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Design-Construction Interface Problems in Building Construction Projects in Gaza Strip: Impacts and Minimization

المشاكل التي تواجه المشاريع الإنشائية في مرحلتي التصميم والتنفيذ في قطاع غزة: آثارها والحد منها

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إقــــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Design-Construction Interface Problems in Building Construction Projects in Gaza Strip: Impacts and Minimization

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نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة عمادة البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ **محمد رسمي خالد نصار** لنيل درجة الماجستير في **كلية الهندسة/قسم الهندسة المدنية/إدارة المشروعات الهندسية،** وموضوعها:

المشاكل التي تواجه مرحلتي التصميم والتنفيذ في المشاريع الانشائية في قطاع غزة

Design-construction interface problems in construction projects in Gaza strip

وبعد المناقشة المغلقة التي تمت يوم السبت ٢٣ جمادي الأولى ١٤٣٩هـ، الموافق ٢٠١٨/٠٢/١٠م الساعة الثامنة صباحاً في قاعة اجتماعات كلية الهندسة، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

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وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في **كلية الهندسة/قسم الهندسة المدنية/إدارة المشروعات الهندسية.**

واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله ولزوم طاعته وأن يسخر علمه في خدمة دينه ووطنه.

والله ولي التوفيق ،،،

عميد البحث العلمي والدراسات العليا

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Abstract

Background and Problem: During the lifecycle of the construction project, project parties are struggling to get the ideal projects with a minimum time and cost overrun, and a minimum margin of conflicts for each phase so, one of the real challenges that face the parties operating in building construction projects is how to mitigate the causes of design-construction interface problems (DCIPs) and negative impact of it.

Aim and Objectives: The aim of this research is to study the DCIPs. To achieve the aim of this research many objectives exist, these objectives can be summarized as to investigate direct causes of the DCIPs, to identify the impact of the DCIPs on overall project performance and to recommend strategies to minimize it.

Methodology: Firstly, the literature review to extract the causes and impact of the DCIPs and recommended strategies to minimize it. Secondly, interviews with projects' managers of six building construction projects to understand the causes and impacts of the DCIPs as well as look for recommendation and strategies if any to minimize the occurrence of the DCIPs. Thirdly, a questionnaire was developed to evaluate the perception of contractors and consultants on the factors causing and impact of the DCIPs, and recommended strategies to minimize.

Results: The most occurred factors caused the DCIPs were Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V, political situation impact on fund continuity, lack of skilled human resources at the construction site, delaying of dues payments. In addition, the most impact the DCIPs were completion schedule delay, cost overrun, quality degradation, poor safety conditions, poor team work performance, project scope control.

Conclusions: It was summarized that there are some differences and similarities among real data from interviews compared to the results of the questionnaire. The differences between the research and real data are mainly because the project has a special nature where these projects faced several difficulties of closure and severe siege after the Israeli war on the Gaza Strip in 2014. Not to forget to mention that the interviews included the perception of the contractors while the questionnaire result included the perception of the consultant and contractors.

Keywords: Design-Construction, Gaza Strip, Building Construction projects, Consultant, Contractor.

الملخص

خلفية عن الموضوع مع استعراض للمشكلة: خلال دورة حياة المشاريع الإنشائية، تجتهد أطراف المشاريع من أجل الحصول على الحد الأدنى من الوقت والتكلفة، وكذلك الحد الأدنى من النزاعات لكل مرحلة من مراحل المشروع، ومن أحد التحديات الحقيقية التي تواجه الأطراف العاملة في مشاريع البناء والتشييد هو كيفية التخفيف من أسباب المشاكل التي تواجه مرحلتي التصميم والبناء والحد من تأثيرها السلبي على المشاريع.

الأهداف المرجوة من موضوع الرسالة: الهدف من هذه الدراسة هو دراسة المشاكل التي تواجه مرحلتي التصميم والبناء ولتحقيق ذلك تم تحديد عدة أهداف التي يمكن تلخيصها لاكتشاف الأسباب المباشرة للمشاكل التي تواجه مرحلتي التصميم والبناء، والتعرف على تأثير هذه المشاكل على الأداء العام للمشروع والخروج بالتوصيات والاستراتيجيات اللازمة لتقليلها.

طريقة ومنهجية العمل لتحقيق الأهداف: أولاً، مراجعة الأبحاث السابقة لاستخراج أسباب وتأثير المشاكل التي تواجه مرحلتي التصميم والبناء والاستراتيجيات وذلك للحد منها. ثانياً، إجراء مقابلات مع مدراء المشاريع لستة مشاريع بنائية لفهم أسباب وآثار المشاكل التي تواجه مرحلتي التصميم والبناء وكذلك البحث عن الاستراتيجيات إن وجدت للحد من حدوث هذه المشاكل. وثالثاً، تم إعداد استبانة لتقييم تصور المقاولين والاستشاريين بشأن العوامل المسببة للتأثيرات الناجمة عن المشاكل التي تواجه مرحلتي التصميم والبناء، والاستراتيجيات اللازمة لتقليلها إلى أدني حد.

النتائج وإلى أي مدى تم تحقيق الأهداف: أكثر العوامل تسبباً في حدوث المشاكل التي تواجه مرحلتي التصميم والبناء هي: ترسية العطاء علي اقل الاسعار دون اعتبار التقييم الفني وسابقة الأعمال، تأثير العوامل السياسية على استمرارية الدعم، نقص الموارد البشرية الماهرة في موقع العمل، والتأخير في الدفعات المستحقة. وبالإضافة إلى ذلك، فإن العوامل الأكثر تأثيراً على حدوث المشاكل التي تواجه مرحلتي التصميم والبناء هي: تأخر تسليم المشروع، زيادة تكلفة المشروع، تدهور جودة العمل، ضعف اعتبارات السلامة والأمان في الموقع، سوء أداء فريق العمل، وضبط أهداف المشروع.

الخلاصة: أستنتج أن هناك بعض أوجه التشابه والاختلاف بين البيانات الحقيقية من المقابلات مقارنة بنتائج الاستبانة. وترجع الاختلافات بين المقابلات والاستبانة إلى أن المشروع له طابع خاص حيث واجهت هذه المشاريع عدة صعوبات منها الإغلاق والحصار الشديد بعد الحرب الإسرائيلية على قطاع غزة في عام 2014. ولا ننسى أن المقابلات شملت تصور المقاولين في حين أن نتيجة الاستبانة شملت تصور الاستشاري والمقاولين.

كلمات مفتاحية: التصميم–الانشاء، قطاع غزة، المشاريع الإنشائية، الاستشاري، المقاول.

Dedication

First, I dedicate this research to my beloved parents for their always encouragement. And to my wife who was the first cheerleader and supporter in my research.

Also, I do not forget to dedicate this thesis to my beloved brother and sisters, And without a doubt, I dedicate this research to all my relatives, friends and everyone who supported me throughout the process to achieve this thesis

Their prayers and encouragement have had a great influence to give me the power to achieve this research.

I also dedicate my work to myself because I have kept trying to learn new things as well as I have been keen on fidelity and accuracy in achieving my thesis

Mohammed Rasmy Nassar

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Last but not the least; I would like to thank my beloved parents for their endless support attention and encouragement throughout all my studies at university. As well, my thanks must be expressed to my beloved brother, sisters, nephews, and nieces for everything.

