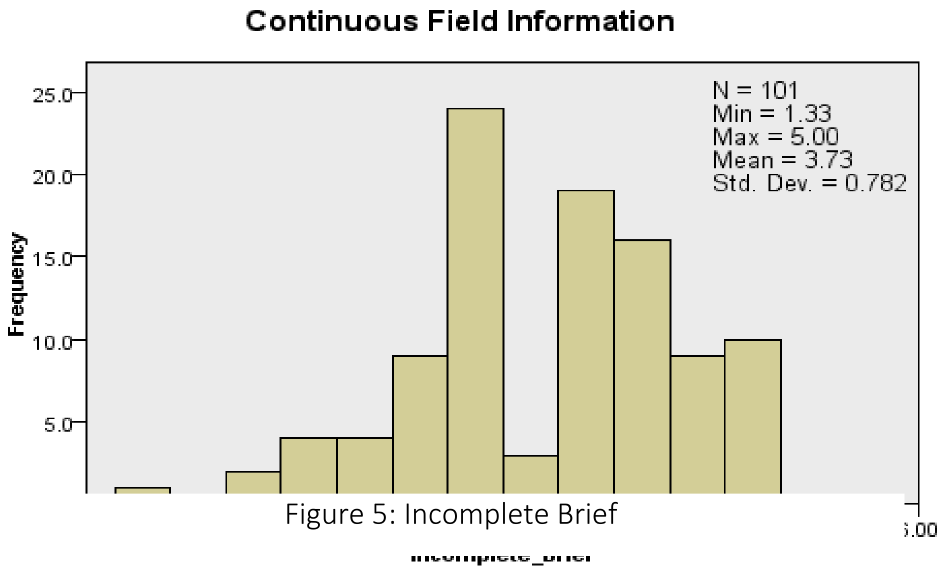

Figure 5: Incomplete Brief

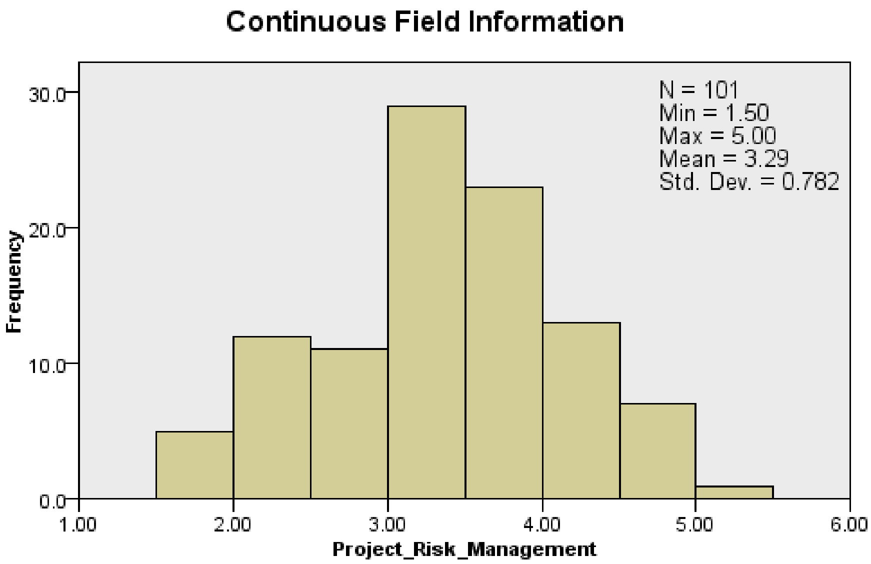

Figure 6: Project-Risk Management

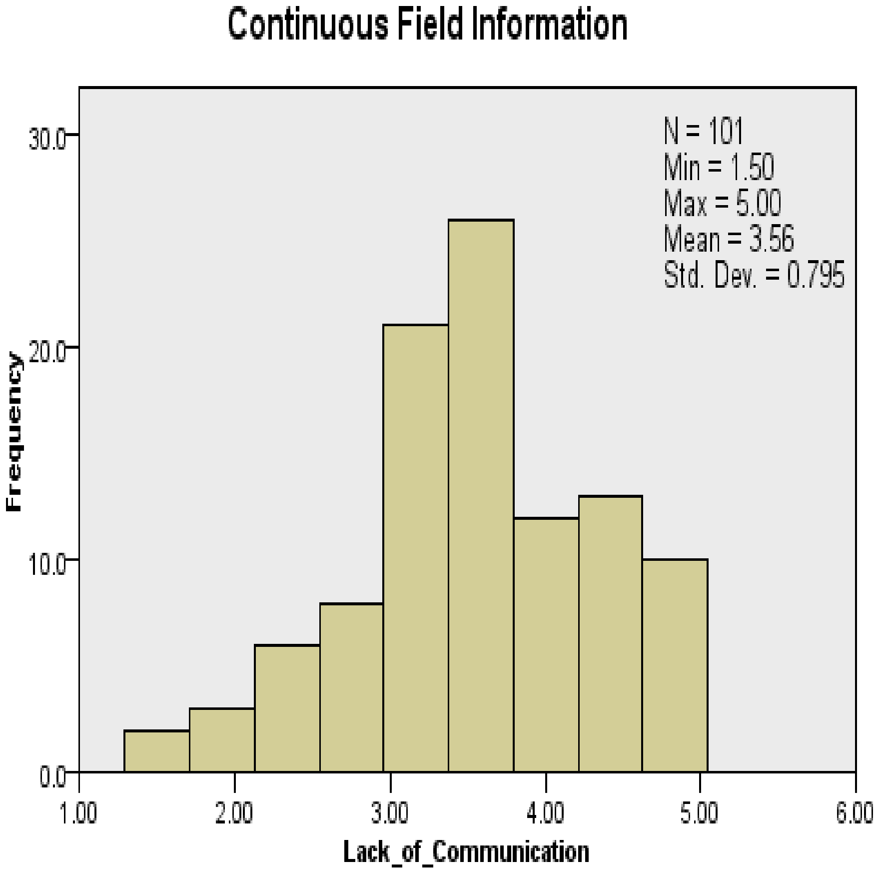

Figure 7: Lack of Communication

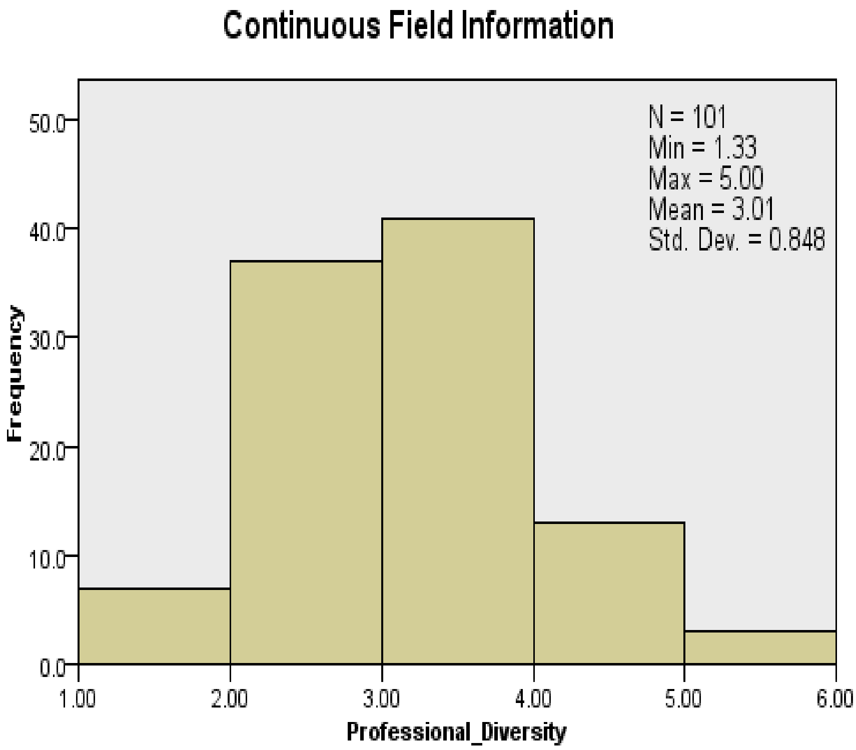

Figure 8: Professional Diversity

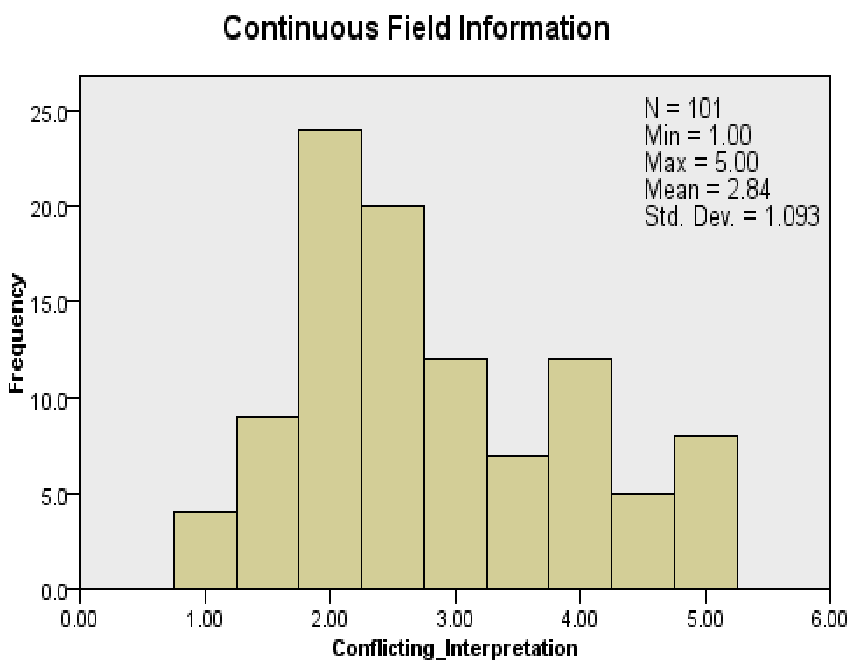

Figure 9: Conflicting Interpretation

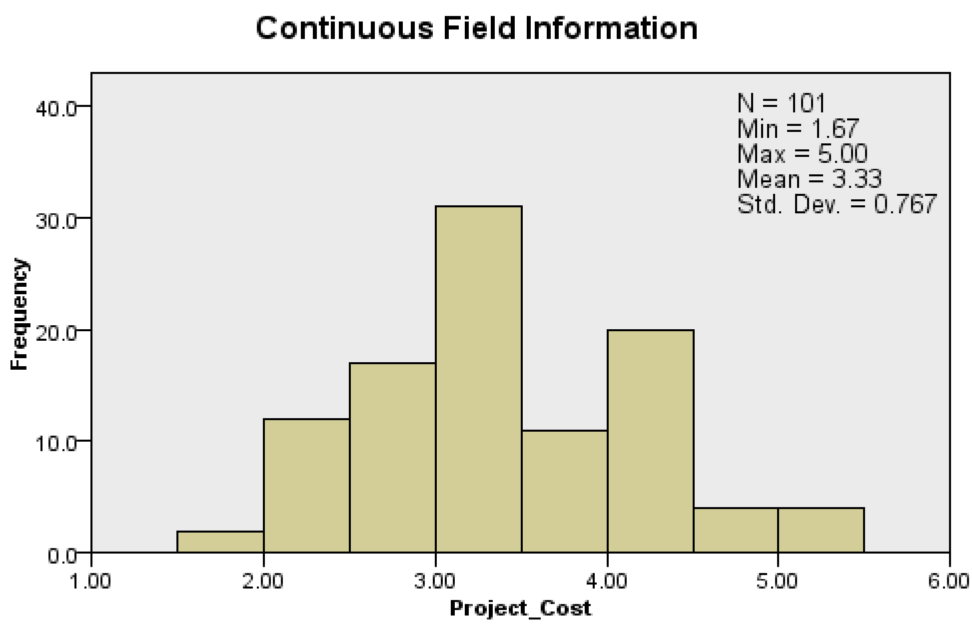

Figure 10: Project Cost

Group Mean

According to Table 47 below, the following could be observed:

Group1: Five new variables received mean scores of greater than 3 but less than 4 meaning that group participants' perceptions were moderate in rating the possible causes of conflicts among FM specialists and design team; while 2 received mean scores less than 3, but greater than 2, meaning that the possibility of causing conflicts is low.

Group2: Similarly, five variables received mean scores of greater than 3, but less than 4; while 2 variables received mean scores greater than 2, but less than 3.

Group3: All seven variables received mean scores of greater than 3 but less than 4, meaning that the causes of conflicts are moderate.

Group4: Three variables received mean scores of greater than 3 but less than 4; while four variables received mean scores of greater than 2, but less than 3.

Therefore, it can be inferred that participants' perceptions when rating the causes of conflicts were between low and moderate.

Q1_Coded		Lack of Motivation	Incomplete Brief	Project Risk Management	Lack of Communication	Professional Diversity	Conflicting Interpretation	Project Cost
1.00	Mean	3.50	3.99	3.54	3.69	3.14	2.92	3.24
	Std. Deviation	0.92	0.79	0.72	0.82	0.99	1.17	0.80
	Std. Error of Mean	0.18	0.16	0.14	0.16	0.20	0.23	0.16
2.00	Mean	3.23	3.61	3.19	3.57	3.03	2.92	3.45
	Std. Deviation	0.72	0.79	0.66	0.64	0.69	1.19	0.80
	Std. Error of Mean	0.15	0.16	0.13	0.13	0.14	0.24	0.16
3.00	Mean	3.17	3.92	3.53	3.68	3.14	3.02	3.51
	Std. Deviation	0.83	0.69	0.69	0.72	0.76	1.05	0.78
	Std. Error of Mean	0.17	0.14	0.14	0.15	0.16	0.22	0.16
	Mean	2.43	3.44	2.95	3.34	2.78	2.55	3.17

4.00	Std. Deviation	0.89	0.76	0.88	0.93	0.89	0.98	0.69
	Std. Error of Mean	0.16	0.14	0.16	0.17	0.17	0.18	0.13
Total	Mean	3.05	3.73	3.29	3.56	3.01	2.84	3.33
	Std. Deviation	0.93	0.78	0.78	0.79	0.85	1.09	0.77
	Std. Error of Mean	0.09	0.08	0.08	0.08	0.08	0.11	0.08

Table 47: New Group Mean

One-Way Analysis of Variance (ANOVA)

One-way analysis of variance was performed twice. Firstly, an ANOVA was conducted (table 48a below) on individual variables under the new headings to determine if they are statistically significant; while the second ANOVA was conducted on group mean. However, the following was found:

Lack of motivation: The following causes of conflicts were found to be statistically significant with moderately low effect sizes ranging from 0.087 to 0.157. Therefore, it can be confirmed that the null hypothesises, which states that these variables cause conflicts among FM's specialists and the design team were rejected.

COC10 (differences in attitudes) with $F(3, 96) = 4.509$ and P-value = 0.005

COC11 (lack of trust) with $F(3, 95) = 4.848$ and P-value = 0.003

COC12 (personality issues) with $F(3, 96) = 6.628$ and P-value = 0.001

COC19 (lack of team cohesion) with $F(3, 97) = 3.085$ and P-value = 0.031

COC37 (lack of shared leadership and accountability) with $F(3, 97) = 4.852$ and P-value = 0.003.

COC39 (conflicting personal values with organisation values) with $F(3, 97) = 5.627$ and P-value = 0.001

COC41 (poor relationship management among integrated design team members) with $F(3, 97) = 6.040$ and P-value = .001

However, COC16 with $F(3, 96) = 2.509$ and P-value = 0.063 was found to be not statistically significant with moderately low effect size of 0.073. Therefore, the null hypothesis is accepted, meaning that the absence of team spirit among the members of the project (COC16) causes conflicts among the FM's specialists and the design team.

Incomplete Brief: Only COC32 with $F(3, 97) = 4.219$ and P-value = 0.008 were found to be statistically significant and the null hypothesis (incomplete project information) does not cause conflicts among FM specialists and the design team. However, COC2, COC3, COC17, COC18 and COC33 were found to be not statistically significant, with varying F- values and p-values: hence, the null hypothesis (undefined projects goals, undefined project priorities, inadequate brief, and lack of client specification and inadequacy of technical specifications) were accepted.

Project Risk Management: COC9 F (3, 94) =4.958 and P-value = 0.003, COC13 F (3, 96) = 2.813 and P-value = 0.043 and COC21 F (3, 97) = 3.375 and P-value = 0.021 were found to be statistically significant and the null hypotheses (poor risk management, unrealistic client expectation and determination and poor interpretation of drawings by client) were rejected; while COC7, COC8 and COC29 were found to be not statistically significant with p-value > 0.05, hence, the null hypothesis (unrealistic service delivery, unfair risk allocation and undefined channel of communication) were accepted as the cause of conflicts among the FM specialists and the design team.

Lack of Communication: All the variables under the lack of communication were found to be not statistically significant with varying F – values and P-values. Hence, the null hypotheses were accepted that inadequate design/design error (COC6), lack of co-ordination (COC26), lack of collaboration during design development process (COC27) and poor communication among integrated design team members (COC28) were found to be causing the conflicts between the FM specialists and the design team.

Professional Diversity: COC15 with F (3, 97) = 3.406 and P-value = 0.021 was found to be significant; hence the null hypothesis (diversity in expertise of project participants) was rejected. However, COC4 (professional culture problems) and COC31 (interdependency of participants) were found not to be statistically significant with varying F-values and P-values, hence null hypotheses were retained, as the causes of the conflicts among FM specialists and the design team.

Conflicting Interpretation: COC20 (unhealthy workplace completion) and COC38 (misunderstanding of the local statutory compliance) were both found to be not statistically significant hence null hypothesises were retained as possible causes of conflicts among FM specialists and design team.

Project Cost: COC25 (budget and time constraints) COC35 (introduction of design innovation) and COC36 (lack of continuous improvement) were found not to be statistically significant with varying F-values and P-values greater than 0.05, hence, null hypothesises were retained as the possible causes of conflicts among FM's specialists and the design team.

ANOVA Table							
			Sum of Squares	Df	Mean Square	F	Sig.
Lack of Motivation Variables							
COC 10 * Q1_Coded	Between Groups	(Combined)	19.905	3	6.635	4.509	0.005
	Within Groups		141.255	96	1.471		
	Total		161.160	99			

COC 11 * Q1_Coded	Between Groups	(Combined)	23.557	3	7.852	4.848	0.003
	Within Groups		153.857	95	1.620		
	Total		177.414	98			
COC 12 * Q1_Coded	Between Groups	(Combined)	28.372	3	9.457	6.628	0.000
	Within Groups		136.988	96	1.427		
	Total		165.360	99			
COC 16 * Q1_Coded	Between Groups	(Combined)	10.177	3	3.392	2.509	0.063
	Within Groups		129.783	96	1.352		
	Total		139.960	99			
COC 19 * Q1_Coded	Between Groups	(Combined)	10.170	3	3.390	3.085	0.031
	Within Groups		106.602	97	1.099		
	Total		116.772	100			
COC 37 * Q1_Coded	Between Groups	(Combined)	16.584	3	5.528	4.852	0.003
	Within Groups		110.505	97	1.139		
	Total		127.089	100			
COC 39 * Q1_Coded	Between Groups	(Combined)	23.456	3	7.819	5.627	0.001
	Within Groups		134.781	97	1.389		
	Total		158.238	100			
COC 41 * Q1_Coded	Between Groups	(Combined)	20.751	3	6.917	6.040	0.001
	Within Groups		111.091	97	1.145		
	Total		131.842	100			
Incomplete Brief Variables							
COC 2 * Q1_Coded	Between Groups	(Combined)	1.468	3	0.489	0.442	0.724
	Within Groups		106.292	96	1.107		
	Total		107.760	99			
COC 3 * Q1_Coded	Between Groups	(Combined)	2.742	3	0.914	0.947	0.421
	Within Groups		92.648	96	0.965		
	Total		95.390	99			
COC 17 * Q1_Coded	Between Groups	(Combined)	11.118	3	3.706	3.582	0.017
	Within Groups		100.348	97	1.035		
	Total		111.465	100			
COC 18 * Q1_Coded	Between Groups	(Combined)	5.186	3	1.729	1.559	0.204
	Within Groups		107.566	97	1.109		

	Total		112.752	100			
COC 32 * Q1_Coded	Between Groups	(Combined)	13.301	3	4.434	4.219	0.008
	Within Groups		101.927	97	1.051		
	Total		115.228	100			
COC 33 * Q1_Coded	Between Groups	(Combined)	5.333	3	1.778	1.769	0.158
	Within Groups		97.498	97	1.005		
	Total		102.832	100			
Project Risk Management Variables							
COC 7 * Q1_Coded	Between Groups	(Combined)	2.928	3	0.976	0.750	0.525
	Within Groups		123.618	95	1.301		
	Total		126.545	98			
COC 8 * Q1_Coded	Between Groups	(Combined)	6.706	3	2.235	1.699	0.172
	Within Groups		124.951	95	1.315		
	Total		131.657	98			
COC 9 * Q1_Coded	Between Groups	(Combined)	17.213	3	5.738	4.958	0.003
	Within Groups		108.787	94	1.157		
	Total		126.000	97			
COC 13 * Q1_Coded	Between Groups	(Combined)	5.899	3	1.966	2.813	0.043
	Within Groups		67.101	96	0.699		
	Total		73.000	99			
COC 21 * Q1_Coded	Between Groups	(Combined)	11.981	3	3.994	3.375	0.021
	Within Groups		114.772	97	1.183		
	Total		126.752	100			
COC 29 * Q1_Coded	Between Groups	(Combined)	6.410	3	2.137	1.730	0.166
	Within Groups		119.808	97	1.235		
	Total		126.218	100			
Lack of Communication Variables							
COC 6 * Q1_Coded	Between Groups	(Combined)	2.695	3	0.898	0.751	0.525
	Within Groups		111.284	93	1.197		
	Total		113.979	96			
COC 26 * Q1_Coded	Between Groups	(Combined)	2.384	3	0.795	0.748	0.526

	Within Groups		99.820	94	1.062		
	Total		102.204	97			
COC 27 * Q1_Coded	Between Groups	(Combined)	1.677	3	0.559	0.539	0.656
	Within Groups		99.483	96	1.036		
	Total		101.160	99			
COC 28 * Q1_Coded	Between Groups	(Combined)	5.740	3	1.913	2.177	0.096
	Within Groups		84.370	96	0.879		
	Total		90.110	99			
Professional Diversity Variables							
COC 4 * Q1_Coded	Between Groups	(Combined)	8.832	3	2.944	2.047	0.112
	Within Groups		138.078	96	1.438		
	Total		146.910	99			
COC 15 * Q1_Coded	Between Groups	(Combined)	8.078	3	2.693	3.406	0.021
	Within Groups		76.694	97	0.791		
	Total		84.772	100			
COC 31 * Q1_Coded	Between Groups	(Combined)	3.849	3	1.283	1.096	0.355
	Within Groups		113.517	97	1.170		
	Total		117.366	100			
Conflict Interpretation Variables							
COC 20 * Q1_Coded	Between Groups	(Combined)	7.341	3	2.447	1.454	0.232
	Within Groups		163.213	97	1.683		
	Total		170.554	100			
COC 38 * Q1_Coded	Between Groups	(Combined)	1.361	3	0.454	0.314	0.815
	Within Groups		138.639	96	1.444		
	Total		140.000	99			
Project Cost Variables							
COC 25 * Q1_Coded	Between Groups	(Combined)	7.713	3	2.571	2.539	0.061
	Within Groups		97.197	96	1.012		
	Total		104.910	99			
COC 35 * Q1_Coded	Between Groups	(Combined)	0.590	3	0.197	0.193	0.901
	Within Groups		98.777	97	1.018		
	Total		99.366	100			

COC 36 * Q1_Coded	Between Groups	(Combined)	3.895	3	1.298	1.262	0.292
	Within Groups		97.741	95	1.029		
	Total		101.636	98			

Table 48a: EFA ANOVA Test

Table 48b below, shows the group ANOVA test. Based on the F-test in Table 48b below, it can be declared that lack of motivation with F (3, 97) = 8.07 and p-value .00, incomplete brief with F (3, 97) = 3.0 and p-value = 0.03, and project-risk management with F (3, 97) = 3.83 and p-value = 0.01 are statistically significant; hence the null hypotheses were rejected; while the lack of communication with F (3, 97) = 1.10 and p-value = 0.35, professional diversity with F (3, 97) = 1.10 and p-value = 0.35, conflicting interpretation with F (3, 97) = .97 and p-value = 0.41 and project cost with F (3, 97) =1.14 and p-value = 0.34 are not statistically significant, hence, the null hypotheses were retained, as the possible causes of conflicts among FM specialists and the design team.

The ANOVA Test

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Lack of Motivation * Q1_Coded	Between Groups	(Combined)	17.28	3.00	5.76	8.07	0.00
	Within Groups		69.23	97.00	0.71		
	Total		86.51	100.00			
Incomplete Brief * Q1_Coded	Between Groups	(Combined)	5.30	3.00	1.77	3.07	0.03
	Within Groups		55.91	97.00	0.58		
	Total		61.21	100.00			
Project Risk Management * Q1_Coded	Between Groups	(Combined)	6.48	3.00	20.16	3.83	0.01
	Within Groups		54.71	97.00	0.56		
	Total		61.19	100.00			
Lack of Communication * Q1_Coded	Between Groups	(Combined)	2.09	3.00	.70	1.10	0.35
	Within Groups		61.08	97.00	0.63		
	Total		63.17	100.00			
Professional Diversity * Q1_Coded	Between Groups	(Combined)	2.36	3.00	0.79	1.10	0.35
	Within Groups		69.54	97.00	0.72		
	Total		71.90	100.00			
	Between Groups	(Combined)	3.47	3.00	1.16	0.97	0.41

Conflicting Interpretation * Q1_Coded	Within Groups		116.08	97.00	1.20		
	Total		119.55	100.00			
Project Cost * Q1_Coded	Between Groups	(Combined)	2.00	3.00	0.67	1.14	0.34
	Within Groups		56.807	97	0.586		
	Total		58.805	100			

Table 48b: Group ANOVA Test

Impact of Causes of Conflicts according to Project Stages

Lack of Motivation: Inception Stage

Figure 11 - 15 represent descriptive analysis based on participants' feedback regarding possible conflict among FM specialists and design team due to lack of motivation. According to descriptive analysis and reference to figure 7, 3.21 was the highest mean score achieved meaning that participants agreed that lack of motivation would cause conflict among FM specialists and design team during inception stage (PLC1).

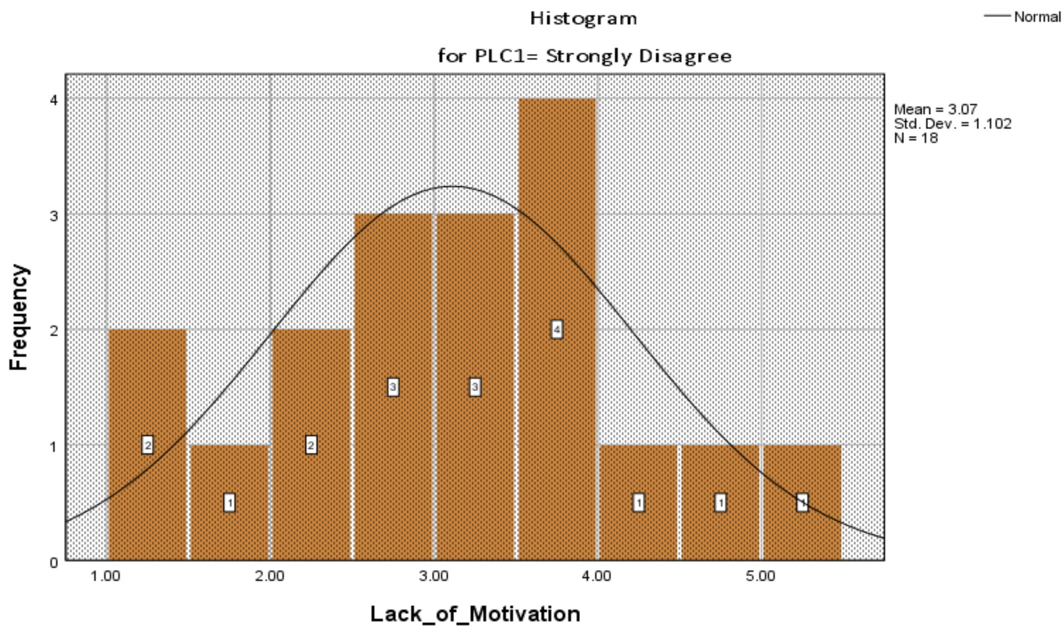

Figure 11: PLC1 - Strongly Disagree

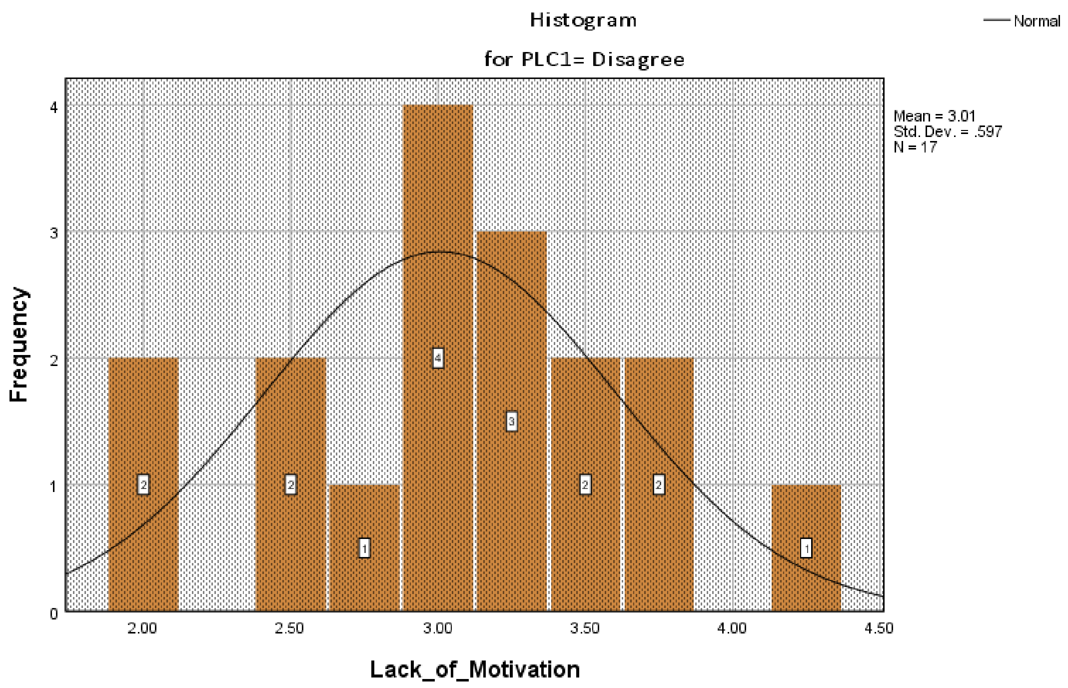

Figure 12: PLC 1- Disagree

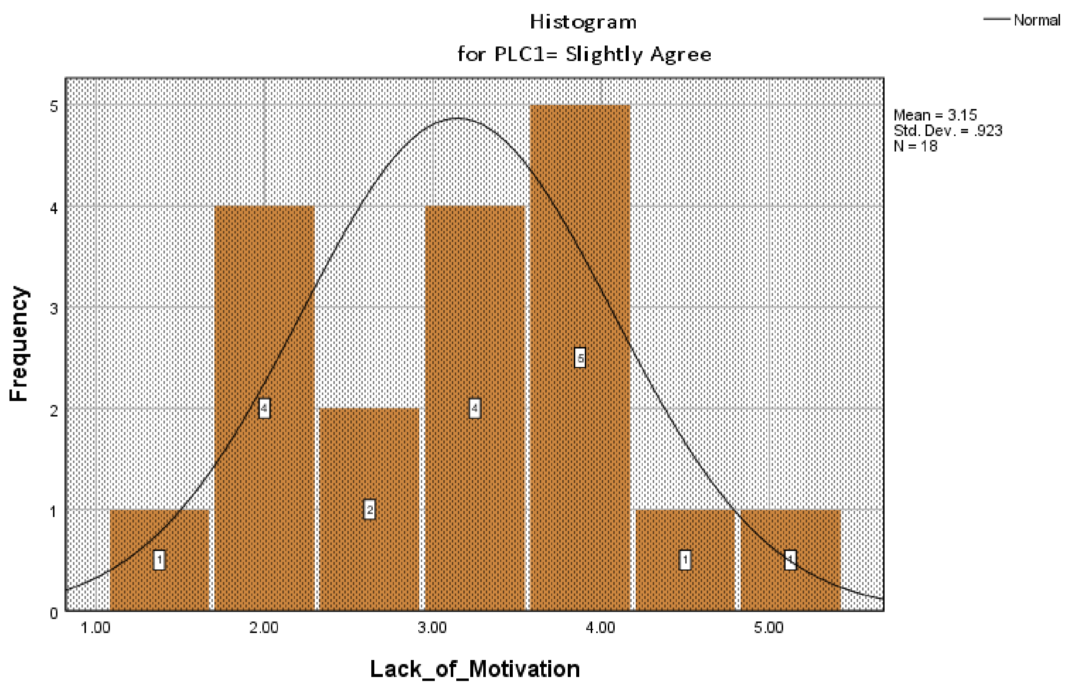

Figure 13: PLC1 - Slightly Agree

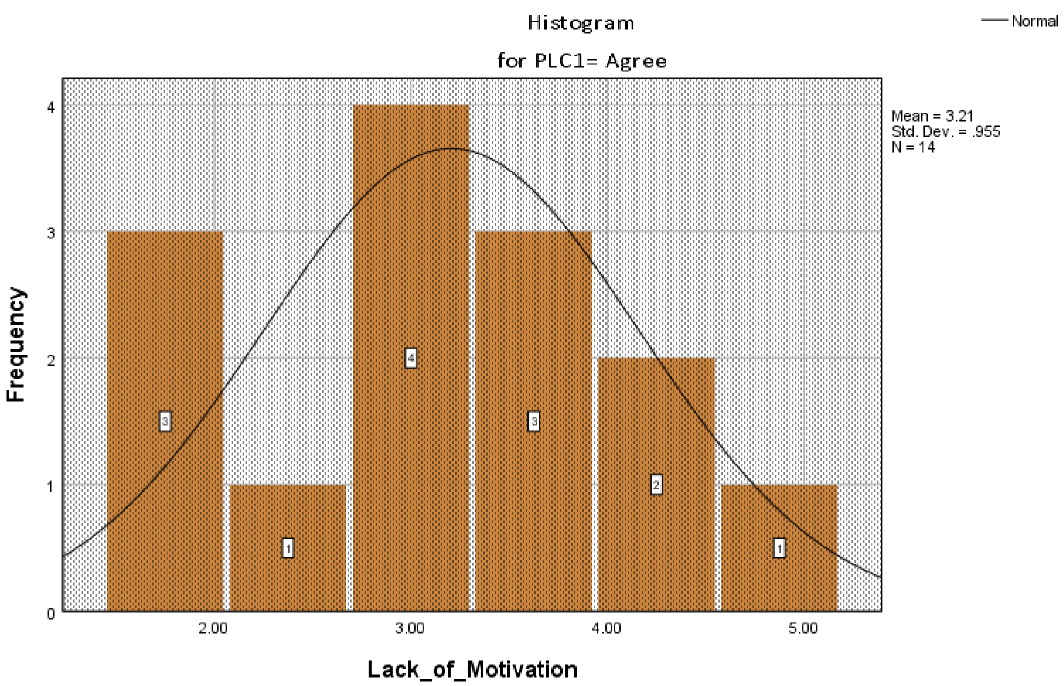

Figure 14: PLC1 - Agree

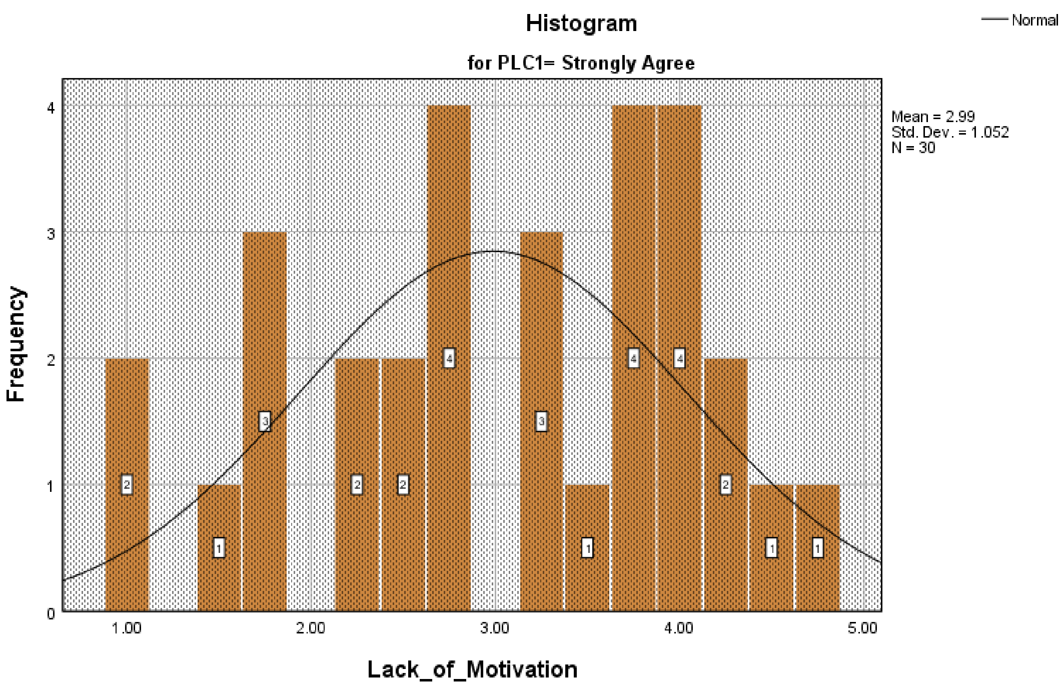

Figure 15: PLC1 - Strongly Agree

Lack of Motivation: Concept and Viability

In reference to Figure 16 - 20, the highest descriptive mean score achieved was 3.19 meaning that participants disagreed that lack of motivation would cause conflict among FM specialists and design team during concept and viability study.