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List of Abbreviation

CFI	Comparative Fit Index
CII	Construction Industry Institute
DBIA	The Design Build Institution of America
DCIPs	Design-Construction Interface Problems
GDP	Gross Domestic Product
GEDCO	Gaza Electricity Distribution Corporation
GFI	Goodness of Fit Index
PCBS	Palestinian Central Bureau of Statistics
PCU	Palestinian Contractors Union
QFD	Quality Function Deployment
SEMs	Structural Equation Models
SEMs	Sequences of Structural Equation Models
UAE	United Arab Emirates
UNRWA	United Nation Relief Works Agency

Chapter 1

Introduction

Chapter 1

Introduction

This chapter shows an introduction to the study about the DCIPs in building construction projects, especially in Gaza strip. In addition, it contains a problem statement, aim and objectives, research questions and hypotheses, justification of the research, scope, and limitations, assumptions, key concepts, ethical considerations, methodology and the structure of the thesis.

1.1 Background:

The construction industry is considered one of the key and important industries of any country meanwhile it has a strong and wide connection with other economic sectors. Dmaidi, Dwaikat, and Shweiki (2013) said that the construction industry is complicated, commonly changing and many factors affecting its projects outcome. The management and challenges become more complicated and essential element for success when construction projects become larger and more complex, El-namrouty (2012) asserted that this catalysis the economic development in the country comes by creating large chances of jobs and participating in the gross domestic product (GDP).

In any construction project, time, cost, and quality are the triple constraints of project management triangle which are used to be an indicator for measuring project success based on the degree to which the project's team could be able to manage these constraints and produce the expected result within the allocated time and budget. Unluckily, it rarely happens that a project completes exactly as it is planned in the beginning and it often incurs time overrun, cost overrun, or quality deviation.

In Palestine, which considered as one of the developing countries, the construction sector plays a strategic role in accounting for 14.0 % of the added value to GDP and hiring more than 15.60 % of workforce. (PCBS, 2017).

In the construction industry, the construction of buildings according to the design is one of the main problems. Problems generally occurred intermediate to the design and construction phases. To reduce these problems, it must be identified. Once the problems are recognized, it is easy to avoid their occurrence. Therefore, effective construction management is important for identifying the factors that cause these problems and avoiding them.

The design-construction interface is mainly important meanwhile the quality of construction facility often is a function of the quality of the information generated through the design and planning stages, and especially of the degree of construction input to the design stage (Yun, Mulva, & O'Brien, 2012). Yun et al. (2012) also explained that reducing the discrepancies that exist significantly, assists the projects to be finished rather successfully. Dissonances on interfaces of concerned authorities either cause of delay in project duration, or compromise on quality or increase in cost. Taking into consideration the prominent issues that finally form any construction project, strengthen the need to have better solutions of those discrepancies and to coordinate on the interfaces. Figure out the potential interface issues that occur in project life cycle consider as the most important aspect. This research work is to identify the causes and impact of DCIPs in building construction projects in Gaza Strip and finally to provide recommendations to reduce the problems at the design construction interface.

1.2 Problem Statement:

Any project begins with a collection of ideas that can be converted into reality to achieve the predictable goals of the project. This conversion process needs input data from a several and wide range of team members of the project (Sugumaran & Lavanya, 2013). In a building construction projects, team members require to cooperate, communicate, and coordinate during the life cycle of the project to complete the project successfully. These teams include the designers, the owner, and the contractors and sub-contractors, besides the maintenance contractors (Wang, 2000). Therefore, Mortaheb, Rahimi, and Zardynezhad (2010) asserted that interfaces would appear through all construction parties. There are many researches in the literature that deal with different kinds of building construction projects in diverse countries. Furthermore, the past few years have shown that several of the building construction projects implemented in Palestine, suffered losses due to cost overrun and time that means they unsuccessful (Dmaidi et al., 2013). Assaf and Al-Hejji (2006) explained that several causes might due to this failure, as the nature of construction process is affected by a lot of unpredictable factors and variables resulting from several sources. These sources might be the participant's performance, the availability of resources, the environmental conditions and the contribution of other parties, in addition to some issues relate to contract.

In Palestine, such studies are few although the United Nation Relief Works Agency (UNRWA) in the year 2006 informed the repeated causes of poor performance of several local building construction projects where most of them were causes of interface problems. These reported causes were: excessive modifications of design and drawings, lack of materials, ineffective feedback and monitoring, poor coordination among contributors, and lack of the skills of project leadership (Mahamid, 2011).

Therefore, in Palestine, it is a good coverage to have some research to be used by building construction participants by understanding the main sources of interface issues and to overcome these issues and increase the possible success of the project. In comparison with the present situation with other Arab countries in the nearby environment, where the construction sector is assumed to be more governed and profitable, logical and reasonable feedback could be provided to assist in improving the continuing interface management in the country as it could be applied to the practices in future.

1.3 Aim and objectives of the research:

The aim of the research is to study the DCIPs in building construction projects in Gaza Strip: Impacts and Minimization:

1. To identify causes of DCIPs in building construction projects from the perspective of the contractors and consultants in Gaza Strip.
2. To identify the impact of the DCIPs on overall the performance of the project.
3. To provide recommendations and suggestions to reduce the problems at the design construction interface.

By the end of this research, it is hoped that a kind of control on the design construction interface will be achieved through eliminating the root causes of this problem even before their inception. As a subsequent result of this elimination, the problems related to cost, time, and quality outlined in the beginning will be depleted. An important issue to put in mind is that denying such causes will directly affect the entire project negatively.

1.4 Hypotheses of the research:

The following hypotheses were determined in this research.

H1: There are differences in responses to DCIPs in Building Construction Projects in Gaza Strip: Impacts and Minimization due to the general information at significance level ($\alpha \leq 0.05$).

H2. There is a significant effect of the DCIPs in Building Construction Projects causes, statistically at $\alpha \leq 0.05$, on impacts of the DCIPs in Construction Projects in Gaza Strip.

H3. There is a significant effect of the causes of the DCIPs in Construction Projects causes, statistically at $\alpha \leq 0.05$, on minimization of the DCIPs in Building Construction Projects in Gaza Strip.

H4. There is a significant effect of the impacts of the DCIPs in Building Construction Projects in Gaza Strip, statistically at $\alpha \leq 0.05$, on minimization of the DCIPs in Construction Projects in Gaza Strip.

H5. The impact of the DCIPs will significantly mediate the relationship between the effects of the DCIPs in Building Construction Projects causes, on minimization of the DCIPs in Building Construction Projects in Gaza Strip statistically at $\alpha \leq 0.05$.

1.5 Justification of the study:

The Palestinian Contractors Union (PCU) claims that the first rank among the Palestinian economic sectors has been occupied by the construction sector (Enshassi, Arain, & Tayeh, 2012). However, the construction process itself is becoming progressively more complex due to the technical and managerial complexity of the industry as well as the huge number of contributed parties such as owners, consultants, contractors, regulators, vendors, shareholders, suppliers, and many others (Navon, 2005).

Many designers and owners are trying to get the perfect projects with a least cost, least margin of conflict and time overrun over each stage in the life cycle of the construction project. It is clearly noticeable in the traditional approach of building construction that there is a lack of interaction between project parties, especially designer and constructor, which may create adversarial relations between them and affect project performance. This can be considered a major obstacle that prevents a stronger design-construction interface. Hence, it is extremely important to eliminate the inconsistency on interfaces in the same party and between various parties that might be raised during the project to ensure the completion of the project successfully. If not, the project might be delayed, the cost might be increased, or quality might be minimized. In this regard, the primary difficulty is to properly convey the correct information, in the accurate format, to the true person, at the exact time. Even though if there is a high level of concurrency, but managing the inflow and outflow information still the main challenge that must be confronted (McCarthy et al., 2000).

The study will be supportive for the construction project stakeholders to increase the awareness of a clearer view of the causes of DCIPs in building construction projects in Gaza Strip, which allow the project team to realise the impact of those problems on overall project performance and finally provide possible recommendations and suggestions to reduce the problems at the design construction interface. Here is an urgent need to have extensive solutions of many problems such that a better control on time, cost, and quality could be emerge and a better management on the interface could be reached as well.