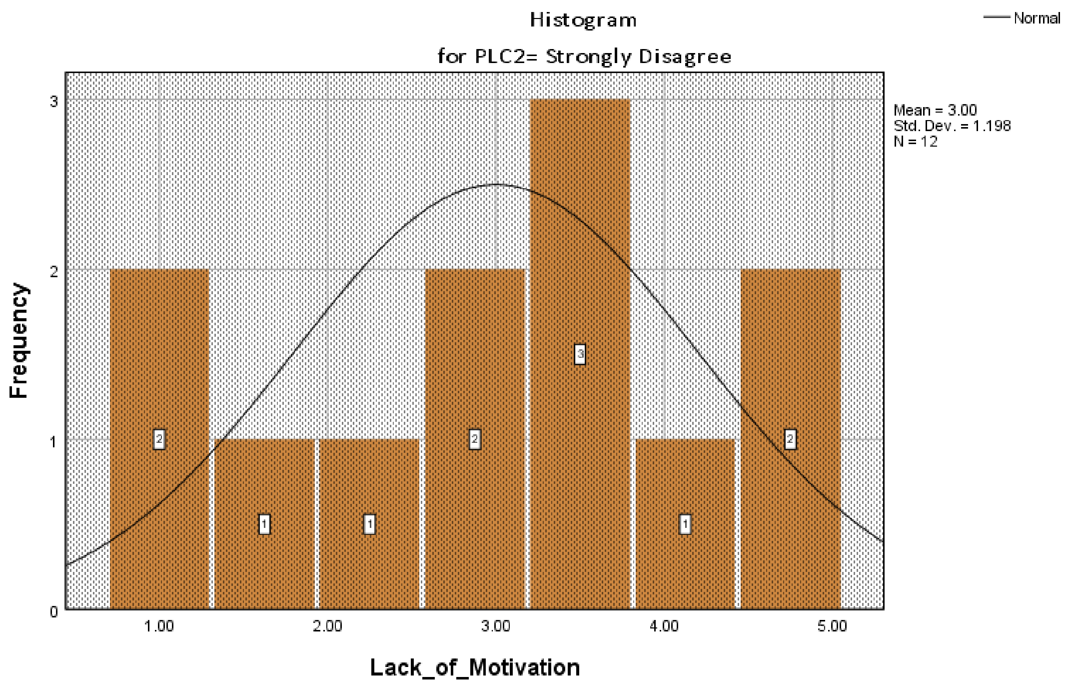

Figure 16: PLC2 - Strongly Disagree 1

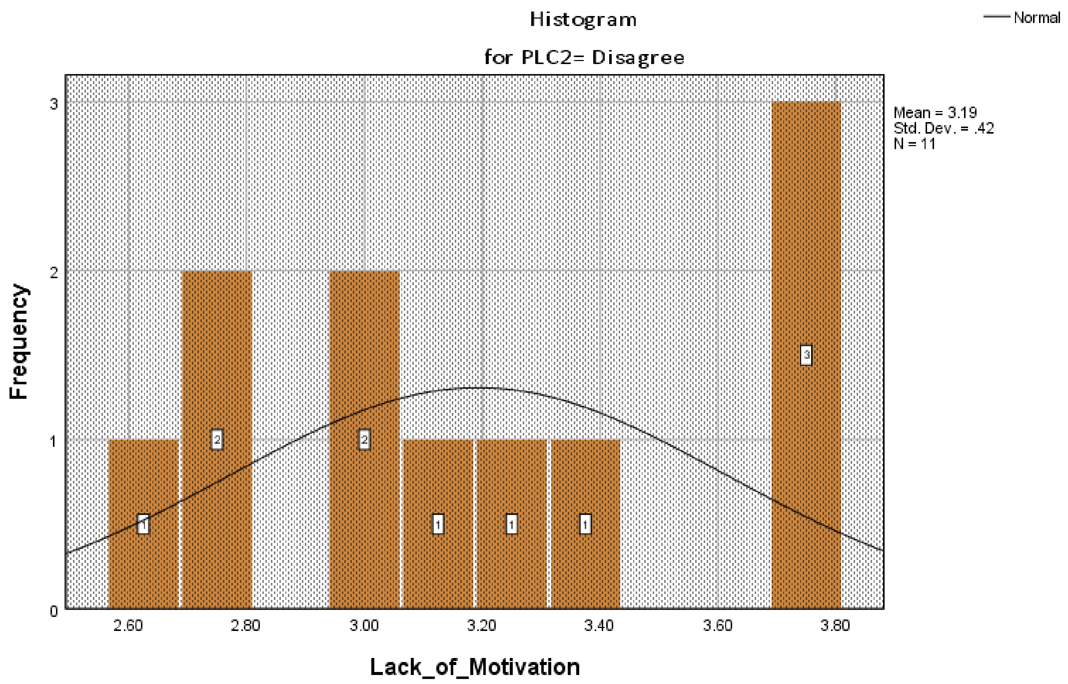

Figure 17: PLC 2 - Disagree 1

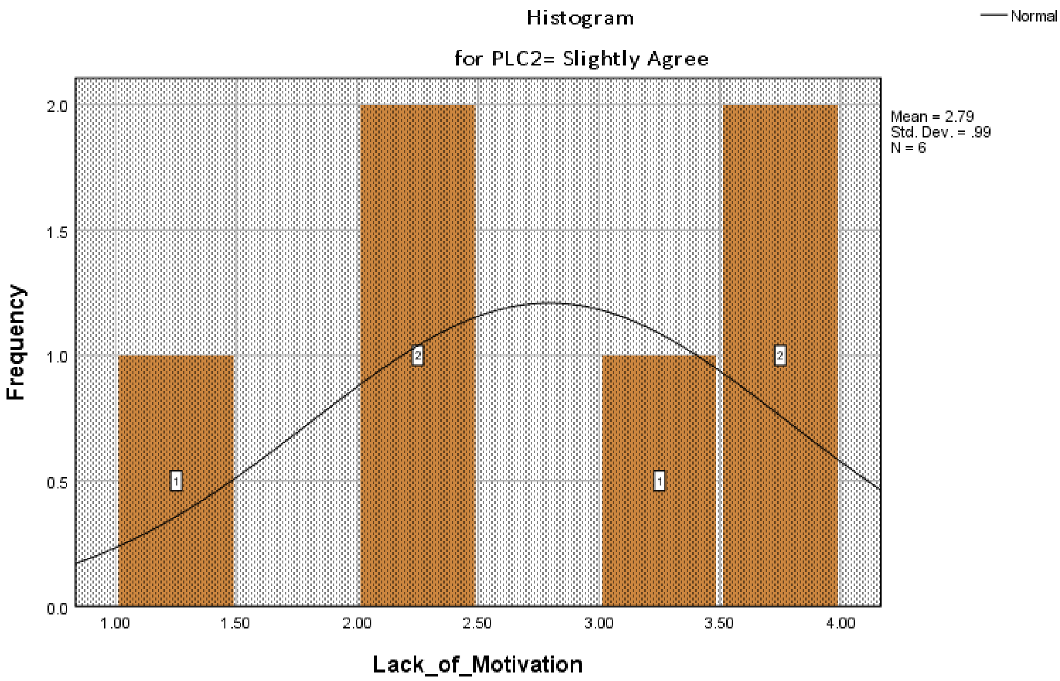

Figure 18: PLC 2 - Slightly Agree

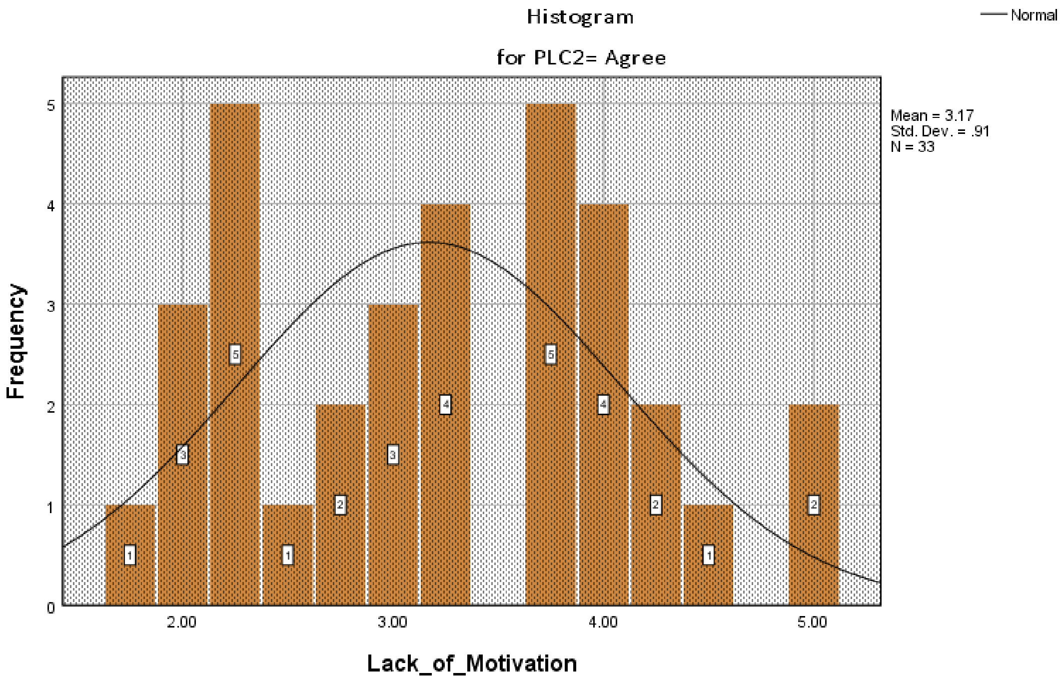

Figure 19: PLC 2 - Agree

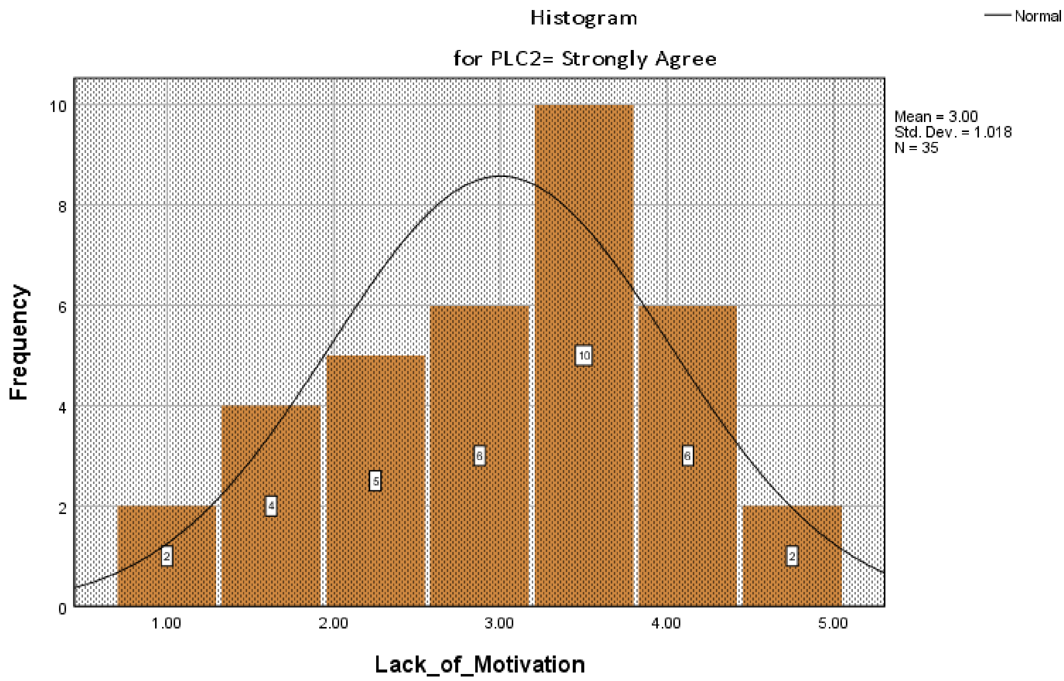

Figure 20: PLC 2: Strongly Agree

Lack of Motivation: PLC 3

In reference to figure 21 -24, the highest descriptive mean score achieved was 3.36 meaning that participants strongly agreed that lack of motivation would cause conflict among FM specialists and design team during design development stage.

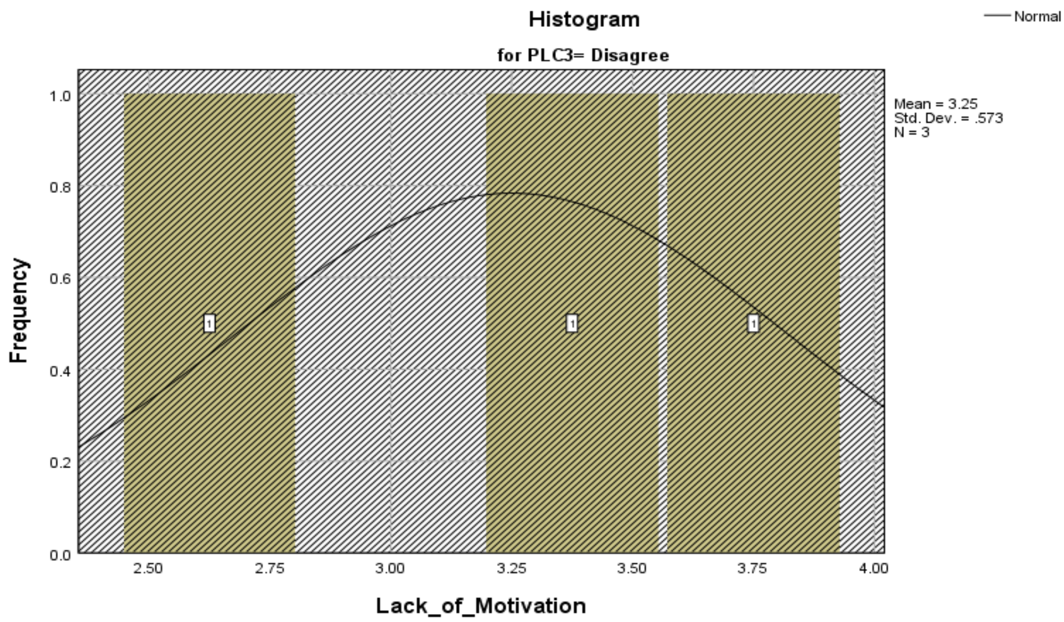

Figure 21: PLC 3: Disagree

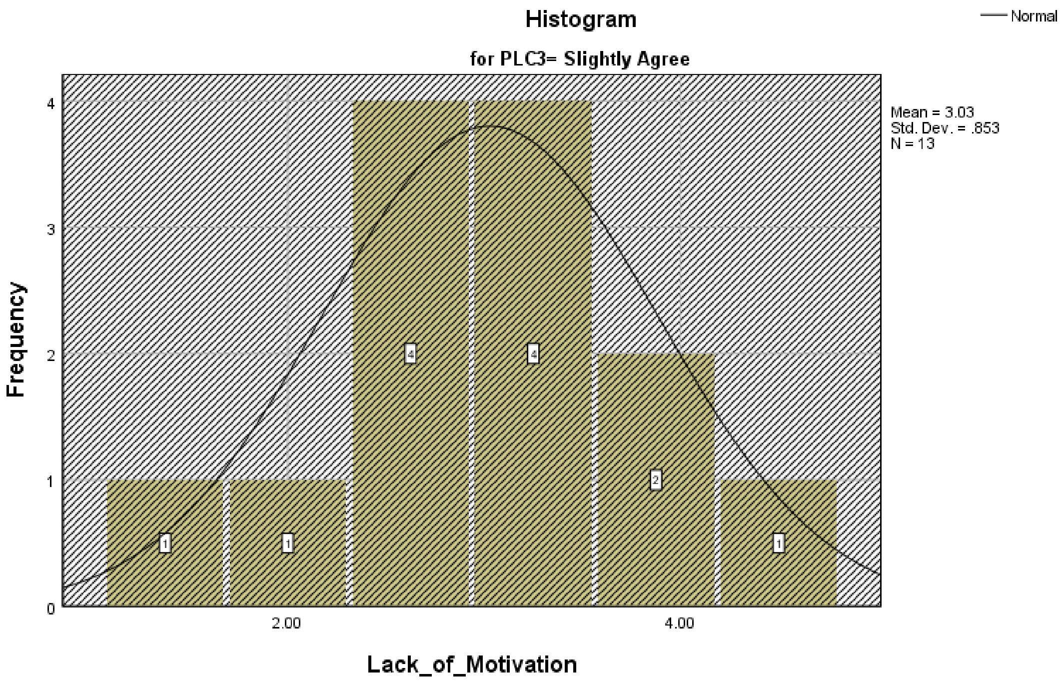

Figure 22: PLC 3 - Slightly Agree

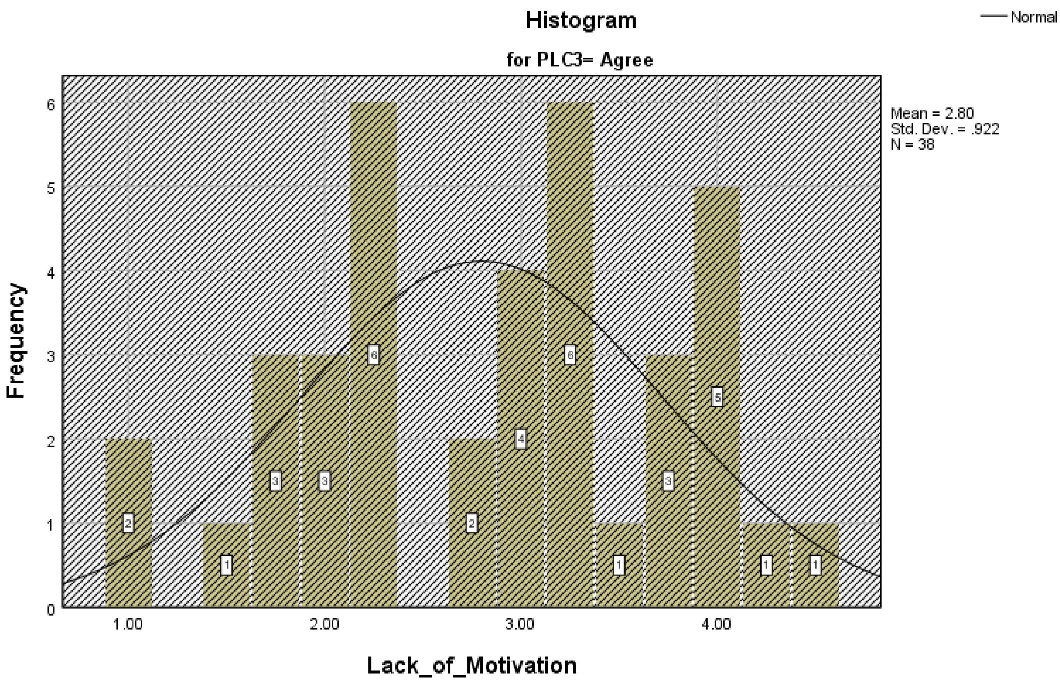

Figure 23: PLC 3 - Agree

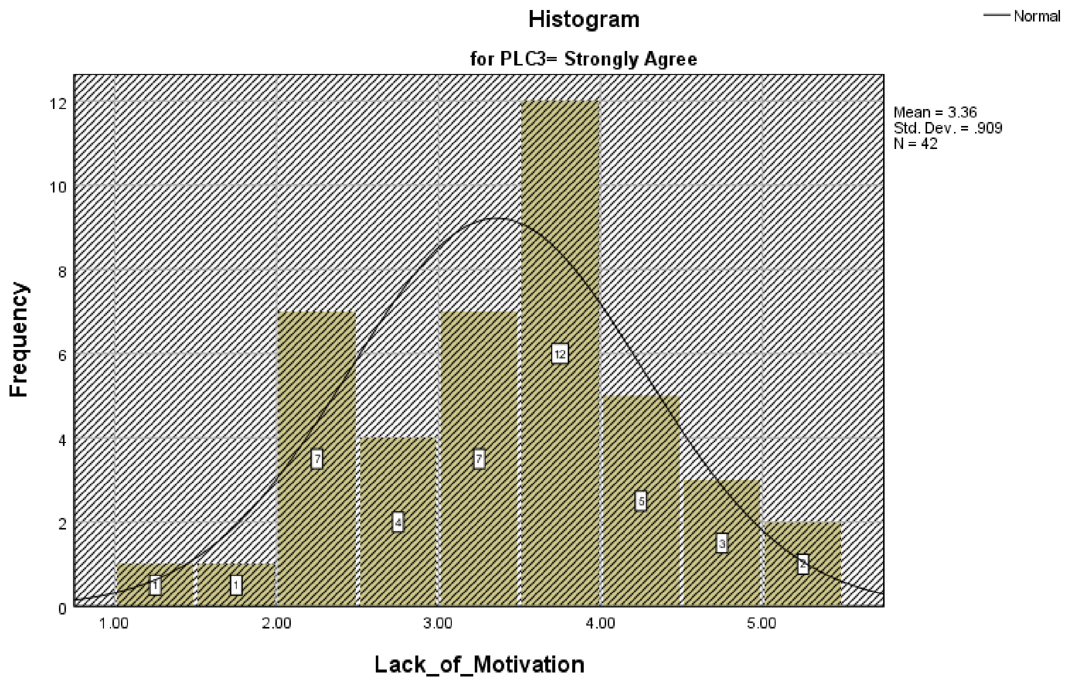

Figure 24: PLC 3 - Strongly Agree

Lack of Motivation: PLC 4

In reference to figure 25 - 29, the highest descriptive mean score achieved was 3.31 meaning that participants disagreed that lack of motivation would cause conflict among FM specialists and design team during documentation and procurement stage.

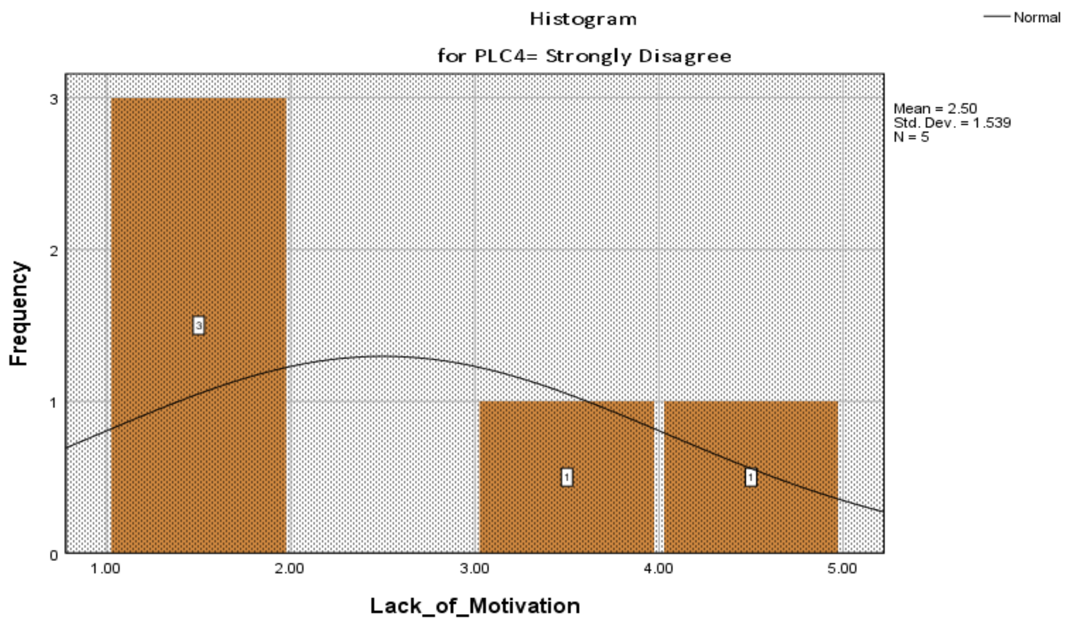

Figure 25: PLC 4 - Strongly Disagree

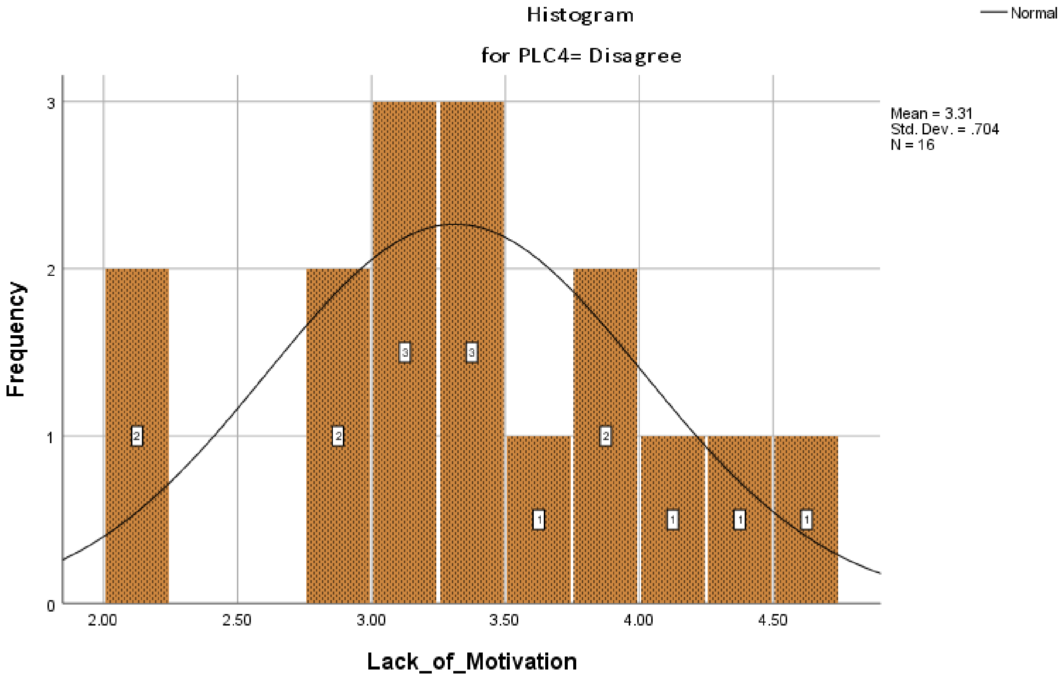

Figure 26: PLC4 - Disagree

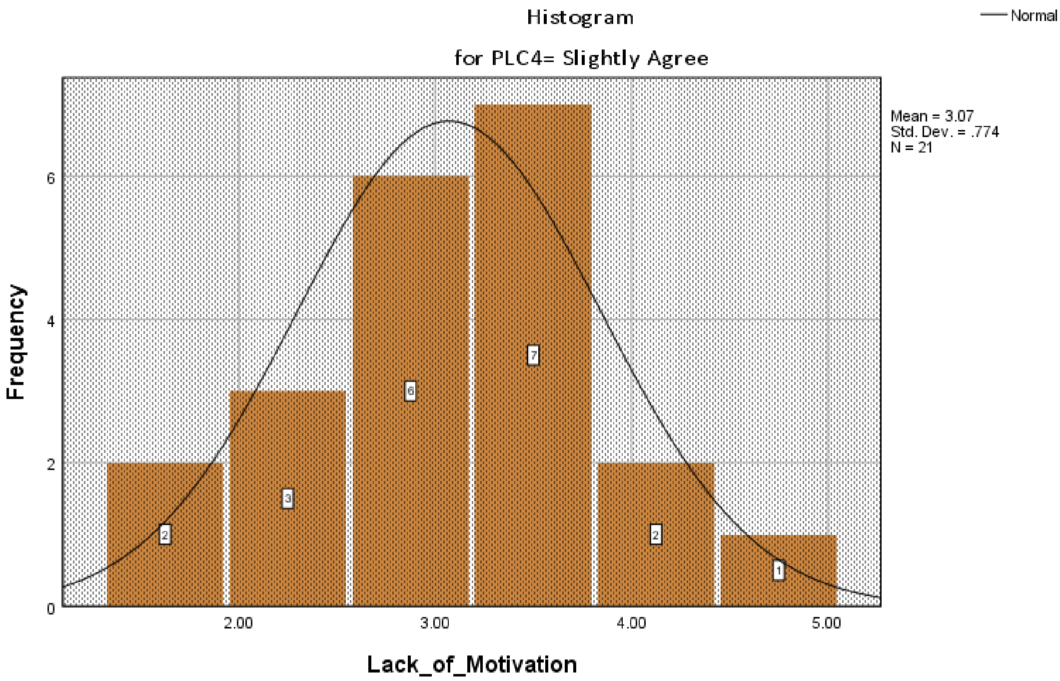

Figure 27: PLC 4 - Slightly Agree

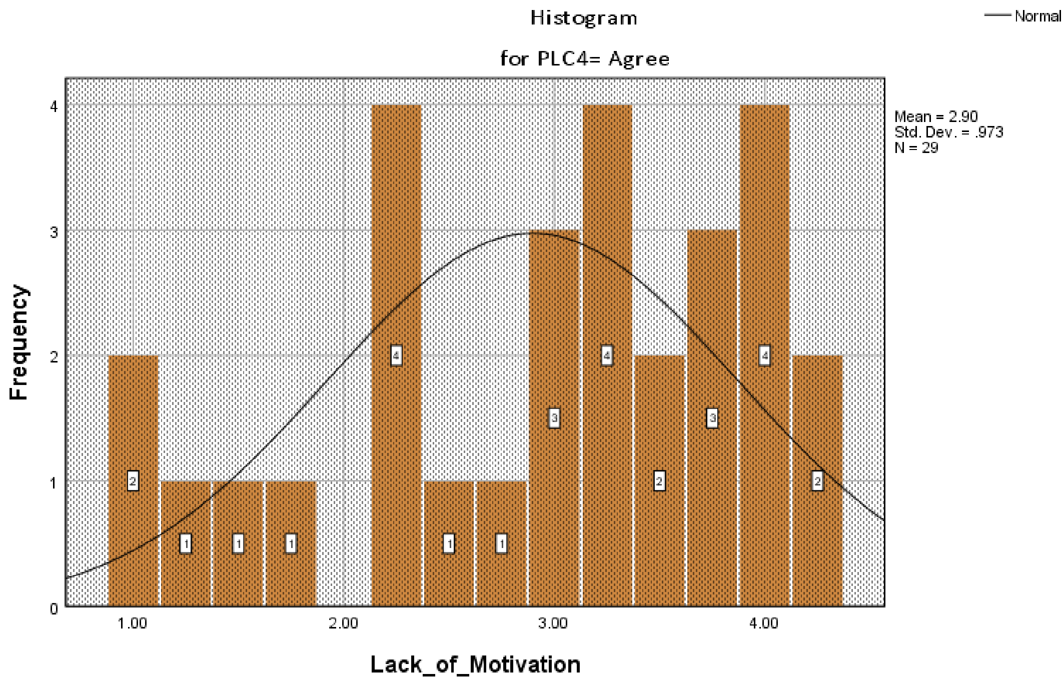

Figure 28: PLC 4 - Agree

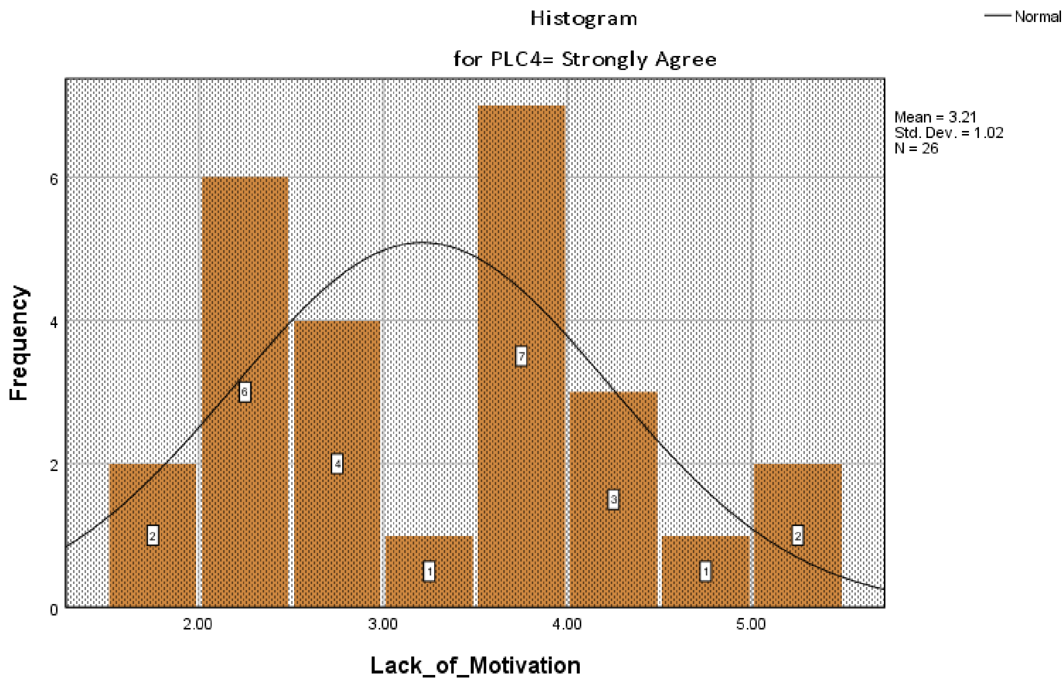

Figure 29: PLC 4 - Strongly Agree

Lack of Motivation: PLC 5

In reference to figure 30 - 34, the highest descriptive mean score achieved was 3.27 meaning that participants agreed that lack of motivation would cause conflict among FM specialists and design team during construction stage.

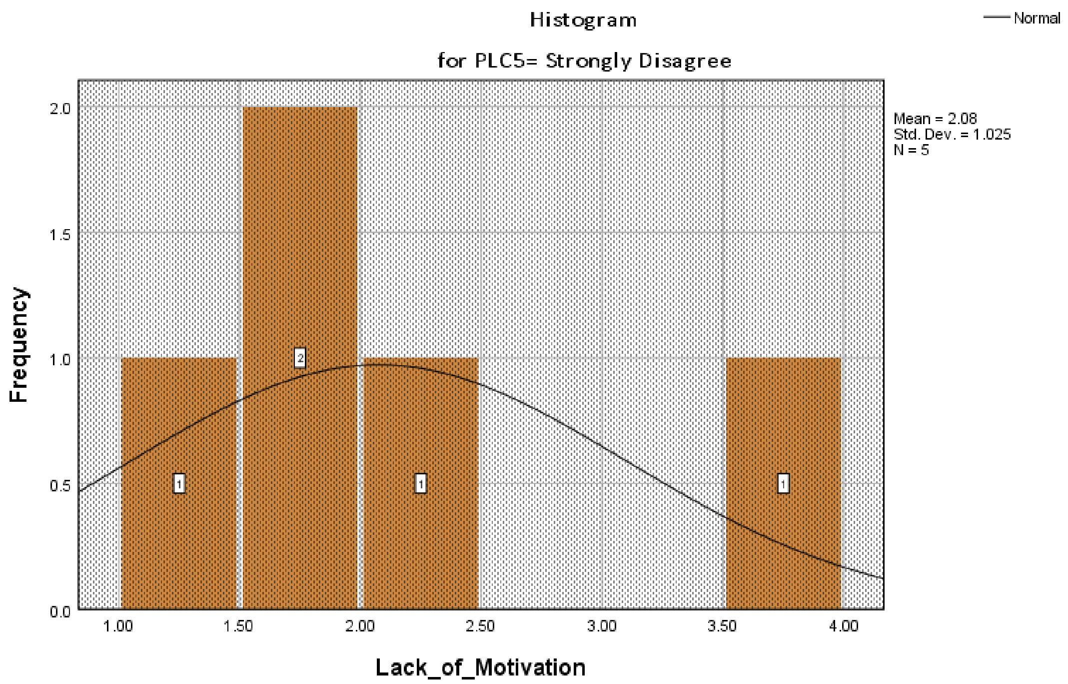

Figure 30: PLC5 - Strongly Disagree

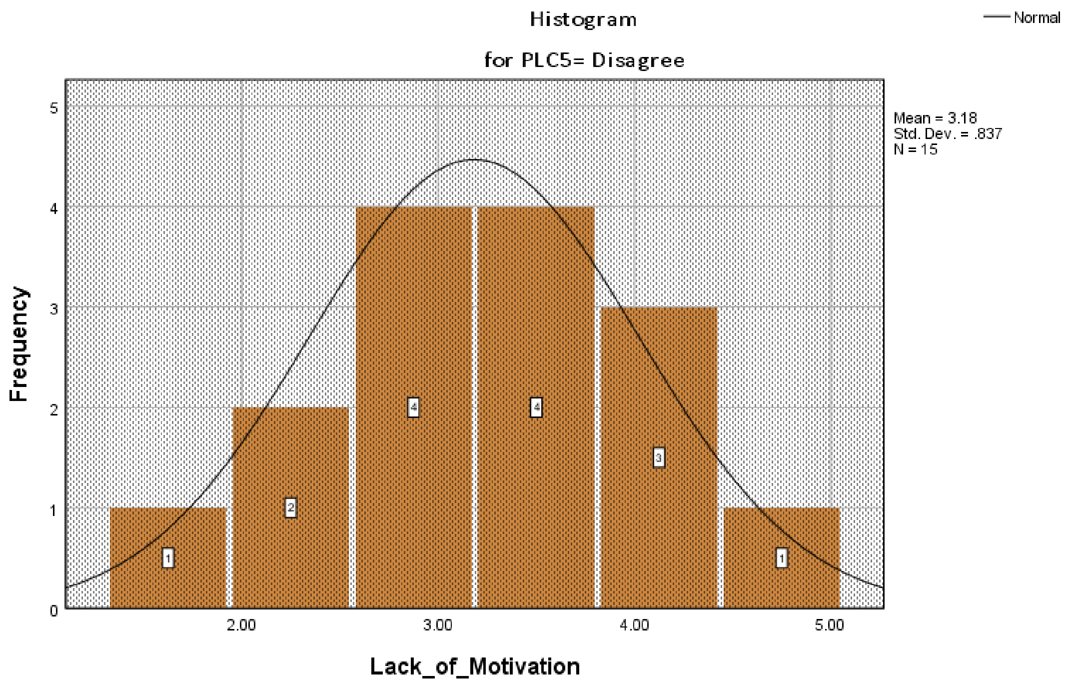

Figure 31: PLC 5 - Disagree

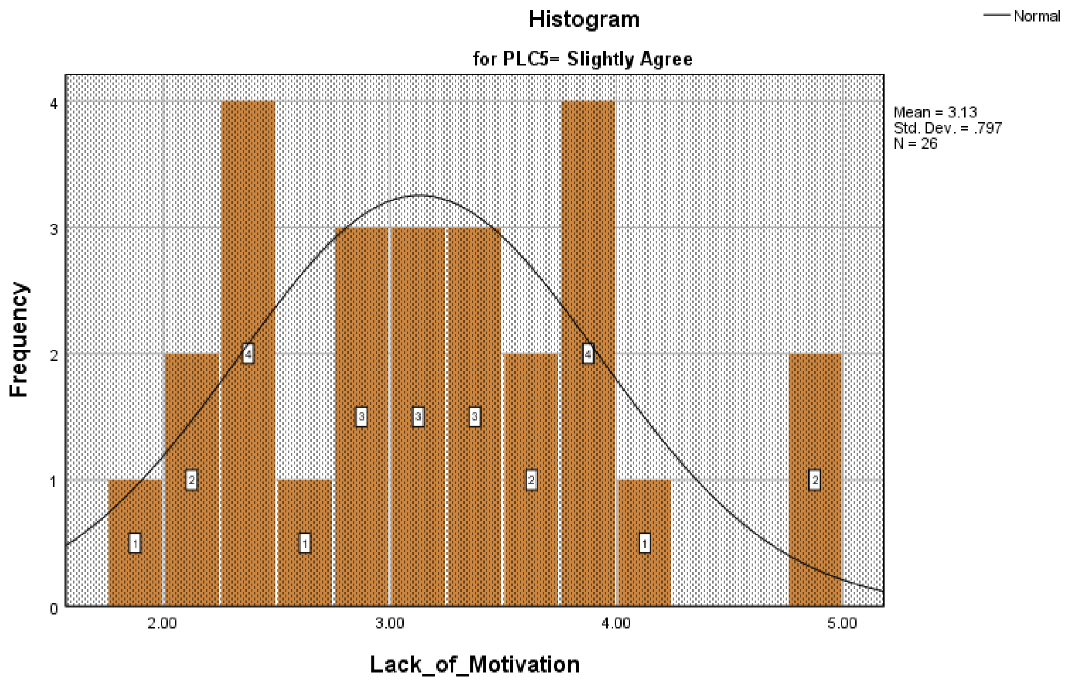

Figure 32: PLC 5 - Slightly Agree

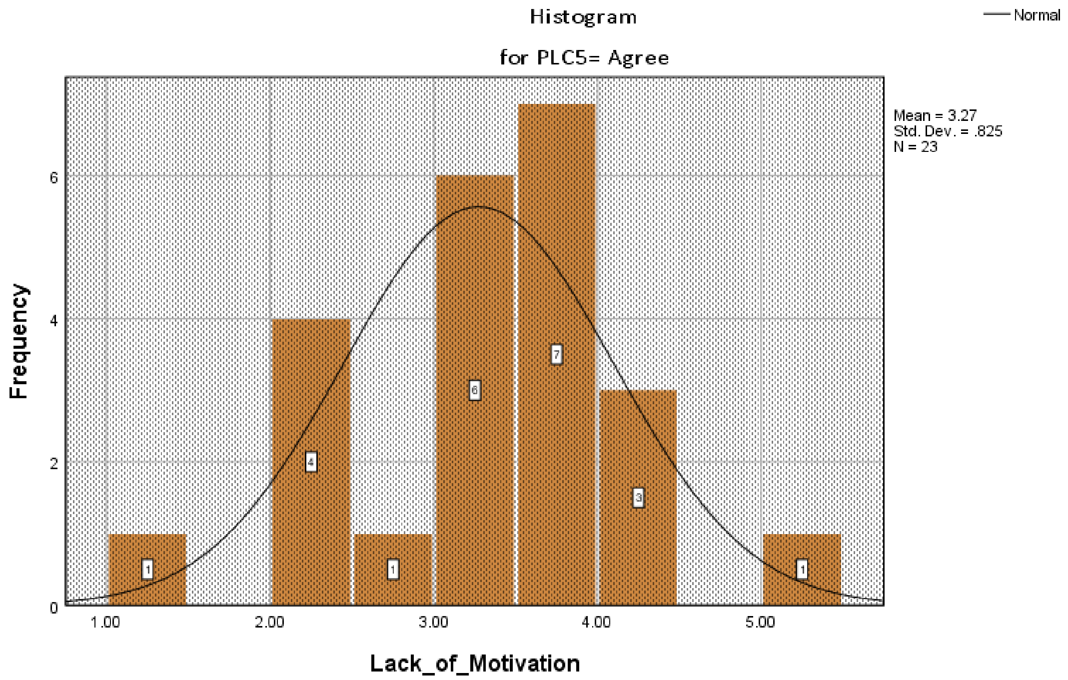

Figure 33: PLC 5 - Agree

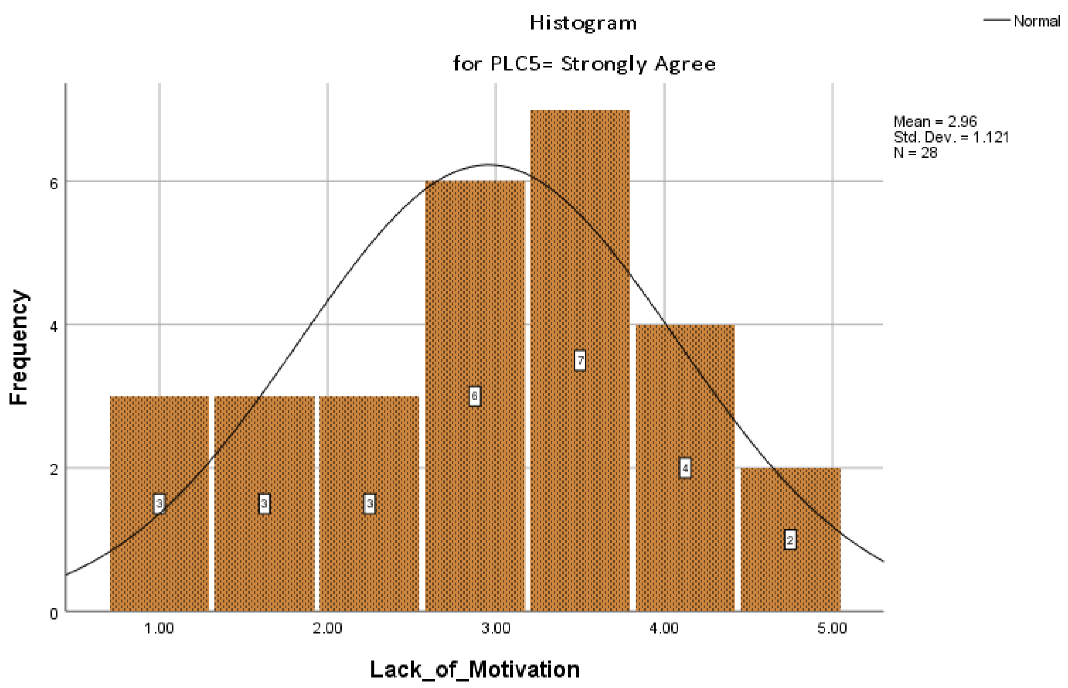

Figure 34: PLC 5 - Strongly Agree

Lack of Motivation: PLC 6

In reference to figure 35 – 39, the highest descriptive mean score achieved was 3.31 meaning that participants disagreed that lack of motivation would cause conflict among FM specialists and design team during project close out stage.