1.6 Scope and Limitations:

This study is concerning to building construction projects in Palestine, specifically in Gaza strip. The data will be collected for building projects that have been implemented in Gaza Strip to accomplish the research goals from the perspective of the local contractors and consultants, a wide review and analysis of the literature were proceed to find causes of DCIPs in building construction projects in Gaza Strip and find the impact of the problems on overall project performance and provide recommendations and suggestions to reduce the problems at the design construction interface.

1.7 Assumptions:

There were several assumptions established in this study as follows:

- Participant companies for interviews will let access to their project information and cooperate as needed by the study.
- Participants will honestly provide correct information regarding the DCIPs.
- Construction projects in Gaza Strip adopt the traditional design bid and build procurement system where construction risks are almost equally shared among the owner and contractor besides the designer is the owner's agent.

1.8 Ethical Considerations:

Precautions were taken to assure that the study was done in an ethical manner. Firstly, the study was carried out with the full consent of the board of postgraduate studies of the Islamic University of Gaza. Secondly, the study certified that the participant's confidentiality was preserved by not requesting for information that would reveal their identity. In addition, the information provided was used for academic purposes only. Finally, the study encouraged voluntary participation and respondents were not enticed to participate in the study.

1.9 Research Methodology:

The objectives of this research will be accomplished as follows:

First Stage: Problem identification. It includes defining the problem, demonstrates the aim and objectives, research questions and hypotheses. In addition, support a research approach and appropriate technique.

Second Stage: Literature Review. Literature and previous studies related to the research will be extensively reviewed.

Third Stage: Interview. face to face interviews with the projects' managers of the selected building construction projects will be done on six building construction projects to find the causes, and impacts of the DCIPs in building construction projects in Gaza Strip and strategies to minimize it. The findings of this research will be the basis for the research design of the main study.

Fourth Stage: Questionnaire.

Fifth Stage: Results and discussions. Collected data will be analyzed using suitable statistical analysis tools. Both qualitative and quantitative methods will be used. Hypotheses will be tested and the findings will be summarized.

Sixth Stage: Conclusions and recommendations. Conclusions will be summarised from the analyzed data and recommendations for improvement and the study in the future will be formulated.

Seventh Stage: Documentation**.** It includes editing the final text, formatting, and spelling and grammatical review.

1.10 Structure of the thesis:

This study was structured into six chapters as follows:

- **Chapter 1 (Introduction):**

This chapter presents a general introduction to the topic of the thesis. It comprised the background of the study, problem statement, aim, and objectives, hypotheses, justification and limitations of the study, assumptions, ethical considerations, methodology of the research and research structure.

- **Chapter 2 (Literature review):**

This chapter shows an extensive literature about the causes and impact of DCIPs and strategies to minimize it will be discussed.

- **Chapter 3 (Methodology):**

This chapter discusses the tools and methods used for collecting data.

- **Chapter 4 (Data Analysis and Discussion):**

This chapter constitutes the analysis of data collected with the research instruments. It analyses data from the interviews and the questionnaire.

- **Chapter 5 (Conclusions and Recommendations):**

This chapter states the conclusions and recommendations written based on analyzed data, connecting them to the problem statement, hypotheses, and objectives of the study. It also includes the recommendation for future studies.

In general, the research was drawn following a certain structure. However, step order may differ reliant on the subject under investigation and researcher, the steps drawn in Figure (1.1).

1.11 Chapter summary:

This chapter drawn the framework of the entire research study. The initial literature review concentrated on the background. Subsequently, a problem statement was formulated. The aim of the research was to study the DCIPs in Building Construction Projects in Gaza Strip, their impact on the building construction projects in Gaza Strip and recommendations of strategies to minimize it. Justification, limitations, and assumptions of the study were mentioned. The research data collecting complied with internationally accepted ethical standards. The research methodology argued the tools and methods used for collecting data. The thesis structure showed an overview set up of each chapter.

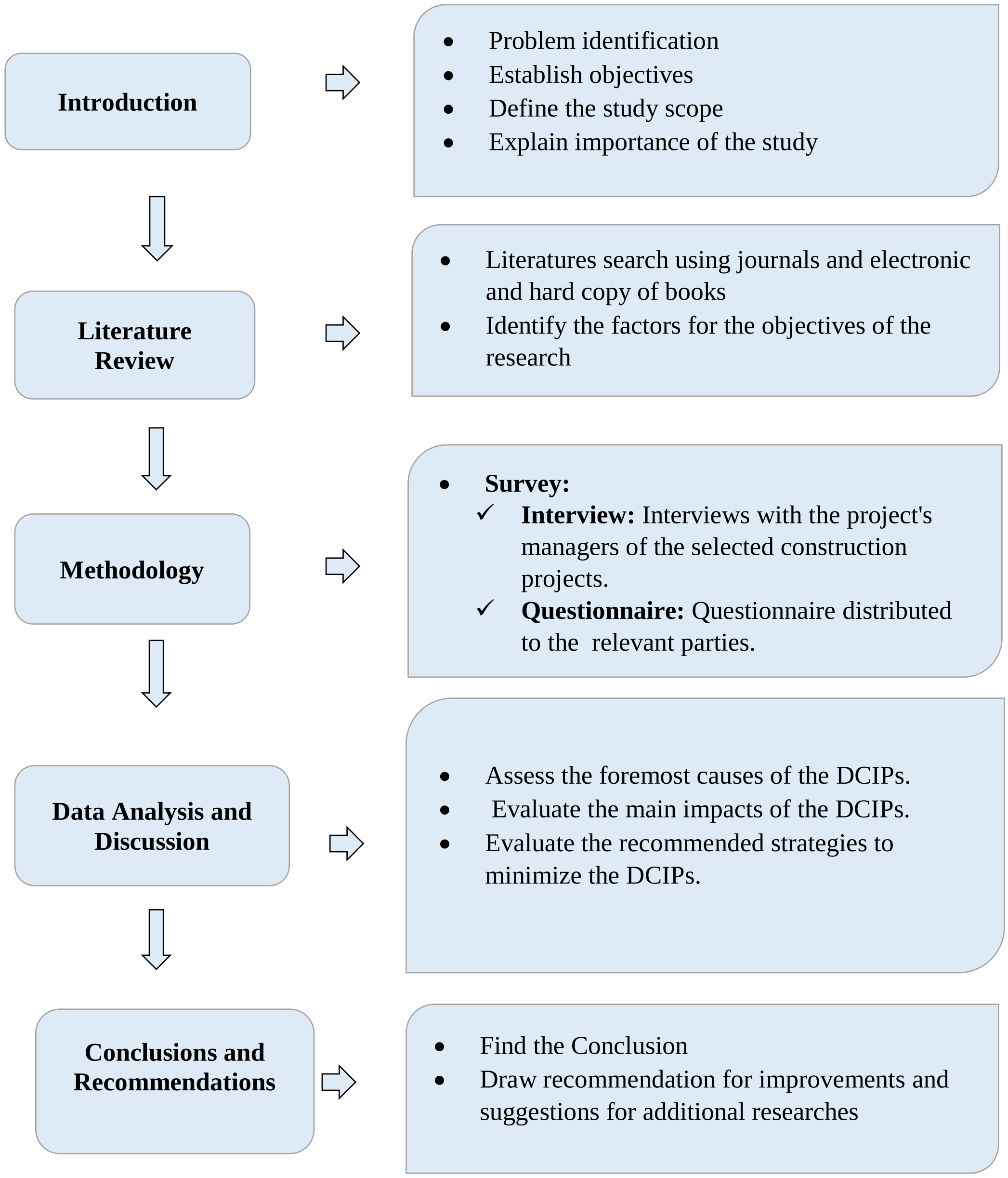

Figure (1.1): The research structure.