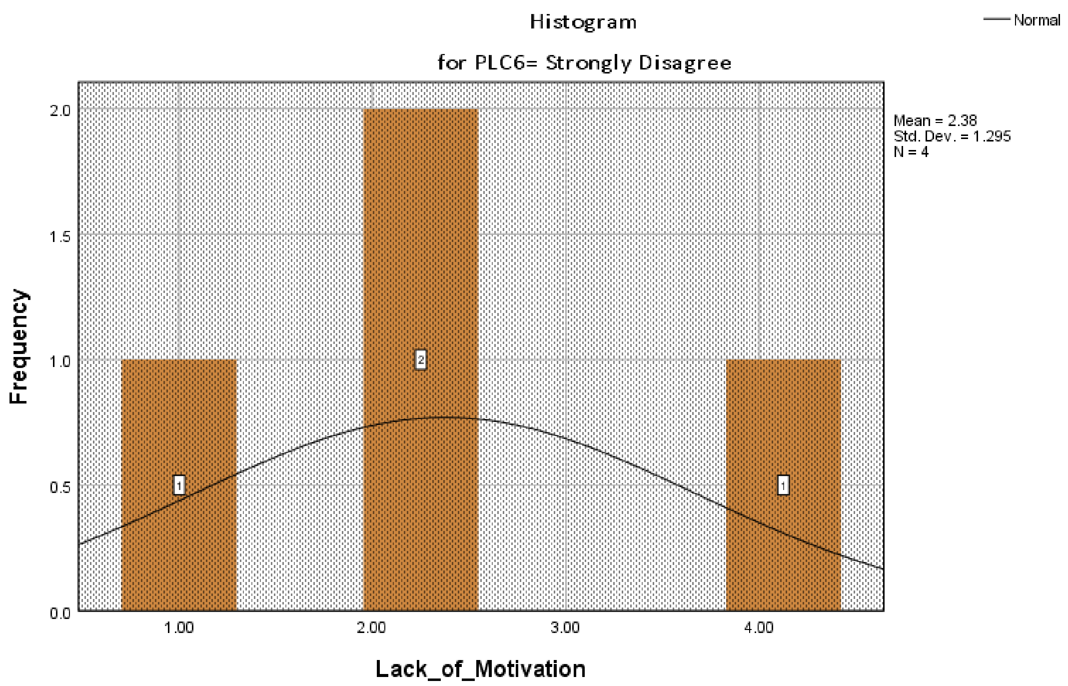

Figure 35: PLC 6 - Strongly Disagree

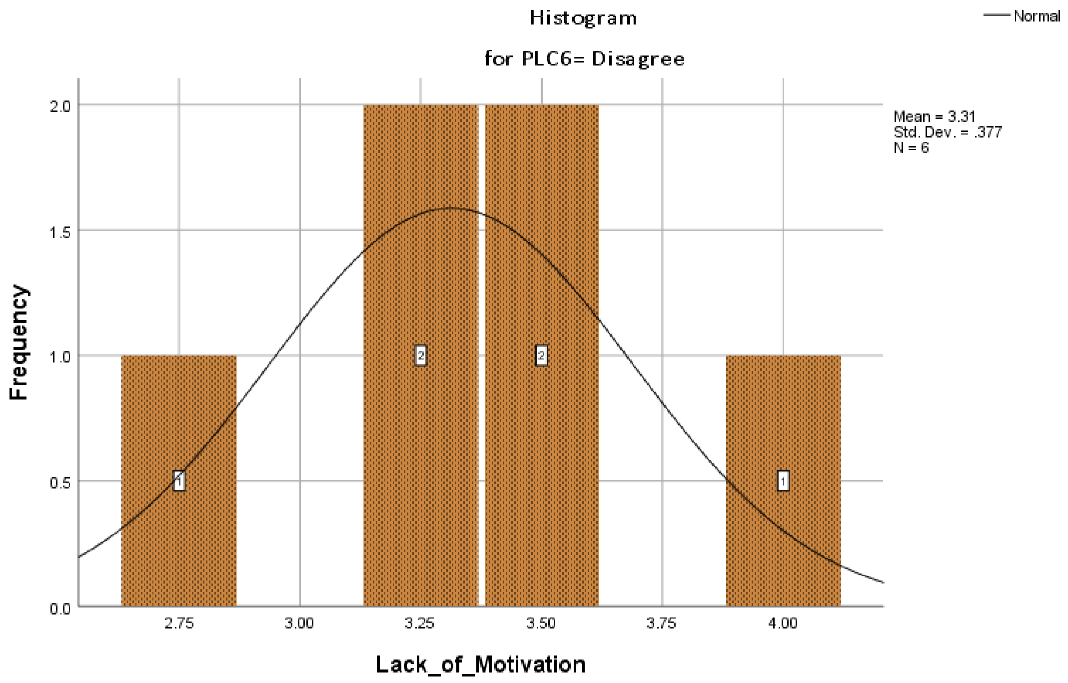

Figure 36: PLC 6 - Disagree

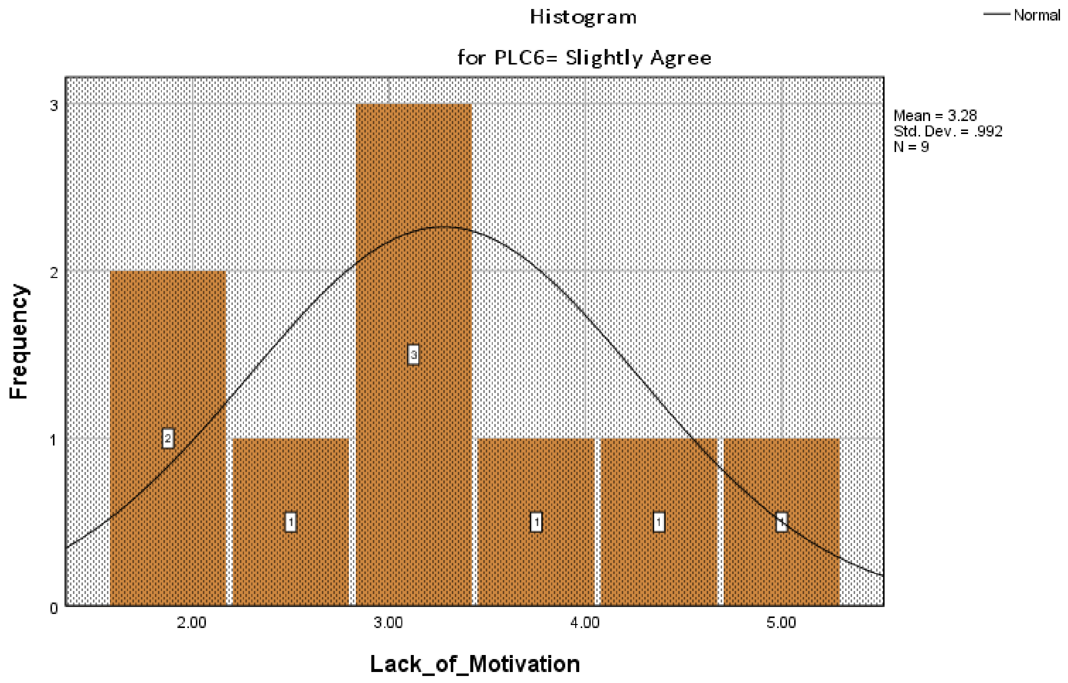

Figure 37: PLC 6 - Slightly Agree

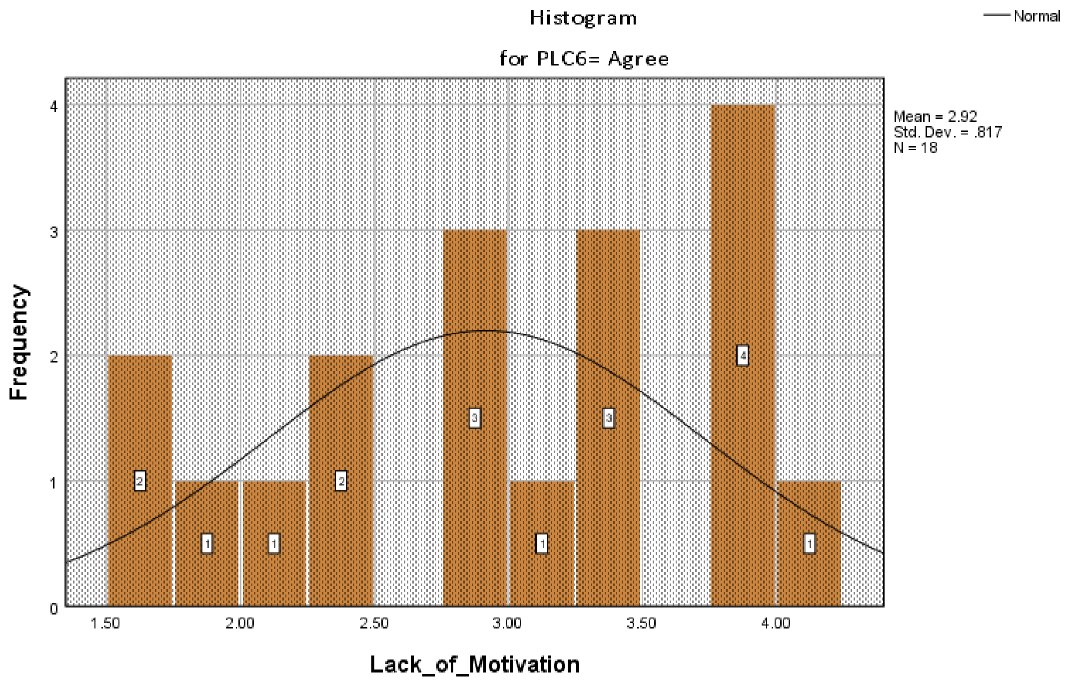

Figure 38: PLC 6 - Agree

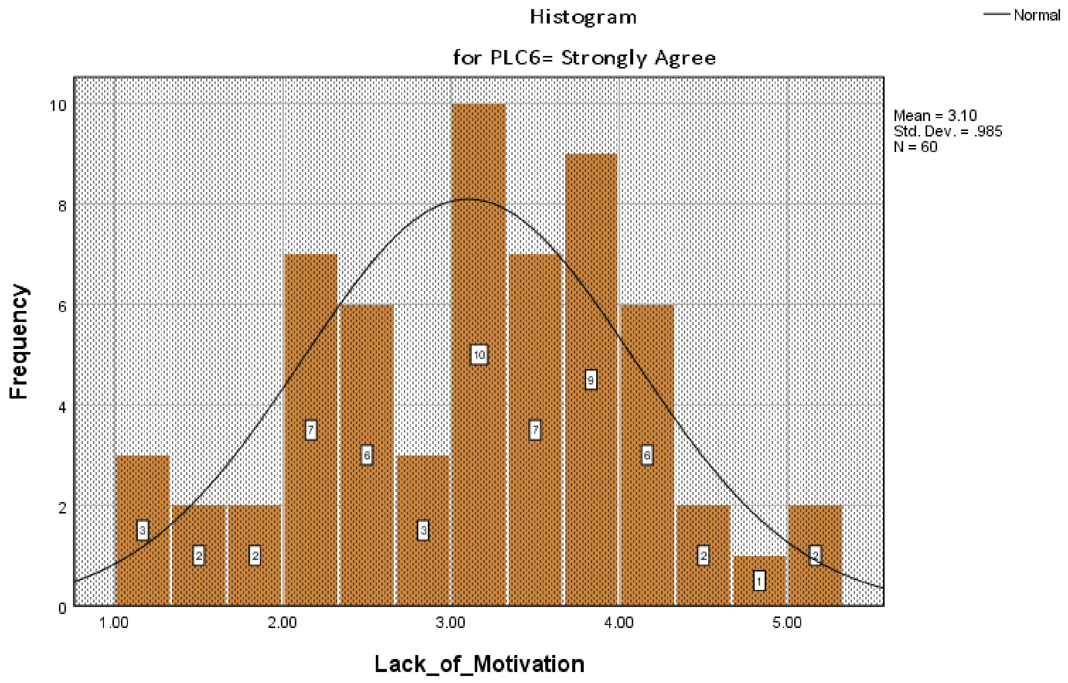

Figure 39: PLC 6 - Strongly Agree

Lack of Communication: Inception Stage (PLC 1)

In reference to figure 40 – 44, the highest descriptive mean score achieved was 4.13 meaning that participants agreed that lack of communication among FM specialists and design team would cause conflict during incept stage

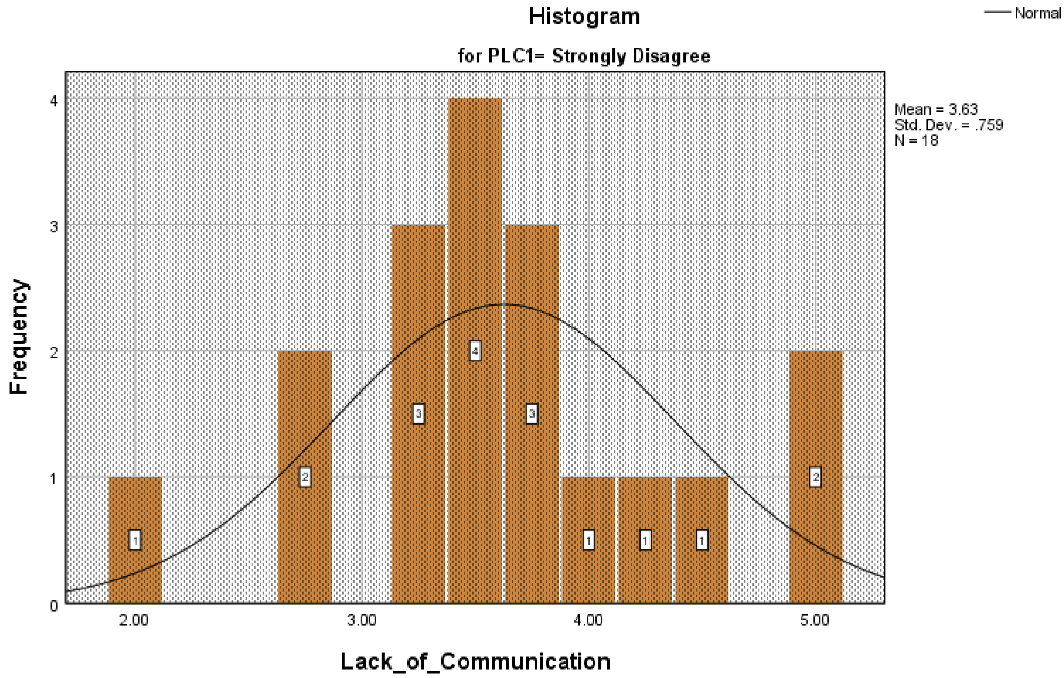

Figure 40: PLC 1- Strongly Disagree

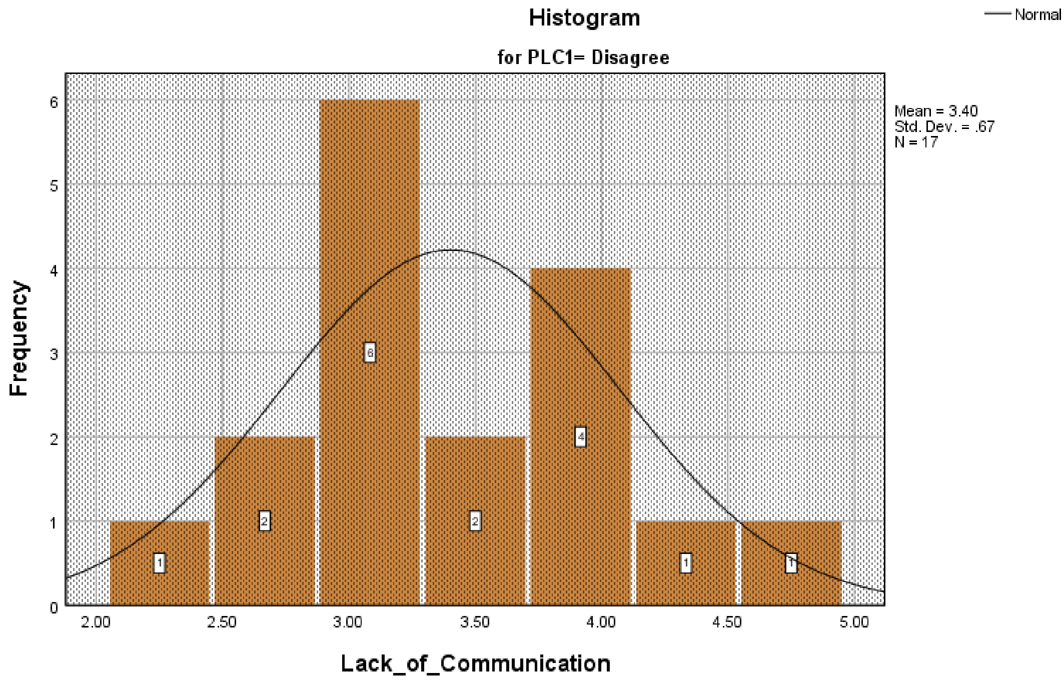

Figure 41: PLC1 – Disagree

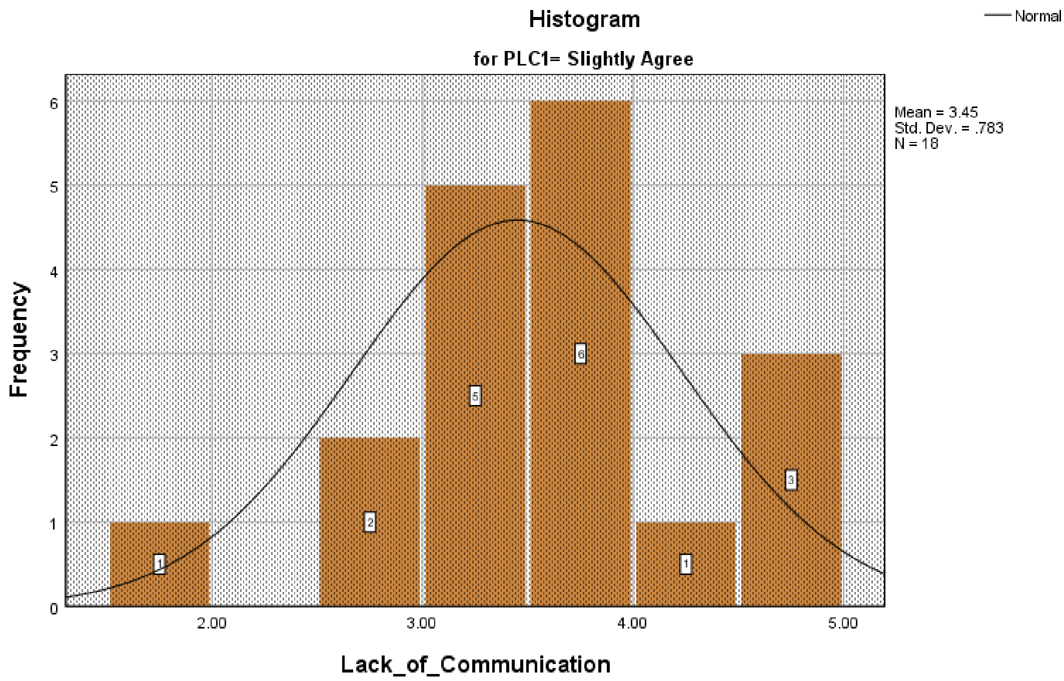

Figure 42: PLC 1 - Slightly agree

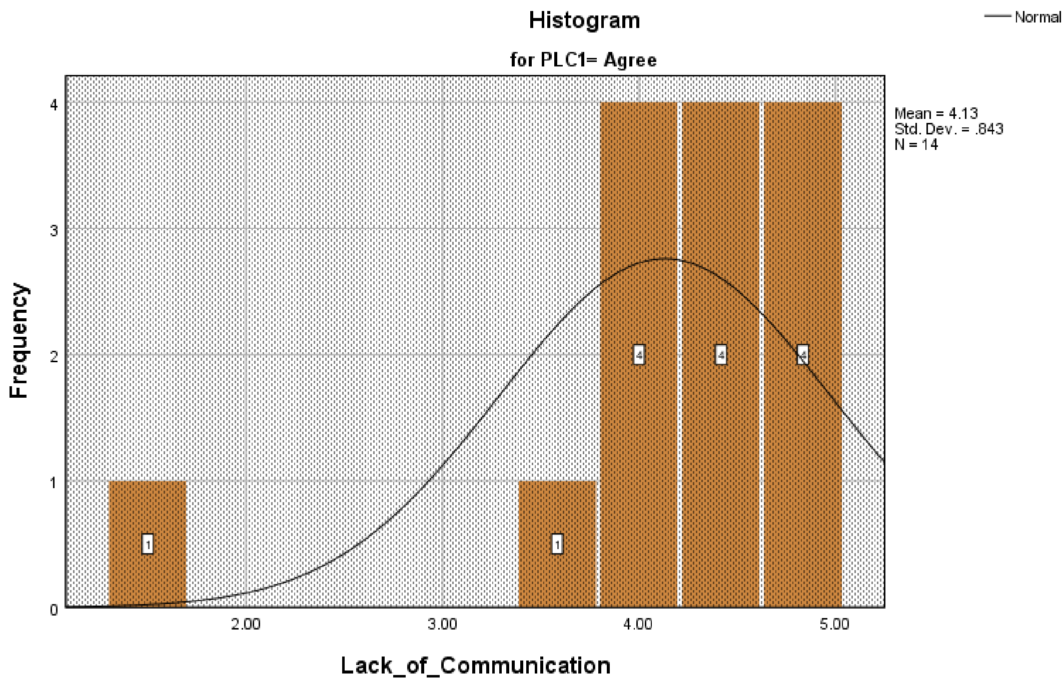

Figure 43: PLC 1 - Agree

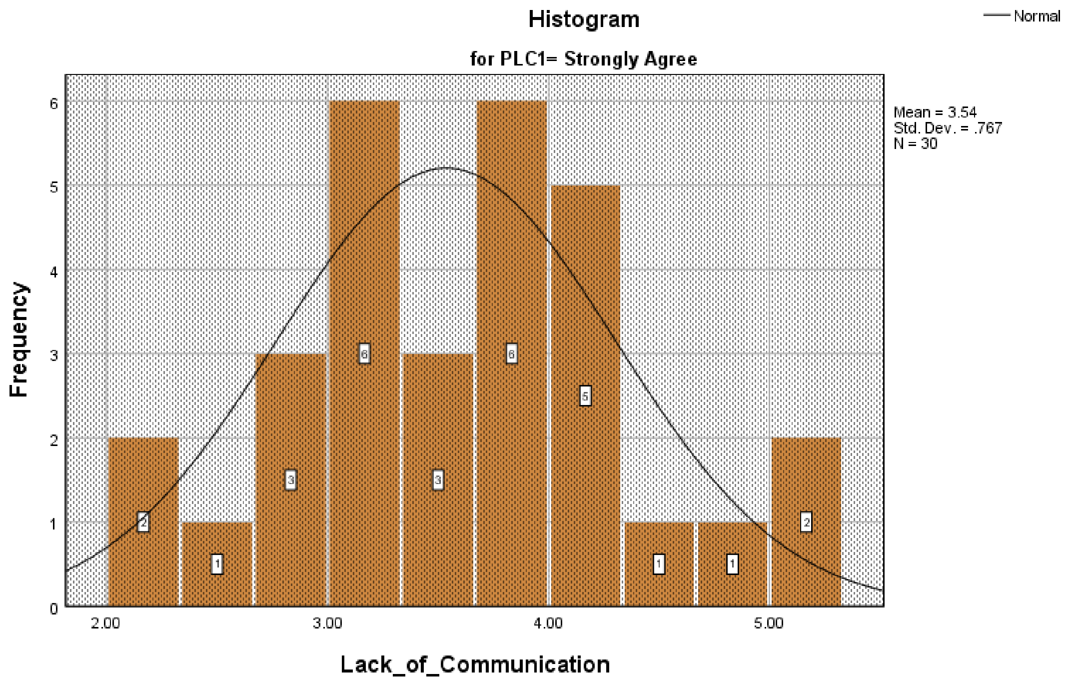

Figure 44: PLC1 - Strongly Agree

Lack of Communication: Concept and Viability Stage (PLC 2)

In reference to figure 45 – 49, the highest descriptive mean score achieved was 3.71 meaning that participants agreed that lack of communication among FM specialists and design would cause conflict during concept and viability stage.

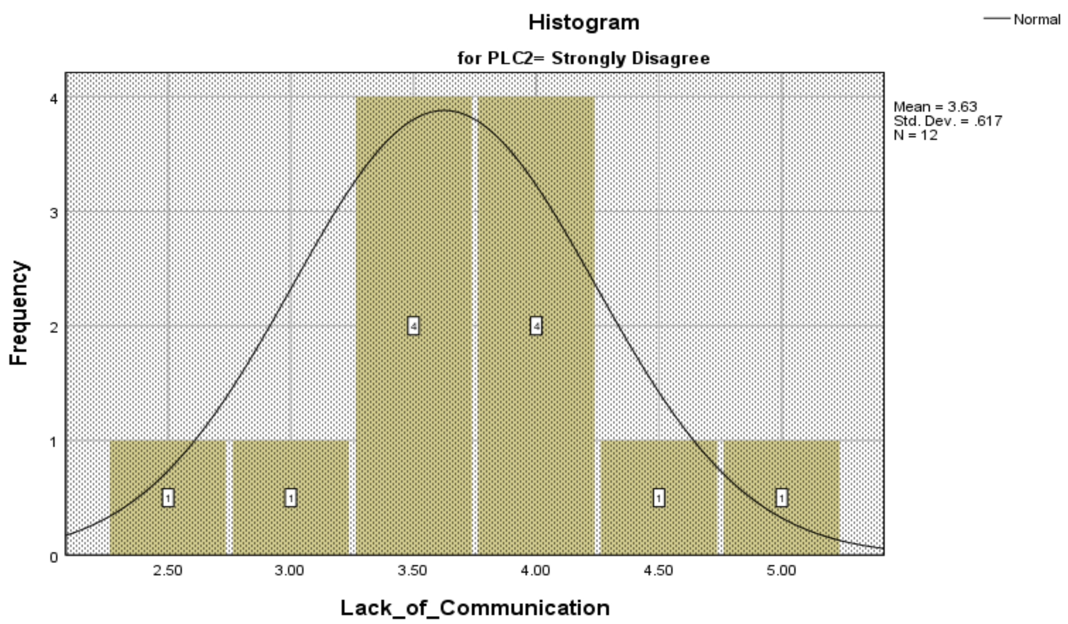

Figure 45: PLC2 - Strongly Disagree

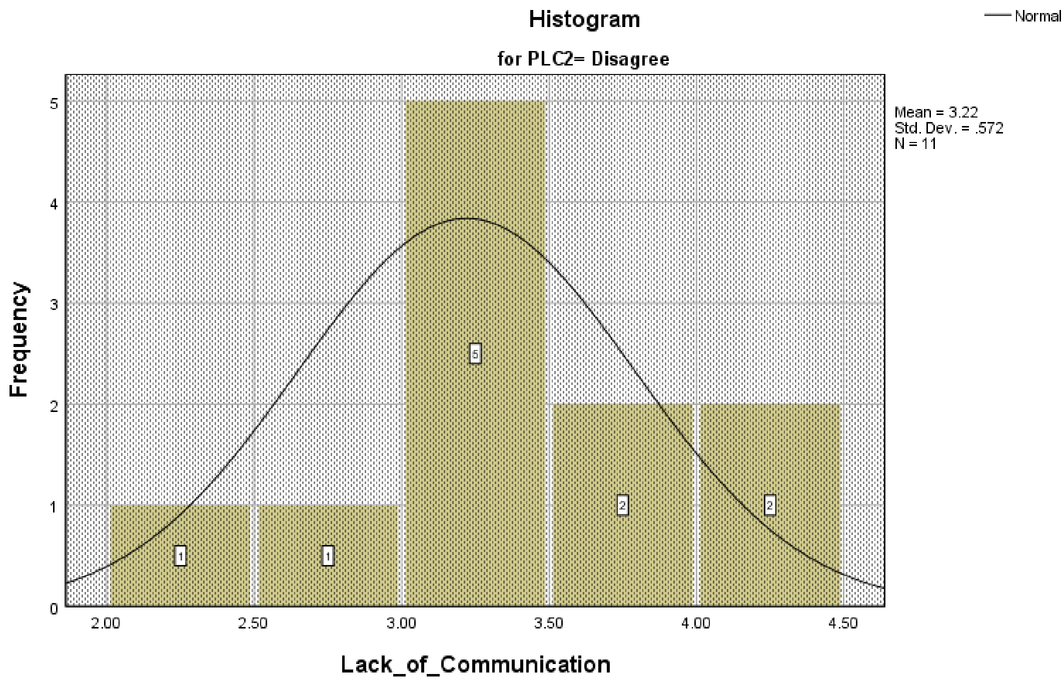

Figure 46: PLC2 -Disagree

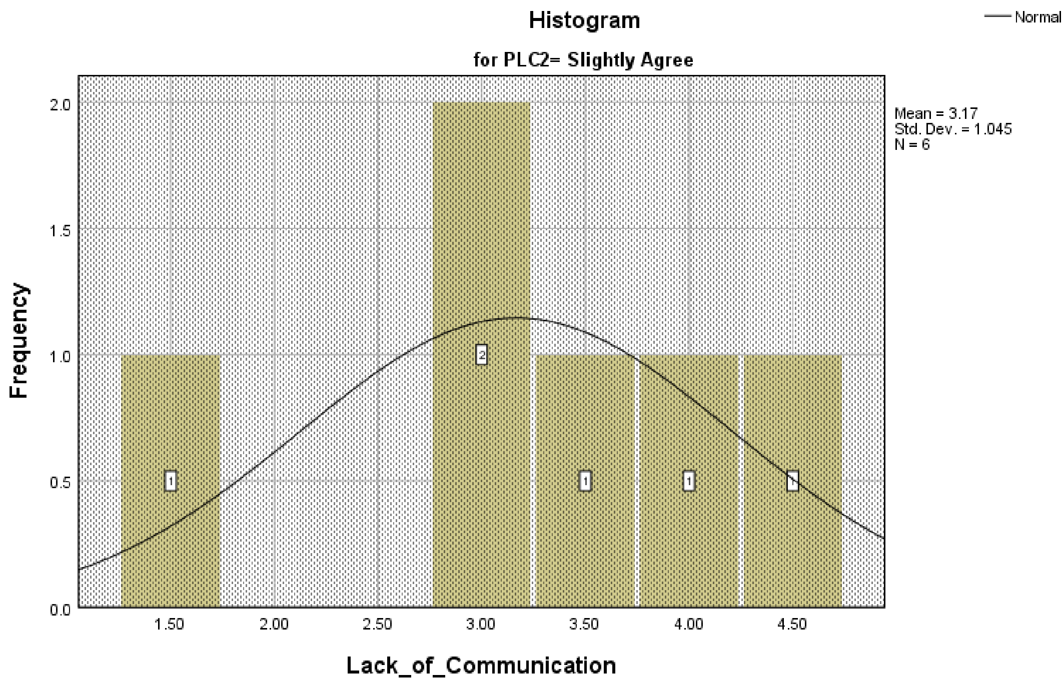

Figure 47: PLC2 - Slightly Agree

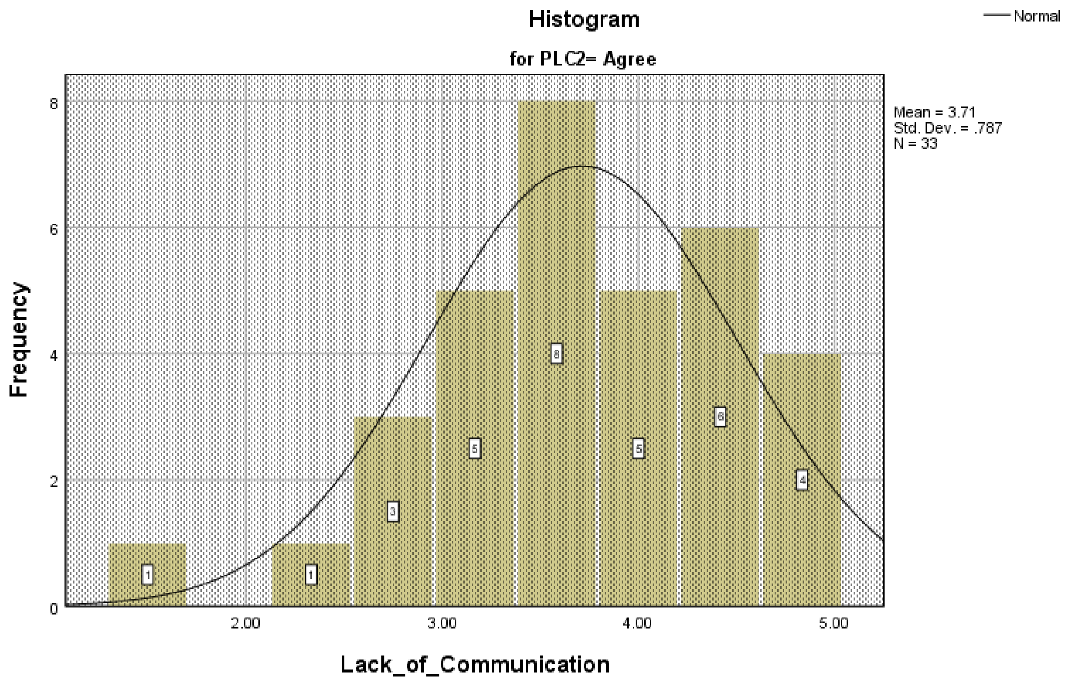

Figure 48: PLC 2 - Agree

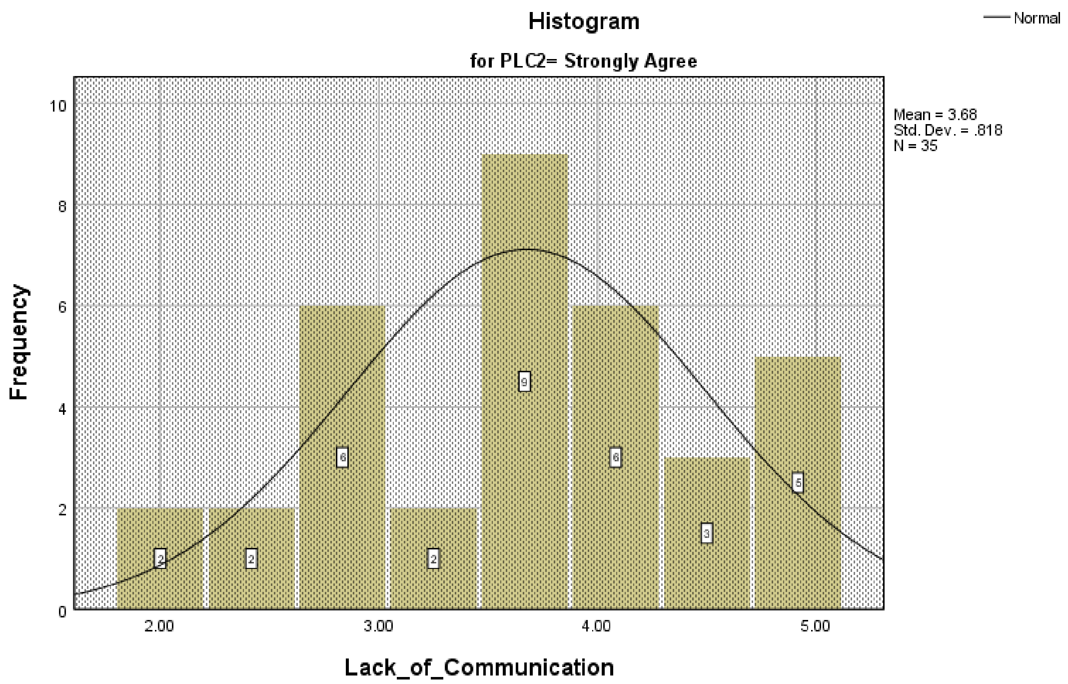

Figure 49: PLC 2 - Strongly Agree

Lack of Communication: Design Development Stage (PLC 3)

In reference to figure 50 – 53, the highest descriptive mean score achieved was 3.84 meaning that participants strongly agreed that lack of communication among FM specialists and design would cause conflict during concept and viability stage.

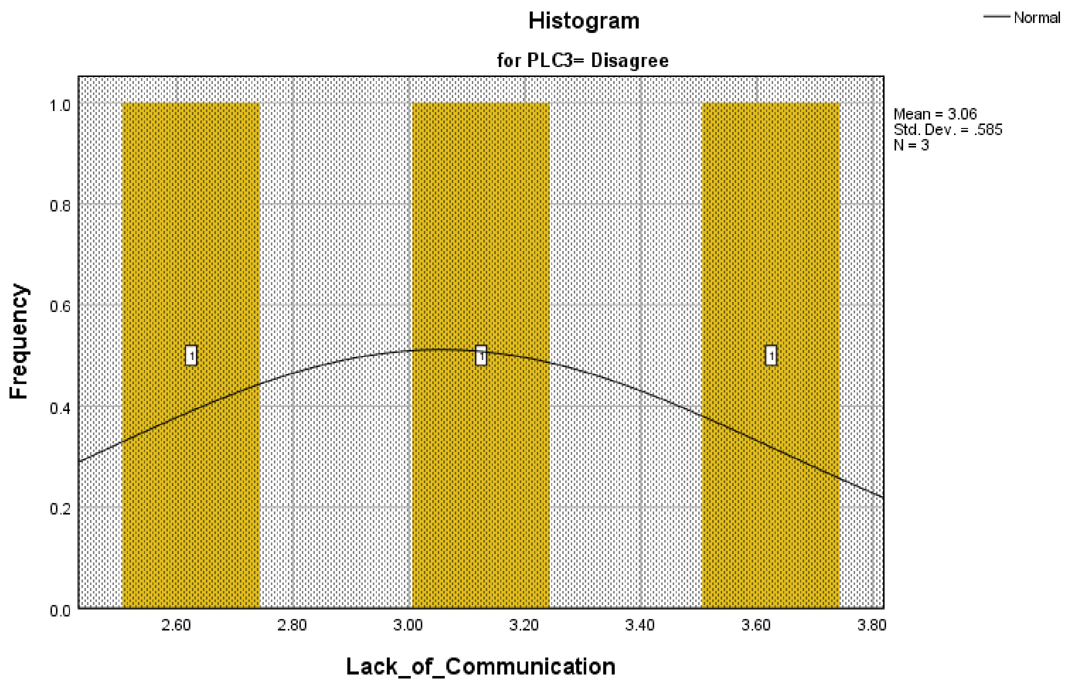

Figure 50: PLC 3 – Disagree

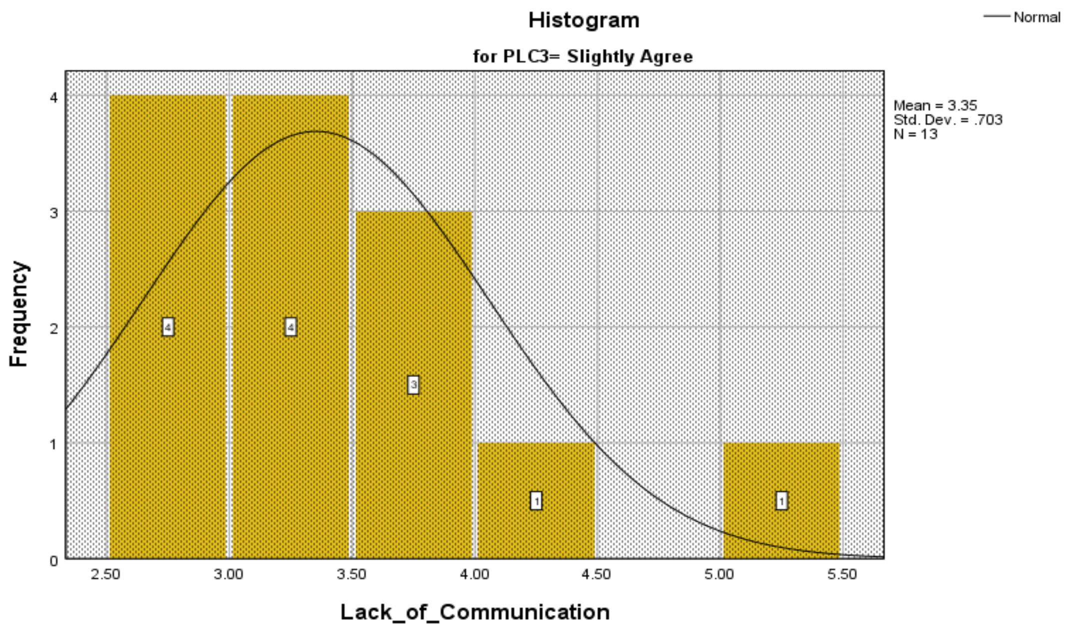

Figure 51: PLC 3 – Slightly Agree

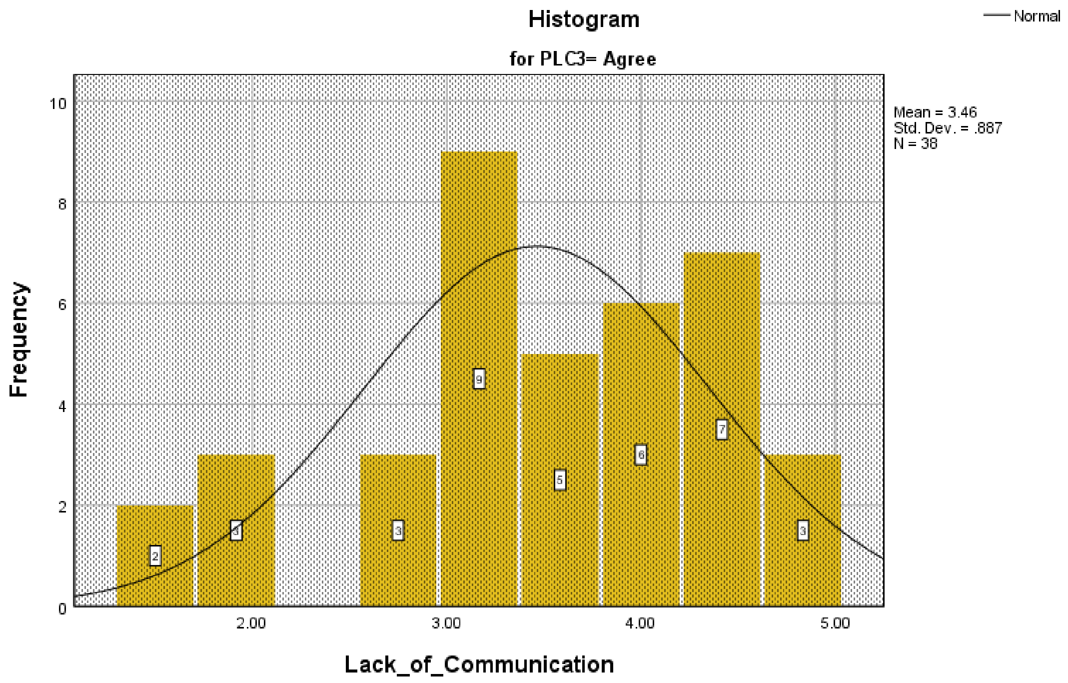

Figure 52: PLC 3 - Agree

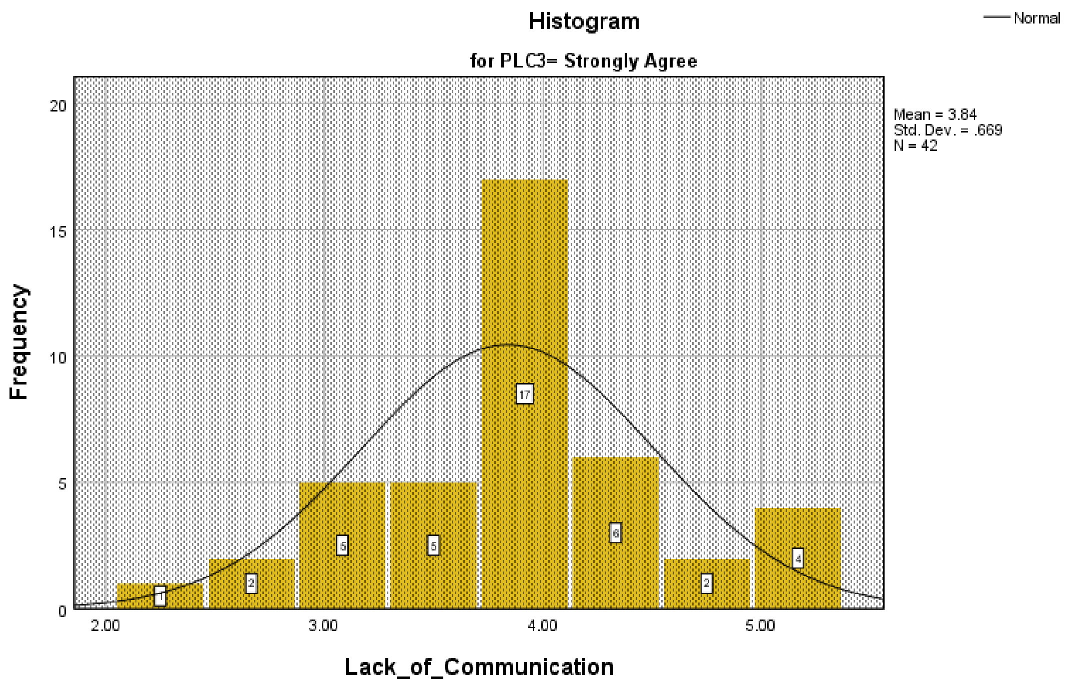

Figure 53: PLC 3 - Strongly Agree

Lack of Communication: Documentation and Procurement (PLC 4)

In reference to figure 54 – 58, the highest descriptive mean score achieved was 3.84 for both disagree and strongly meaning that there was no consensus among participants regarding the effect of lack of communication among FM specialists and design during documentation and procurement stage.