Chapter Two

Literature Review

Chapter 2

Research Methodology

This chapter discusses the literature review that has been aimed to establish an understanding of the design–construction interface problems. It covers the introduction, construction project life cycle, design phase and construction phase, types of construction projects, the parties in construction projects, types of construction contracts, project delivery method, design–construction interface definition, DCIPs, impact of the DCIPs, recommended strategies to minimize the DCIPs. The main sources have been refereed academic research journals, theses, publications, websites and conferences.

2.1 Introduction:

Many papers address the issues relating to design and construction processes interface in different ways. Out of the found issues, design-construction interface and its associated problems were considered as a key issue in this regard which requires a fair attention. A reason for this is that better managing this interface and knowledge transformation process across it will reduce project delivery time, cost, and save the quality of the final product. Moreover, both design and construction phases are just starting points at the beginning of the line of projects lifecycle. The status of the construction phase totally depends on the design phase, and the statuses of the other phases depend on the successful relationship between them both. Thus, the lack of conscious concerning the problems that may arise on the interface between design and construction and the different ways in solving them might have a bad effect on the status of the whole project.

Design–construction interface inconsistencies, are considered as an obstacle to the success of the project. however, Interface problems often happen much earlier among project personnel and business within an owner's organization. These interface issues, also, lead to a misalignment of strategy of business with the management of the project (Yun et al., 2012).

2.2 Construction Project life cycle:

Any project in the life includes a certain number of phases of development. These phases should be clearly understood for more efficient project control as they represent the path which takes the project from the starting point to the end point and is generally referred to as “the project life cycle”. However, there is no standard project life cycle as it may differ in both the number of phases and the detailed within each phase.

Shokri, Ahn, Czerniawski, Haas, and Lee (2014) indicated that the Construction Industry Institute (CII) described the traditional life cycle of the project for most construction projects that it is relatively linear in its process where each phase should have completely finished before starting the subsequent phase. The main phases that comprise this process are Feasibility study, Concept, Scope, Design and Procurement stage, Construction stage, Commissioning and Start up, and Operation as shown in figure (2.1).

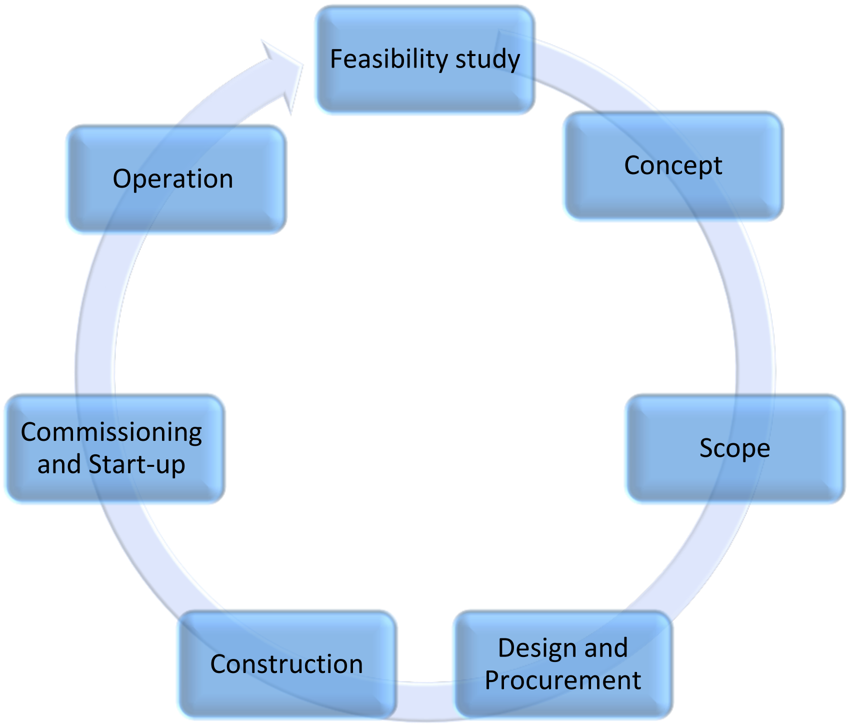

Figure (2.1): life cycle of the construction project.

Ismail, Rahman and Memon (2013) categorized the project life cycle phases into four main stages, which were planning stage, design stage, construction stage, and finishing stage. The planning stage emphasis on few things like the scope, purpose, objectives, resources, cost, time, and deliverables of the construction project to guarantee the desired completion. In the design stage, detailed plans and drawings are prepared according to the client requirements. After finishing the design, the construction stage starts which comprises of project plans execution, communication between various parties, project progress reporting, and time, cost, and quality control. Finally comes the finishing stage to conclude the construction work where exterior and interior finishes are conducted for the constructed facility, such as plastering, flooring, painting, and others.

Saad (2011) divided the project life cycle to five stages which include conceptual planning and feasibility study stage, engineering and functional design stage, stage 3, construction and completion stage, and operation and utilization stage. The first stage comprises of conceptual planning and feasibility study on a project using a few number of components like analyzing the concept, studying economic and technical issues and reporting the expected impact on the environment. Engineering and functional design stage was divided into two main stages or sub-stages that are preliminary engineering and design, and detailed engineering and design. However, all these stages have more emphasis on the architecture concepts and structural analysis to guarantee that there is no contradiction between any structural element and its actual specification. For the phase 3, the designer should be prepared all contract documents and submitted to the contractor. The accomplishment of this phase goes through an order of the following steps: preparing drawings and specifications, tendering and awarding, and procurement process. Next, in construction and completion phase, project execution starts, where the on-paper designs are to be converted into a physical component, and goes on until completion within the previously allocated time, cost, and quality. Finally, operating and utilizing the project begins and it is usually determined since the concept development during the beginning of the project.

2.3 Design Phase and Construction Phase:

This study will focus only on two main phases of project life cycle in addition to the relationships between them. These phases are:

2.3.1 Design Phase:

There are several definitions of architectural design, most commonly and traditionally that Carmona (2010) defined as "Creating or Designing space while accommodating the important requirements of the space stipulated by owner".

In the design stage, many designs are developed, with which the project result can actually be reached. The designer recognize the Owner's strategic need, the initial goals of the project are established along with exploring the availability of means to achieve them, and a set of formal drawings and other related documents that reflect these goals has been developed properly for execution.

Mendelsohn (1997) noticed that the design phase probably generate 75% of the problems occurred on site which not mean that contractors don't make a lot of their own problems but that these problems were frequently occurred due to design flaws. If one were to seriously consider ways to eliminate problems on the site, clear place to begin with is to give attention to what the project team can do to reduce these problems at the design stage.

Arain (2002) described the design phase services for a building construction project to include these jobs:

A. Preliminary Services:

1) Inception: This includes discussion of owner's requirements, the allocated time and cost, and the desired level of quality, to assess all of these constraints and advise the owner. For this purpose, many project information should be encircled and a primary analysis of project concept including a conceptual design proposal should be initiated to help the owner in site selection (if required).
2) Feasibility: Through the project feasibility study, owner secure his investment return where the designer consider all the available data on the project and owner requirements, review alternative designs and the associated construction methods a cost implications, advise on to get planning

permissions or approvals under building acts or even regulations (if there is a need).