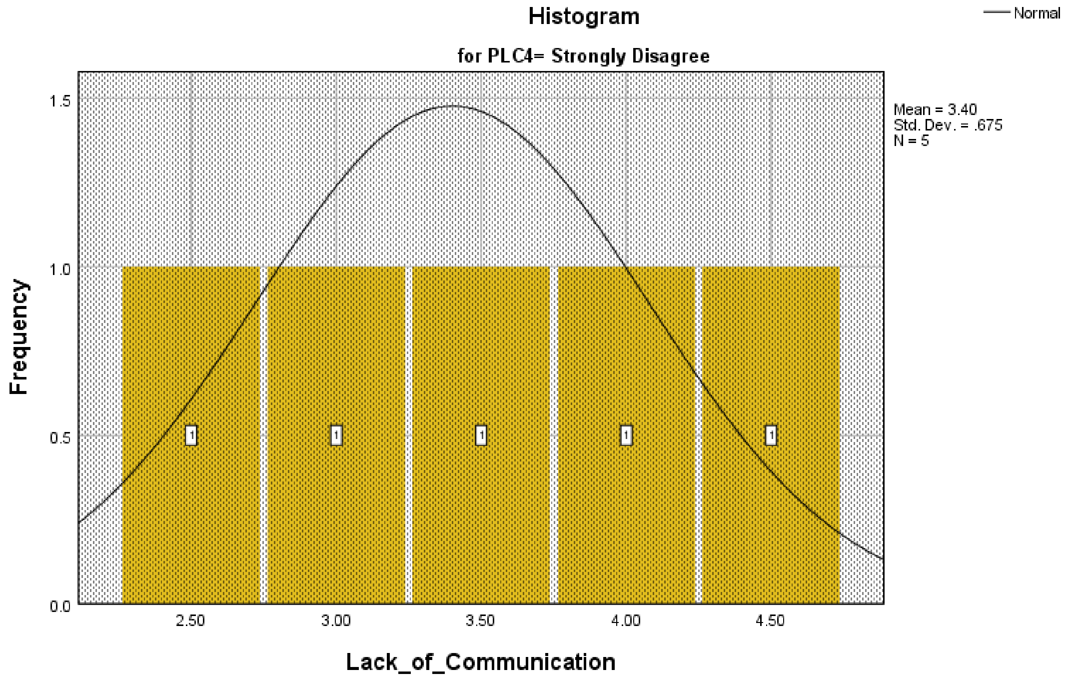

Figure 54: PLC 4 - Strongly Disagree

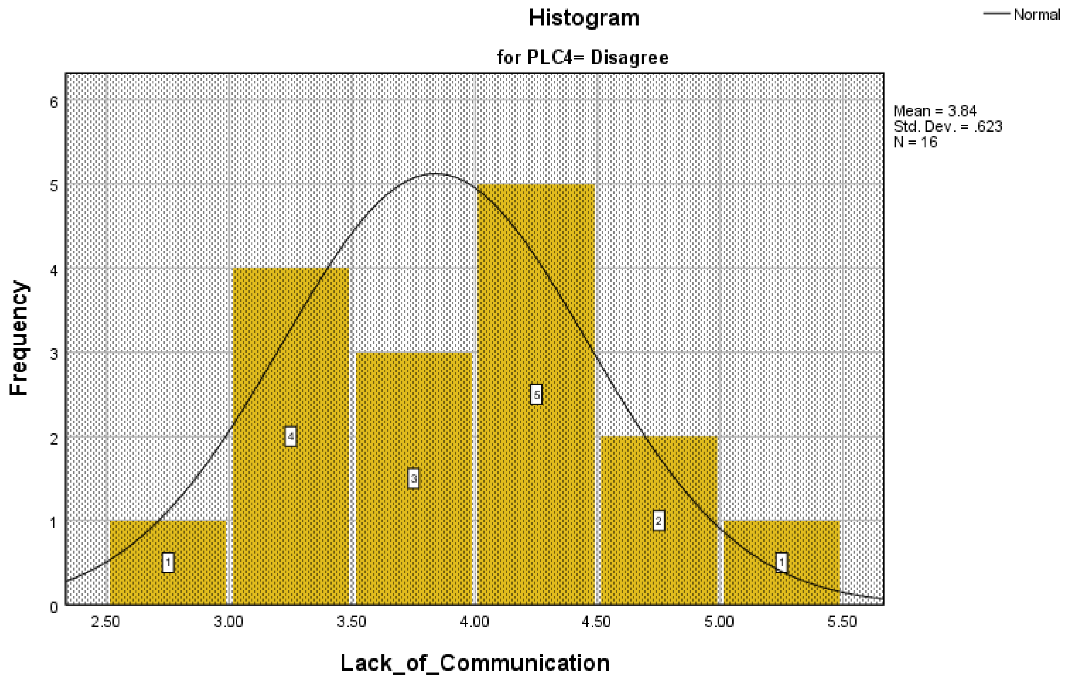

Figure 55: PLC 4 - Disagree

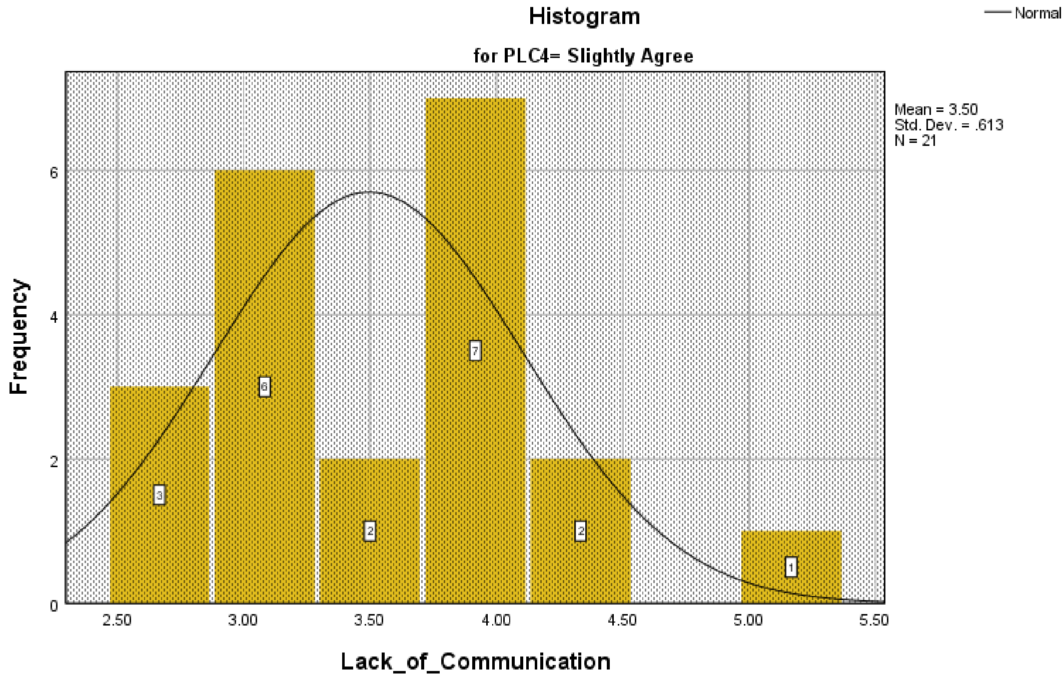

Figure 56: PLC 4 - Slightly Agree

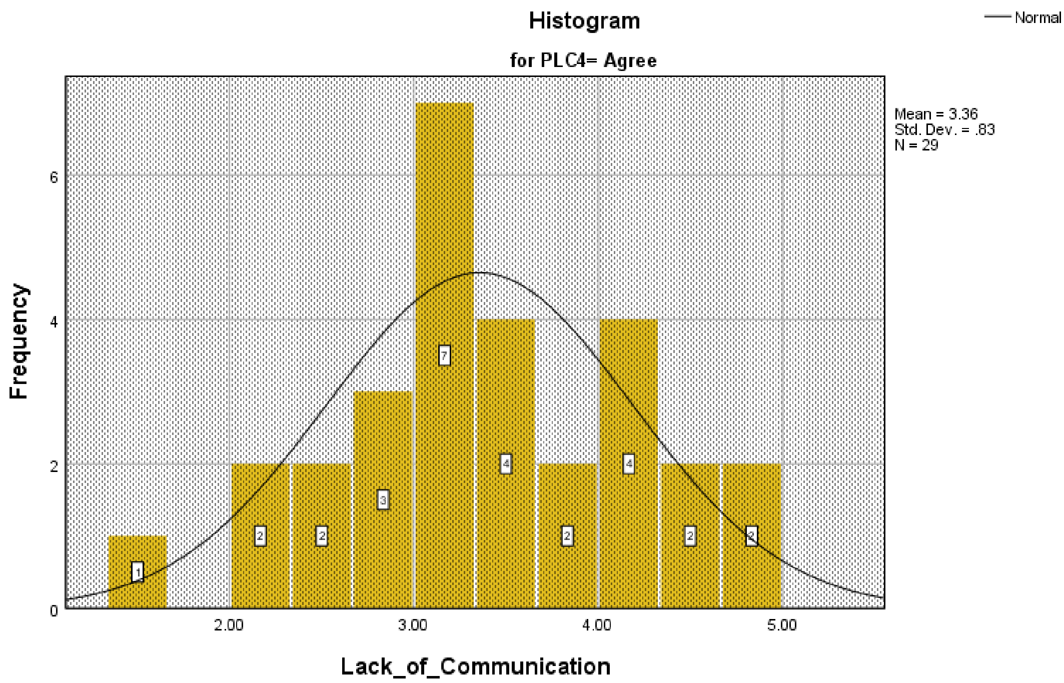

Figure 57: PLC 4 - Agree

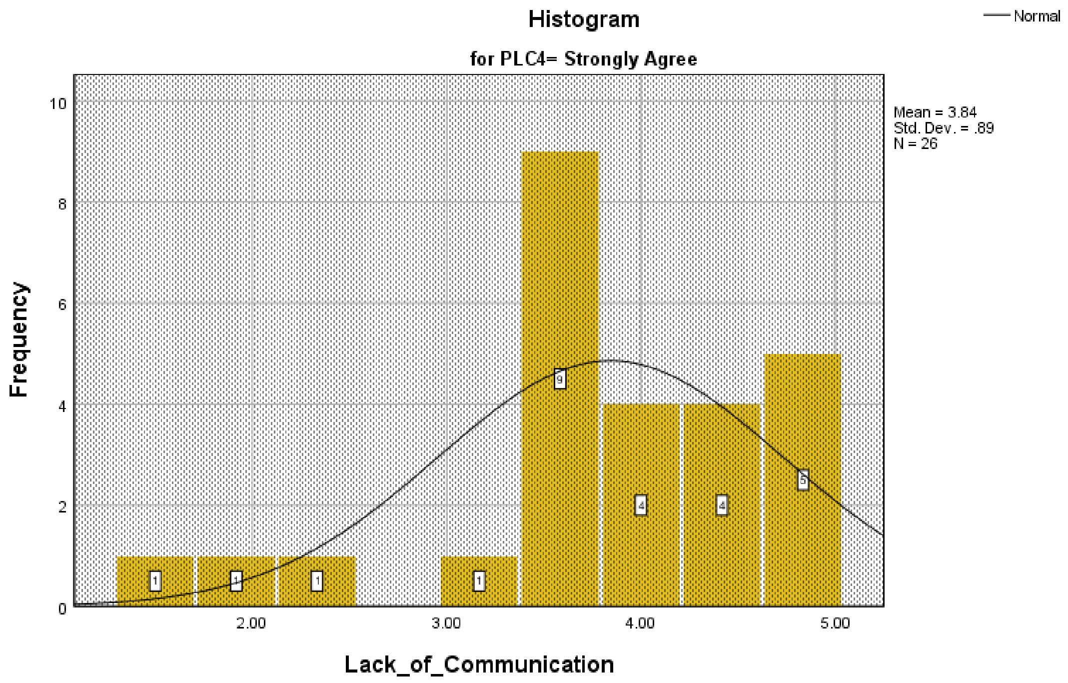

Figure 58: PLC 4 - Strongly Agree

Lack of Communication: Construction Stage (PLC 5)

In reference to figure 59 – 63, the highest descriptive mean score achieved was 3.69 meaning that participants disagreed that lack of communication among FM specialists and design would cause conflict during construction stage.