B. Basic Services:

1) Sketched Design Proposal: This requires a collaboration with other consultants (if appointed) and a comprehensive analysis of owner's requirements in order to prepare outline proposals associated with an approximation of construction cost to be preliminarily approved by the owner.
2) Final Design Proposal: This is going to be developed based on the approved sketch considering owner's amendments. A modified cost estimate will be prepared in addition to providing an indication of a possible schedule for the contract (if applicable). This proposal will illustrate, in details, project size and character in a way enabling the owner to agree on the building final image including the spatial arrangement, materials, and appearance. It also includes advising the owner concerning any implication of subsequent changes on project cost or outcomes.
3) Detailed Design: It comprises the development of the final proposal agreed by the owner to result in completed design documents which are drawings, specifications, and calculations. The main services of this job include:
   - Preparation of production information such as drawings and others.
   - Obtaining the owner's approval of construction type, materials quality, and workmanship standards.
   - Obtaining quotations and other information concerning specialists' work.
   - Coordinating other contractors, manufacturers, and suppliers.
   - Checking construction cost.
   - Advise the owner of the subsequent of any variations on the cost and schedule.
   - Negotiate to obtain the needed approvals on building acts, regulations, and other statutory requirements.
4) Quantity Take-off and Tenders: To finalize the design, all the related information concerning, construction schedule, specification of materials and workmanships bill of quantities, expected cost should be available.

2.3.2 Construction Phase:

In the construction stage, the actual work of the project is performed, resources and materials are procured, performance capabilities are verified, and, at the end of this phase, the project will transferred to the intended users for utilization. O'Connor, Torres, and Woo (2016) explained that all fabrication/jobsite/field activities and decisions, starting with construction phase whereas Jabar, Ismail, and Mustafa (2013) explained that the construction stage acknowledged as the performing stage where the project plan is implemented, and work tasks are execute to accomplish project deliveries and project objectives.

Arain (2002) also explained that the construction phase refers to all services required to transform the design into an operating facility.

These services are mainly include:

1) Provision of Human Resources: It is the constructor responsibility to provide the required human resources for the project in addition to any specialist as indicated by the contract.
2) Machines and Equipment: All machines and equipment stipulated by the construction contract should be provided on time at the construction site by the constructor.
3) Building Materials: Construction materials provided by the constructor should be as specified in the documents and as required by the owner. In addition, they should be approved for quality and materials and so on before installation.

2.4 Types of construction projects:

A vital element of any country's infrastructure and industrial growth is a construction project. The construction field is as diverse as the forms and uses a lot of types of structures it produces. Arain (2002) explained that the construction categories are four main types of construction projects; engineering, industrial, building, and residential construction. They further explained the categories as the housing or residential construction contains the building single-family homes; multi-unit tower houses, condominiums, high-rise apartments, and low-rise garden type apartments. Building construction includes institutional, governmental, educational, light industrial, religious, social, commercial, and recreational purposes. Engineering construction is a wide range category and covers structures, which are planned and designed by engineers. Industrial construction contains the erection of projects that are associated with the manufacture or production of a service or commercial product.

Moreover, Love (2002) mentioned that there are three type of construction projects; residential, industrial, and commercial building projects.

2.5 The parties in construction projects:

Construction projects include many parties like consultants, designers, contractors, suppliers, and subcontractors (Huang, Huang, Lin, & Ku, 2008). In addition, Acharya, Lee and Kim (2006) articulated that the construction project as an enterprise which has three main parties that affect the project. These three parties are the client, contractor, and designer. The major construction parties have diverse objectives and thinking way.

In general, construction project includes three main parties in traditional practices of the construction project. In particular case in Gaza Strip, there is an additional party called the donor. These four parties are Owner, Designer, Contractor, and Donor. Communication and coordination among all parties is the key element to be considered to complete the project successfully. It is assumed that discrepancies between the parties (Constructor and Designer) most active parties initiate obstacles in the construction and design phases.

2.5.1 The Owner:

The owner is a person on behalf of the users and future occupants. Asamaoh and Offei-Nyako (2013) noted that the owner as the project originator plays a main role in the construction project from the beginning to the end. Owners expect the requirements and objectives of the projects, formulate the scope of works and the necessary quality standards. The owner is the most party responsible for unclear briefing and changing requirements (Anees, Mohamed, & Razek, 2013; Mohammad, Ani, Rakmat, & Yusof, 2010; Eigbe, 2016).

Donold (2013) classified owners into two categories: owners who have extensive experience of the construction industry and those with little experience or without experience (naive). Experienced owners in construction are included during the design phase by giving professional guidance to the team of design. This participation may contribute to the prevention of continuous variations through the construction phase. The technical input into the design by owners avoids them from fully depending on the designer, reducing the opportunity for them varying their mind throughout the construction phase. Owners with little or without knowledge in construction lead to follow the guidance of the designer with no apparent idea that their needs have been met.

2.5.2 The designer:

The designer team commonly consist of an architect, quantity surveyor, services engineer (electrical and mechanical) and structural engineer (Mbamali & Okotiee, 2012). Traditionally, the designer transfer their ideas to the physical world through sketches and drawings. Architect/ Engineer develop the design according to the needs of the owner taking into consideration the building laws and regulation related to that design premises, because of this purpose firstly, designer considers all the available information and then analyze it for developing a design consequently.

Mendelsohn (1997) stated that a contractor has a concrete mind and the designer has a conceptual mind. One relates to tangibles and the other relates to intangibles. This difference between these two parties will be the source problems in the design and construction stages (Arain, Pheng, & Assaf, 2006).

2.5.3 The contractor:

In conventional construction contracting, the contractor builds according to a design provided by the owner and prepared by the designer. Each parties included in the contract should be know that the information given by the designer is not always right. According to Sweeney (1998), the contractor may suggest alternative construction methods because of his knowledge in the field will work well and fit the function of the design than the way proposed by the consultant or owner. Donold (2013) mentioned that the contractors may discover errors, omission, and conflict in the documents and may request designers opinion concerning the problem arise.

Little interaction among design and construction, including their specialists, would lead to suboptimal solutions and a great number of changing orders (rework of design and construction).

Arain and Assaf (2007) proposed that getting the contractor included in the design can assist to reduce the interface problem among him and the designer. Lack of contractor's involvement in design may eventually cause variations. Practical ideas that are not accommodated through the design stage will finally influence to the progress of the project in the construction stage where the impact can be more worse than in the design stage.

2.5.4 The Donor:

Today's Palestinians were under their own civil rule. Though, they were far from having the field to grow, move freely and develop; restrictions on trade and movement were imposed. The continuity of fight over resources, and this constrained entity was denied the sovereignty; it had no definite borders, no even a national currency or army, no control over crossings (Sarsour, Naser, & Atallah, 2011). Therefore, the donor assistance played a vital role in promotion infrastructure facilities of Palestinian and minimizing the negative impact of the Israeli practices and policies.

Gaza Strip depends on most on external funding from Arabian and international donors, that made a high real challenge for the contractors, owners, and all parties operating in construction projects. Alimrani (2015) stated that the donor sought to strengthen the Palestine National Authority to manage the Palestinian areas, establish facilities and institutions, execute projects for restoring the infrastructure, and to administer the funding of the overall development process. This leads Enshassi, Arain, and Al-Raee (2010) to argue that the donor does not fund any projects that exceed his financial capability and not satisfying his guidelines. As the donor allocated the required fund, he plays a regulator role and his interference in project stages is smaller.

2.6 Types of Construction contracts:

Construction contracts are categorized and described by the terms of payment they contain: Lump Sum or Stipulated Price, Cost Plus, Unit Price, etc. (Wideman, 2002).

The written contracts provide businesses and individuals with a legal document stating the anticipations of the two parties and how to resolve the disputes. In addition, contracts are legally enforceable in a court of law and often considered as a tool that companies use to protect their resources. If there are some errors in the formulation of contract documents, the unclear language of the contract can be a reason for the dispute. Dmaidi et al. (2013) said that for the successful project, it is important that the obligations and requirements of the construction contract are fulfilled and understood by parties to attain contract predictable benefits as effectively and efficiently as possible.

Construction contracts must involve a compensation system and commonly are categorized regarding the compensation system as shown in figure (2.2).

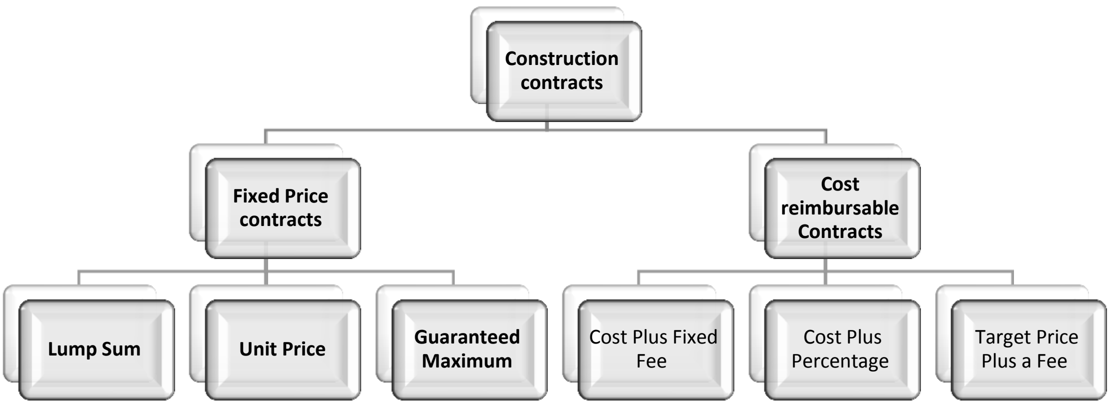

Figure (2.2): Types of construction contracts.

2.6.1 Fixed Price contracts:

Fixed Price Contract involves all types of contract in which financial terms need the contractor to "establish a required sum for the completion or implementation of a defined quantity of work". Under this category, the following types are listed:

2.6.1.1 Lump Sum:

The contractor is required to implement the project in accordance with specification and plans for a fixed price. The contractor will be only responsible for any cost above the agreed amount. As agreed, the scope may include or exclude materials, engineering or procurement. Love (2002) asserted that cost certainty is an essential part of the lump sum method and appears to be a key driver for owners.

2.6.1.2 Unit Price:

This contract type includes a list of estimated work quantities in detail like cubic meters of concrete or excavation work or a different length of pipe sizes. The client in this situation will take the risk of changes in quantity. Fixed price paid is specified by actual units done as executed. Unit price contract gives the client freedom to make variations in the volume of work and allow more control.

Al-Hammad (1995) mentioned that after the contractor starts work, the owner unit price contracts might cut the budget so such conflicting practices may create problems between the two parties.

2.6.1.3 Guaranteed Maximum:

Guaranteed Maximum is a form of contract that compensation may differ regarding the amount of work involved but in any case not more than an agreed total amount (Wideman, 2002). The owner is guaranteed a maximum price for performing the work as defined in the contract. Generally, the contract includes penalty clauses for cost overruns and incentive clauses for cost under-runs.

2.6.2 Cost reimbursable Contracts:

All contract types included in this category, in which the contractor price adjustment relative to project costs allowed in financial terms. Under this category, the types as following:

2.6.2.1 Cost Plus Fixed Fee:

whatever cost incurred with the project is paid by the contractor plus a lump sum fee for overhead and profit (Berends, 2000).

2.6.2.2 Cost Plus Percentage:

All costs incurred with the project is paid by the contractor plus a percentage of these costs rather than a fixed sum or fee (Arain, 2002).

2.6.2.3 Target Price Plus a Fee:

A target price is first recognized for the cost of the project based on unit prices or contract documents. “The contractor’s fee will be based on this sum. Normally financial arrangements make provision for the contractor to share any savings under the target price or contribute to the liability of cost overruns” (Larson& Gray 2013).

2.7 Project delivery Method:

The Design-Build Institution of America (DBIA, 2015) defined the project delivery as a complete process with planning, design, and construction needed to perform and complete a building facility or other type of project.

The successful completion of a building project needs a complete vision of owner’s requirements, the responsibilities of all concerned authorities, and the nature of the service to be provided. In any construction project, a diversity of major authorities and different responsibilities could be found relied on the selected delivery method for this project. Choosing a project delivery method is one of the essential choices owners make while developing their gaining strategy. Therefore, Ibbs, Kwak, Ng, and Odabasi (2003) stated that every owner accountable for the execution of a construction project must make an important and early decision relating the method by which the project will be designed and implemented.

Mahdi and Alreshaid (2005) described three common methods for project delivery which are traditional/conventional design-bid-build (DBB) system, design-build (DB) system and Construction management at risk (CM@R).

2.7.1 Traditional/conventional delivery Method (DBB):

This system has three main parties: designer, owner, and constructor. Here, the design is followed by construction and they are assigned to two separate entities, where the design contract is assigned on a quality-based selection, while the construction contract is assigned to a bid-based competitive.

The employer agrees that design work will frequently separate from construction, consultants are responsible for cost control and design, and the contractor is responsible for implementing the works (Davis, Love, & Baccarini, 2008). The complete design can be prepared during the design stage. Thus, client and designer discuss together the final design.

It is obviously seen that both designer and constructor are the responsibility of the owner and no one is responsible for the other, the thing that creates an independent relationship between them. This separation, in turn, produces a system of checks or balances as both entities are in a position to determine the errors originated by the other and sometimes they are needed to report it to the owner such that error effects can be minimized or eliminated and the quality of the construction project will be improved. However, this method is frequently criticized due to the time extension in both design and construction in addition to the adversarial nature of the relationship between constructor and designer. That is why many changes of this project delivery system have arisen.

2.7.2 Design and build delivery Method (DB):

DB is the oldest method which is considered as a new and alternative delivery method. It recovers the master build concept in construction and variations are viewed as improvements on the project that makes it one of the best methods of design and construction integration but this integration lets the process of detail design and construction to run nearly concurrently and in parallel to each other and construction beginning before completion the final design.

This method has been seen by some as the right solution in addressing the other methods' limitations. As a client, the great advantage lies under the simplicity of having one party which is responsible for the project development. Many of the disputes raised among various project participants, when using the other delivery methods, turned to be internal team issues in this system which do not affect the client since he will not be a referee anymore. Moreover, this system typically requires owner's completion of only 5-30% of the project's initial design before transforming it to the design-build team to complete it. On the other hand, this system gives the design-build team an opportunity to merge alternative technical concepts at both design and construction stages in a way that improves the project's delivery process.

Ashworth (1998) mentioned that the design will be more affected by the contractor's construction abilities than the design requirements of the owner. The participation of contractors into the design is a chance for them to use methods of construction and specialized knowledge developing from their own design and as a result, there is minimize DCIPs.

2.7.3 Construction management at risk delivery Method:

Construction management at risk (CM@R) include a construction manager who takes on the risk of building a project. The engineer is chosen first for designing the project and then a construction manager is employed at risk to be as a contractor through construction phase while guaranteeing the facility construction at a certain amount. At the same time, he is responsible for providing consultation to the design phase in terms of evaluating schedule, costs, as well as alternative designs, materials during and after the design of the facility, and systems (Rojas & Kell, 2008).

It is somehow similar to DBB, but the advantage here is that the construction manager holds the risk of giving construction works to trade subcontractors and providing a guaranteed maximum price for project completion, either negotiated price or a fixed.

2.8 Design–Construction Interface:

2.8.1 Definitions of design–construction interface:

In the construction projects, many interfaces would appear between numerous contractors, owners, and engineering teams, as well as, manufacturers contractors and, contractors and sub-contractors (Mortaheb et al., 2010).

Design–construction interface has numerous definitions. According to Ku (2000), the interface is the dimension among two organizations that both of them affect each other.