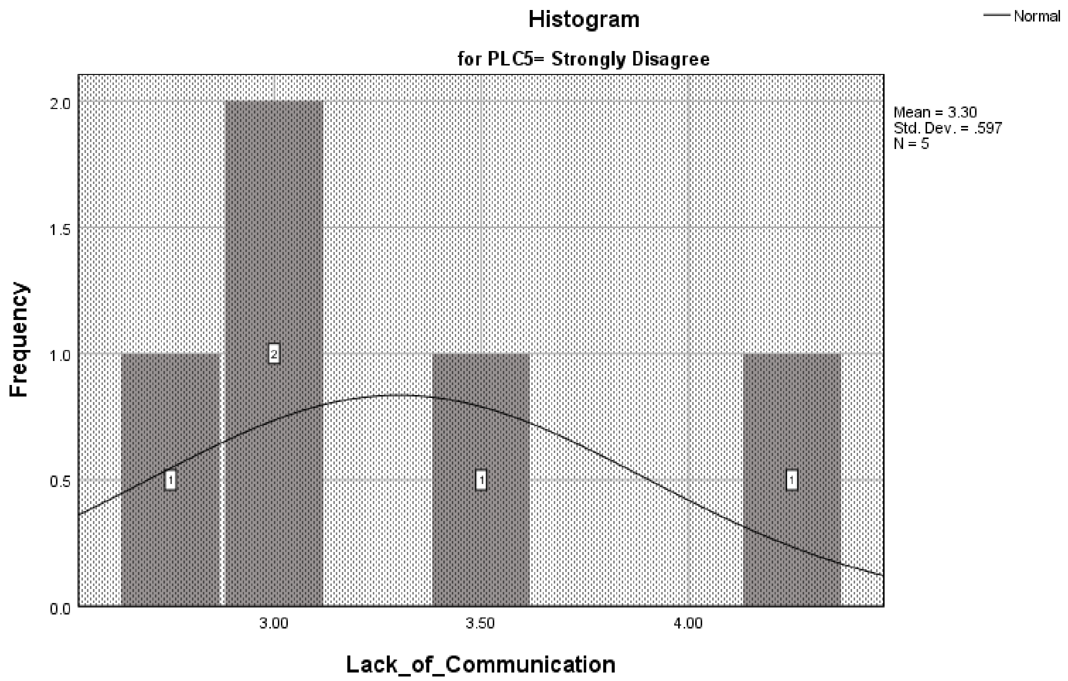

Figure 59: PLC 5 - Strongly Disagree

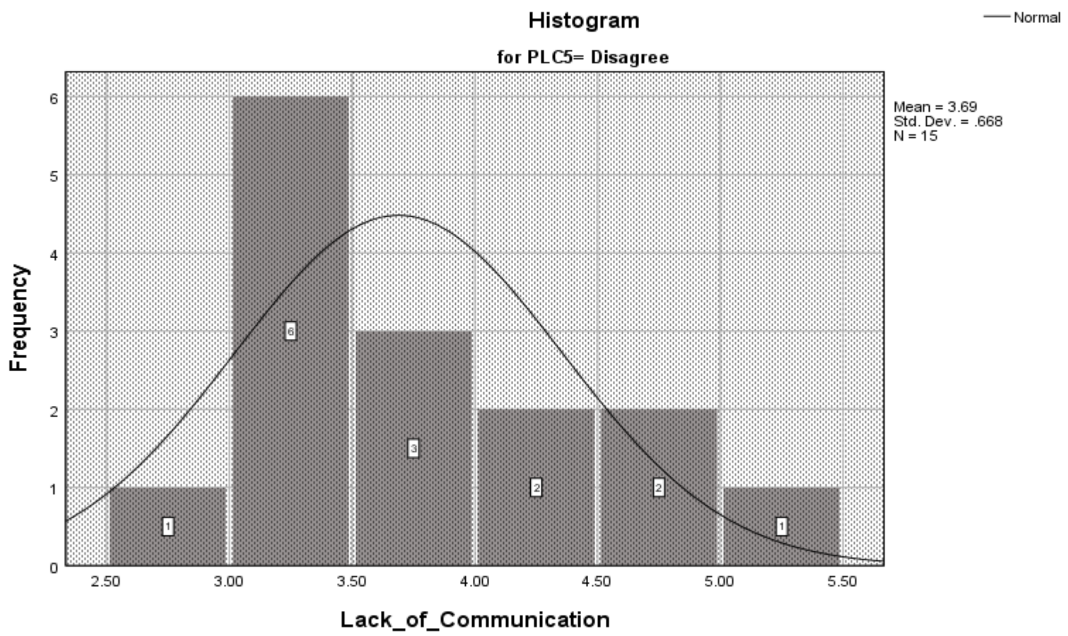

Figure 60: PLC 5 - Disagree

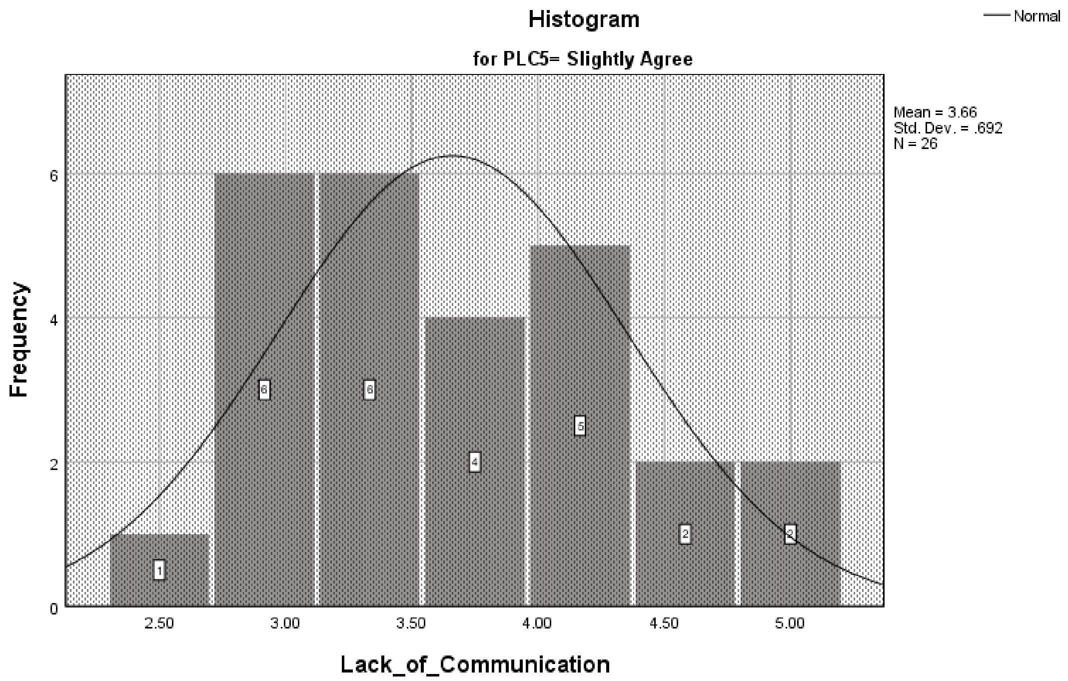

Figure 61: PLC 5 - Slightly Agree

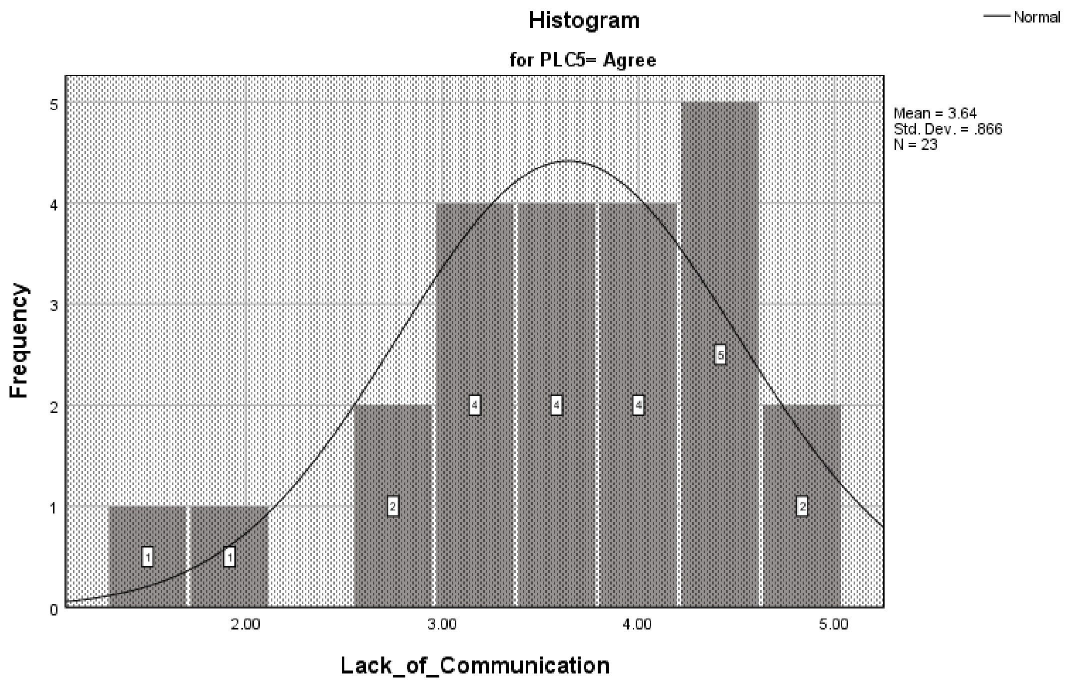

Figure 62: PLC 5 - Agree

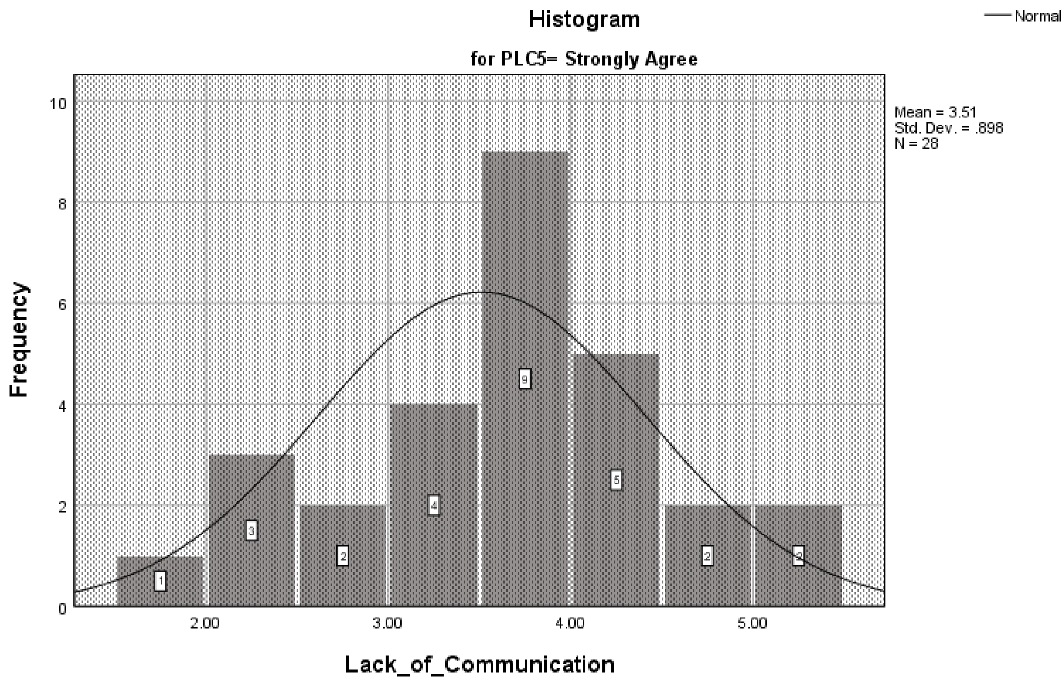

Figure 63: PLC 5 - Strongly Agree

Lack of Communication: Close-Out Stage (PLC 6)

In reference to figure 64 – 68, the highest descriptive mean score achieved was 3.92 meaning that participants slightly agreed that lack of communication among FM specialists and design would cause conflict during concept and project close out stage.

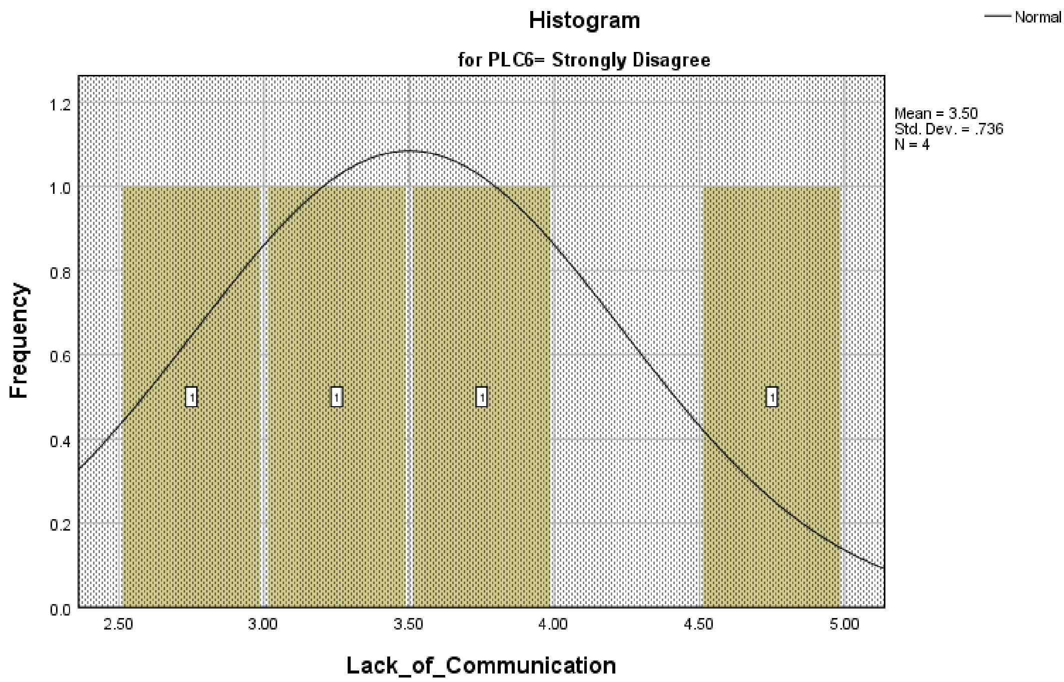

Figure 64: PLC 6 - Strongly Disagree

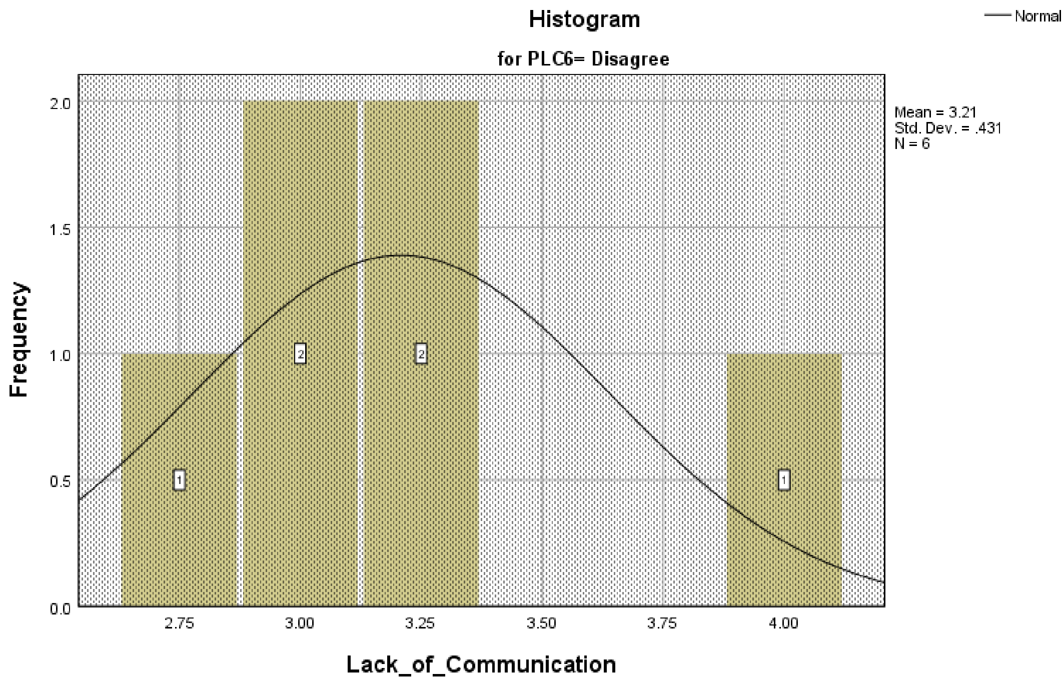

Figure 65: PLC 6 - Disagree

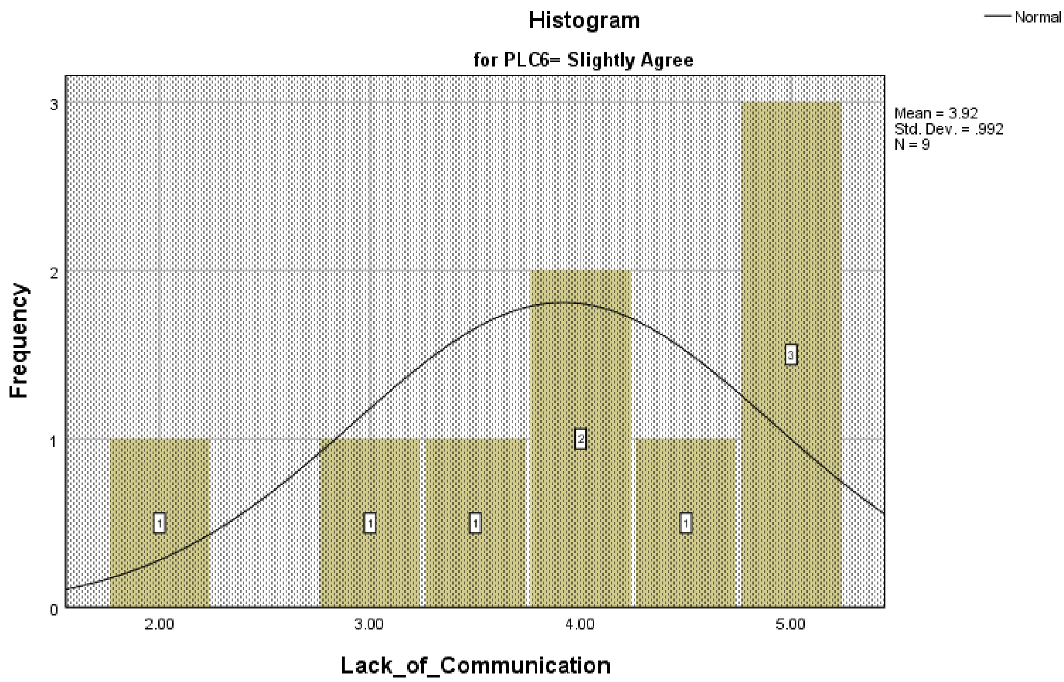

Figure 66: PLC 6 - Slightly Agree

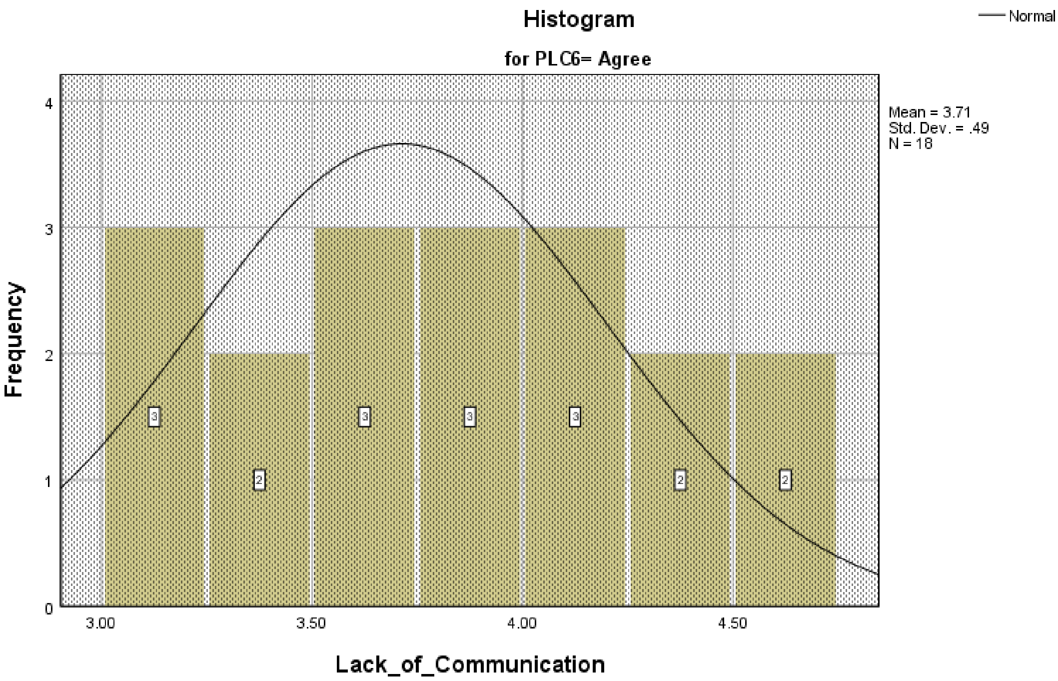

Figure 67: PLC 6 - Agree

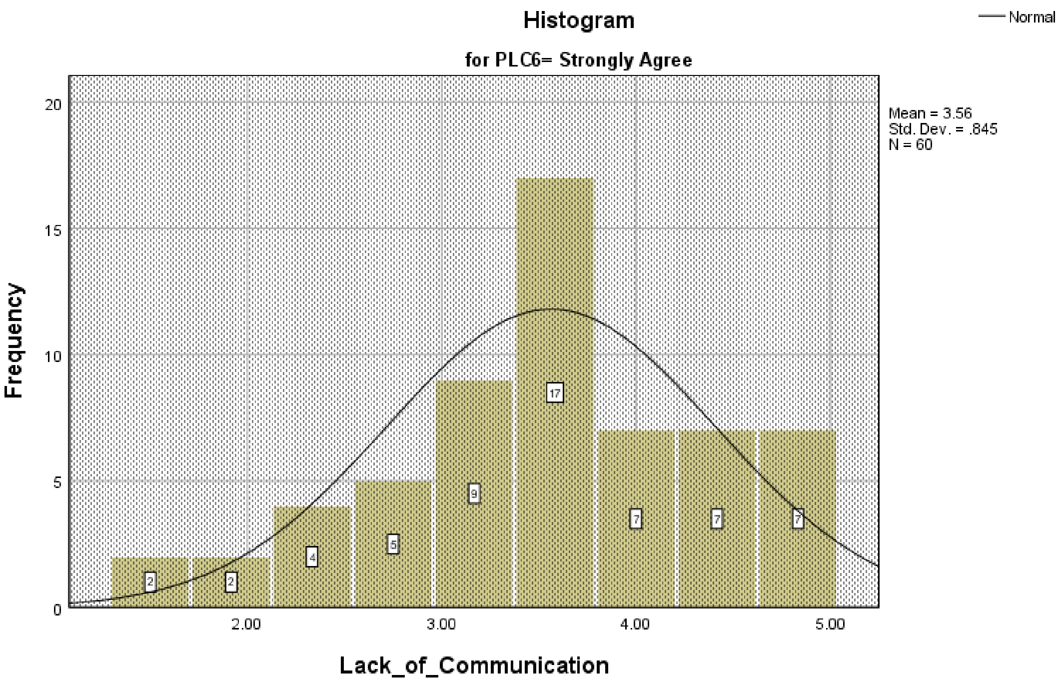

Figure 68: PLC 6 - Strongly Agree

Null Hypothesis Tests

Null Hypothesis Test - Lack of Motivation

The Kruskal-Wallis Test was conducted at a significant level of 0.05, however, a significant value of factor less than 0.05 indicates that respondents had varying views on the criticality of that factor(s) (Sholanke *et al*., 2019). In reference to the table below, the following causes of conflicts which were combined and renamed as lack of motivation were rejected and subjected for further investigation:

- Difference in attitudes (COC10)
- Lack of trust (COC11)
- Personality issues (COC12)
- Lack of team cohesion (COC19)
- Lack of shared leadership and accountability (COC37)
- Conflicting personality values (COC39)
- Poor relationship management among integrated design team members (COC41)

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 10 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.010	Reject the null hypothesis.
2	The distribution of COC 11 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.005	Reject the null hypothesis.
3	The distribution of COC 12 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.
4	The distribution of COC 16 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.057	Retain the null hypothesis.
5	The distribution of COC 19 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.046	Reject the null hypothesis.
6	The distribution of COC 37 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.005	Reject the null hypothesis.
7	The distribution of COC 39 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.
8	The distribution of COC 41 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.001	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 48: Hypothesis - Lack of Motivation

Hypothesis Tests: Incomplete Brief

The Kruskal-Wallis Test was conducted at a significant level of 0.05, however, a significant value of factor less than 0.05 indicates that respondents had varying views on the criticality of those factor(s) (Sholanke *et al*., 2019). In reference to the table 49 below, the null hypothesis of the following causes of conflicts were rejected and subjected for further investigation:

- Inadequate brief (COC17)

- Incomplete project information (COC32)

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 2 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.666	Retain the null hypothesis.
2	The distribution of COC 3 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.347	Retain the null hypothesis.
3	The distribution of COC 33 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.160	Retain the null hypothesis.
4	The distribution of COC 17 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.027	Reject the null hypothesis.
5	The distribution of COC 32 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.012	Reject the null hypothesis.
6	The distribution of COC 18 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.281	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 49: Hypothesis - Incomplete Brief

Null Hypothesis Test: Project Risk Management

The Kruskal-Wallis Test was conducted at a significant level of 0.05, however, a significant value of factor less than 0.05 indicates that the respondents had varying views on the criticality of that factor(s) (Sholanke *et al.*, 2019). In reference to table 50 below, the null hypothesis of the following causes of conflicts associated with project risk management were rejected and subjected to further investigation:

- Poor risk management (COC9)
- Unrealistic client expectations and determinations (COC13
- Poor interpretation of drawings by clients (COC21)

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 8 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.185	Retain the null hypothesis.
2	The distribution of COC 9 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.003	Reject the null hypothesis.
3	The distribution of COC 7 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.414	Retain the null hypothesis.
4	The distribution of COC 13 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.049	Reject the null hypothesis.
5	The distribution of COC 21 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.023	Reject the null hypothesis.
6	The distribution of COC 29 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.167	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 50: Hypothesis – Project-Risk Management

Null Hypothesis Test: Lack of Communication

In reference to the table 51 below no null hypothesis was rejected, hence, no further investigation was necessary.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 26 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.521	Retain the null hypothesis.
2	The distribution of COC 27 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.843	Retain the null hypothesis.
3	The distribution of COC 28 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.079	Retain the null hypothesis.
4	The distribution of COC 6 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.509	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 51: Hypothesis - Lack of Communication

Null Hypothesis Test - Professional Diversity

In reference to the table 52 below, the null hypothesis of the following causes of conflicts were rejected and subjected for further investigation:

- Diversity in expertise of project participants (COC15)

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 4 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.137	Retain the null hypothesis.
2	The distribution of COC 15 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.025	Reject the null hypothesis.
3	The distribution of COC 31 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.310	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 52: Hypothesis - Professional Diversity

Null Hypothesis Test: Conflicting Interpretation

In reference to the table 53 below, all causes of conflicts associated with conflicting interpretation were retained and no further investigation is required.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 20 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.206	Retain the null hypothesis.
2	The distribution of COC 38 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.859	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 53: Hypotheses – Conflicting Interpretation

Null Hypothesis Test: Project Cost

In reference to the table 54 below, all causes of conflicts associated with project cost were accepted with no further investigation required.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of COC 25 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.083	Retain the null hypothesis.
2	The distribution of COC 35 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.870	Retain the null hypothesis.
3	The distribution of COC 36 is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.327	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

is

Table 54: Hypothesis - Project Cost

Null Hypothesis Test:

The Kruskal-Wallis Test was conducted at a significant level of 0.05 on the 7 new components, however, a significant value of factor less than 0.05 indicates that respondents had varying views on the criticality of that factor(s) (Sholanke *et al.,* 2019). In reference to table 55 below, the null hypothesis of the following causes of conflicts were rejected and subjected to further investigation:

- Lack of motivation
- Incomplete brief
- Project risk management

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Lack_of_Motivation is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.
2	The distribution of Incomplete_Brief is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.027	Reject the null hypothesis.
3	The distribution of Project_Risk_Management is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.015	Reject the null hypothesis.
4	The distribution of Lack_of_Communication is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.480	Retain the null hypothesis.
5	The distribution of Professional_Diversity is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.308	Retain the null hypothesis.
6	The distribution of Conflicting_Interpretation is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.313	Retain the null hypothesis.
7	The distribution of Project_Cost is the same across categories of Q1_Coded.	Independent-Samples Kruskal-Wallis Test	.347	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 55: New Components - Hypothesis