Huang et al. (2008) explained that the interface like the matters required being functionally and physically coordinated with two or more topics. The size of construction projects and complexity could increase the design–construction interface problems. Huang et al. (2008) also stated that the interface problems result in the interactive relationships between units that can be materials, events or contractors. Therefore, the interactive relationship in complicated construction projects among parties would increase the opportunity of interface problems. Shokri, Haas, G. Haas, and Lee (2016) articulated that large and complex projects experience large risks regarding the interfaces among parties. Previous studies that identified the design–construction interface problems vary by their method of categorizing the problems. For example, Pavitt and Gibb (2003) divided interface problems into organizational, physical and contractual problems while other researchers shed light on the interface problems among two construction parties, such as contractors and designers (Al-Hammad & Assaf, 1992), owners and contractors (Al-Hammad, 1990), subcontractors and contractors (Al- Hammad, 1993), and among construction parties (Al-Hammad, 2000).

Arain et al. (2006) and Arain and Assaf (2007) considered the interface problems using the phases of the construction project that include design, construction stage and the problems which might occur in both of the stages that is named design–construction stage. This method of classifying is adopted in this research as it contains the key stages of the construction project.

2.8.2 Relevant Previous Studies:

Lin and Jeng (2017) explained the interface problems causes in construction projects by structural equation modelling. This technique is a systematic approach that combines path analysis and factor analysis to examine the causal relationships amongst multidimensional factors. By reviewing the literature on construction interface problems and conducting a questionnaire survey in Taiwan to classify 27 initial factors that be the source of interface problems in three dimensions: design, owner, and construction. Then, a sequence of structural equation models (SEMs) was developed to explore the origin causes of the interface problems. Three main findings of the study: firstly, poor design causes interface problems; secondly, poor coordination and communication between the design, owner, and construction dimensions are the key factors that cause construction interface problems; and thirdly, a lack of communication and coordination has a greater effect on the construction dimension than on the design and owner dimensions. These findings can be used as significant references and maintainable management strategies for academia and decision-makers in the construction industry.

Sha'ar, Assaf, Bambang, Babsail, and Fattah (2016) conducted a study in large building construction projects in Palestine to identify the reasons for DCIPs. The results explained that the top 10 important causes are 'lack of proper coordination between various disciplines of the design team', 'unstable client requirements', 'lack of skilled and experienced human resources in the design firms', 'awarding the contract to the lowest price regardless of the quality of services', 'lack of skilled human resources at the construction site', 'delaying of dues payments', 'lack of specialized quality-control team', 'lack of professional construction management', 'delaying the approval of completed tasks' and 'vague and deficient drawings and specifications'. Spearman's rho coefficient was 0.64, which shows that the overall level of correlation among Palestinian contractors and consultants in this study can be recognized as moderate.

AL Mousli and El-Sayegh (2016) studied, in the United Arab Emirates (UAE), the design–construction interface problems construction industry. The results disclosed in the UAE that the most important interface problems involve lack of specialist construction manager, lack of coordination inside the design firm, poorly written contract, lack of project management as individual professional service and time limitation in the design stage. Besides, the study analyzed the responses regarding company role. Many problems are the result by the lack of coordination and communication among the main contracting parties.

Sugumaran and Lavanya (2013) studied in India the causes of the conflict at design- construction interface for large building projects. First, a review of literature talking about design-construction interface issues was conducted where the resulted information regarding the potential discrepancies between design and construction were utilized to develop an initial questionnaire that would be used in the next step. Then, a pilot study was conducted on three large building projects to validate the initial questionnaire and develop a final one for the survey purpose. Two samples of 31 consultants and 30 contractors were statistically analysed and the results indicate that the most significant causes of design-construction interface discrepancies were "Lack of coordination", "Insufficient working drawing details", "Involvement of designer as a consultant", "involvement of contractor as a consultant", and "participant's honest wrong beliefs". Against the most significant causes, there are the least important origins which were "Project management as individual professional service", "nationality of professional firms", "involvement of contractor in design conceptual phase", and "involvement of contractor in design development phase". Cause and effect analysis was used to improve the design- construction interface.

Mitchell, Frame, Coday, and Hoxley (2011) considered the interface between construction and design processes to examine a conceptual framework of this interface such that a basis for improving its understanding could be provided for a better management. A theoretical understanding of the relationship among both design and construction processes was considered to produce a framework that reflects what actually occurs at this interface theoretically and empirically. To achieve this goal, literature and different theoretical backgrounds for the processes of both design and construction phases, as well as the significance of developing such framework were reviewed. As a result of this review, a significant difference between the theoretical understandings of these two processes was identified to mark a starting point for developing a conceptual framework for the interface among design and construction. This difference is that while design process can be described as iterative and circular, the construction process is sequential and linear in nature, and there is a kind of uncertainty in design much more than it is in construction. This significant theoretical dichotomy among these two processes will affect the information's flow through their interface and as a result, the interface management will be affected as well. The developed framework is considered to have a considerable effect in improving project management techniques on this interface and optimizing the process of subcontractors' selection, input, and an appointment. Furthermore, it opened the door for further researches in the future through providing a good understanding of the characteristics of the interface.

Chang, Shen, and Ibbs (2010) studied the design and construction coordination problems that any new user might encounter in execution of design-build projects in

Taiwan. The case study approach was selected to analyse these problems such that coordination problems and their possible solutions were investigated through studying 5 ongoing design-build projects and interviewing 9 major contract parties. The analysis of the collected information revealed that inadequate planning and execution are the main causes of coordination problems in design-build projects. Inadequate planning comprises completion of conceptual design at a high level, while inadequate execution comprises dissonant design-construction, long review process, and little feedback between designer and constructor. It was concluded that the problems of major influence on design-build projects were the dissonant design-construction and the little feedback between designer and constructor. Furthermore, the results indicated that inadequate coordination between design and construction will affect project time and cost and will lead to many design changes and conflicts. At the end, the researcher advises for good planning and execution guidelines in addition to good management practices to avoid, minimize, and solve such problems.

Mitchell, Frame, and Coday (2008) in their paper "A Conceptual View of the Interface between the Detailed Design Process and the Construction Process" examined the diverse theoretical backgrounds to the construction and design processes and discussed their effects on the interface between the construction design processes in practice. They identified the important difference among the theoretical understanding of the design and construction process. What emerges could have effects on the interface management among them. Furthermore, a possibly important impact on the design process established because the lack of access to specialist knowledge at the optimal time is also identified. The importance of conceptual frameworks in research is identified, and the conceptual frameworks for the interface between the detailed construction and design processes are developed. These provided a foundation for a better model for the understanding and management of the interface that reflects the diverse theoretical foundations, and for an optimized process for the selection, appointment and input of professional subcontractors.

Arain and Assaf (2007) studied in Saudi Arabia the causes of problems at design and construction interface in large building projects from the consultants' point of view. They distributed a questionnaire on consultant firms to collect the required information about the potential sources of design-construction interface dissonances. Responses from 24 consultant firms were analysed and the conclusion was that “Contractors’ lack of comprehension of drawing details and specifications”, “Involvement of contractor as consultant”, “Time limitation in the design phase”, “Design complexity”, and “Honest wrong beliefs of participants” were the sources of problems with the highest significance on design-construction interface. On the opposite side comes the sources of problems with the lowest significance which were “Project management as professional services”, “Weather conditions”, “Unforeseen conditions”, “Involvement of contractor in the design conceptual phase”, and “Involvement of contractor in the design development phase”. At the end, various ways of reducing the gap between the consultants and contractors were suggested to improve the design-construction interface.

Arain et al. (2006) studied in Saudi Arabia the causes of discrepancies between design and construction of large building projects from the contractors’ point of view. They distributed a questionnaire on contractor firms to collect the required information about the potential causes of discrepancies at design-construction interface. 27 responses were collected from contractor firms and then analyzed to conclude the most important causes which were “Involvement of designer as a consultant”, “Communication gap between designer and constructor”, “Insufficient working details”, “Lack of coordination between parties”, and “Lack of human resources in design firm”. Moreover, the least important causes on the other side could be concluded as well. They were considered by respondents to be “Project management as a professional service”, “Weather conditions”, “Nationalities of participants”, “Involvement of contractor in the design conceptual phase”, and “Unforeseen conditions”. At the end of the research, many recommendations were suggested to overcome the most significant sources of discrepancies such that the design- construction interface will improve.

Arain (2002) in his study "Design-Construction Interface Dissonances" shown results of the study in large building projects on design-construction interface dissonances in Saudi Arabia. The results showed that insufficient working drawing details, lack of coordination, an involvement of designer as a consultant, an involvement of contractor as a consultant and participants’ honest wrong beliefs are considered as most important origins of professional dissonances on project design and construction interfaces. While nationality of professional firms, the project management as individual professional service, and involvement of contractor in design stages are interestingly shown as least important causes of dissonances among construction interfaces and professionals on project design in large building projects.

Al-Hammad (2000) studied general interface problems between various construction parties in Saudi Arabia. He identified and assessed these problems through conducting two phases of research: the first phase was conducting a literature review and interviews with numerous construction professionals from numerous parties to identify the potential interface problems among them and then he classify them into categories to be presented in a logical sequence by grouping the problems that have a common purpose, while the second one comprised developing a questionnaire containing the problems previously identified from the first phase to be distributed on respondents. A sample of 102 construction professions including designers, owners, general contractors, subcontractors, and maintenance contractors were selected for the survey to assess the severity of 19 potential interface problems, which were classified in four general categories from a subjective perspective: financial, contract and specifications, environmental, and other common interface problems. A severity index was used to determine the relative severity of each category and its regarding problems such that a ranking order could be built for them. Analysing the survey's results revealed that the highest severity ranking of the presented interface problems was given to "Violating conditions of the contract", "Owners low budget for construction relative to requirement", "Insufficient working drawing details", "Poor quality of work", and "Poorly written contract". On the opposite side of the highest ranking comes the lowest ranking where "Weather", "Delay in the finish of project", "Prices change of materials and laborers during construction", "Geological problems at a site", and "Unavailability of professional construction management" were ranked as the lowest severity interface problems. Additional interface problems, which were added by respondents to be part of the survey's final results.

McCarthy et al. (2000) studied the evolution of information exchange and sharing interfaces between designer and constructor during a project in the UK and identified the critical success factor of knowledge management in this regard. This work was part of a project entitled "Knowledge Learning in Construction" that aims at improving the quality and value solution of the project environment. This project examined knowledge transformation mechanism from the early design of the project to the detailed design and then going on to the construction phase. The researcher part examined the mechanism of knowledge transformation in the tendering phase as it is the initial interface between the designer and some potential constructors and it set the foundation for exchanging information efficiently throughout the project. He also examined the flow of geotechnical and site investigation information through the project activities.

Wang (2000) studied the pros and cons of the foreign design that might affect the local community and the construction market in China. A questionnaire survey was directed to assess the positive and negative influences. Despite the advantages of introducing foreign design companies into the local construction market in the country, the survey revealed a problem in the coordination issue between local project participants and foreign designers as one of the most prominent negative effects in this regard. Furthermore, different backgrounds of the Western construction industries and the Chinese one were analyzed in addition to the other factors that might lead to coordination problems. An evaluation of some measures that try to solve this coordination problem was conducted proposing other measures to help in the same issue. Finally, possible coordination methods were suggested to grasp the advantages of utilizing foreign designers such as careful selection of architects, better organization, appropriate selection of communication tool, and adopting other professional agencies.

Alarcon and Mardones (1998) studied the design-construction interface. The study included: data collection from numerous projects and design, interviews with experts, and application of improvement tools. A review of the most common design defects found through the construction stage in four building projects allowed the researchers to design numerous tools to avoid the occurrence of these defects. Quality Function Deployment (QFD) was used to identify the most effective tools and to set priorities for execution. The proposed variations were applied in a construction company participating in the research with important impacts on performance. The execution comprised new design and review procedures, standards for communication besides obvious definition of internal customer needs and design attributes. The execution of these variations brought important minimizations on design defects and their effects in the company.

Vanegas and Opdenbosch (1994) studied the design-construction interface and developed a new methodology for simulating construction operations in a way that strengthening this interface. This methodology runs a simulation of real-time and interactive construction operations in a virtual environment such that a user will be nearer to the actual world than previous. In this environment, problems through the planning or design stages of any project could be identified virtually and solved before starting facility construction. This helps in improving the quality of facility construction many times as the quality of generated information improved, especially in the degree of construction input and its enhancement for the design process.

Al-Mansouri (1988) studied, in Saudi construction industry, the relationship among the consultant and contractor. He concluded that it was poor due to applying the traditional procurement method that is totally dissociates the design phase from the construction phase. He also analyzed the effects of applying this procurement method on the efficiency of the industry and on the people involved in it. To do so, he first determined the factors that affect the efficiency which could be gathered from literature and classify them in three separate categories: factors affecting design efficiency, factors affecting construction efficiency, and factors affecting the efficiency of both design and construction phases. Then he distributed two questionnaires: one for a sample of consultants to determine the extent to which these factors affect the design efficiency and the design-construction interface, and the other distributed to a sample of contractor regarding the factors that affect the construction efficiency and the design-construction interface. Statistical analysis was performed on this survey to analyze design efficiency, construction efficiency, and the relationship between both. He found that "fast track" and "work packaging" were agreed upon to be of low importance, while "early involvement of contractor" and the other related factors had a contradiction between consultants and contractors, the thing that reflects the low efficiency and poor relationship. After that, he distributed the third questionnaire to consultants only to test their experience in using alternative procurement approaches and to determine if these approaches could give them the anticipated contractor's response or not. This questionnaire was to find out the requirements that allow consultants and contractors acting hand by hand. After analysis, he could conclude that the Professional Construction Management (PCM) contract type could solve the poor efficiency of the design-construction interface as well as the relationship between consultant and contractor in the country.

2.9 DCIPs:

The DCIPs can be classified into five groups. Therefore, fifty-eight (60) problems were identified from literature review as follows in Table (2.1).

Table (2.1): DCIPs.

NO	Factors	(Sha'ar et al., 2016)	(Chen, Reichard, & Beliveau, 2008)	Huang et al. (2008)	Ku, H. K., Lin, J. D., Huang, C. T., & Shiu, R. H. (2010)	(Al-Hammad, 1995)	(Al-Hammad & Assaf, 1992)	(AL Mousli & El-Sayegh, 2016)
	Client related factors							
1	Unstable client requirements	●						
2	Unrealistic client expectations regarding project time, cost or quality	●	●	●	●			
3	Outsourcing of design services	●	●	●	●			
4	Lack of contractor involvement during the design phase	●					●	●
5	Awarding contract to the lowest price regardless of the quality of services	●						
6	Unclear definition for scope of work	●						●
7	Inappropriate work packaging and subcontracting	●						
8	Poorly written contract with insufficient detail	●		●				●
9	Delaying the approval of completed tasks	●				●		
10	Delaying of dues payments	●				●		

Continued

NO	Factors	(Sha'ar et al., 2016)	(Chen, Reichard, & Beliveau, 2008)	Huang et al. (2008)	Ku, H. K., Lin, J. D., Huang, C. T., & Shiu, R. H. (2010)	(Al-Hammad, 1995)	(Al-Hammad & Assaf, 1992)	(AL Mousli & El-Sayegh, 2016)
11	Inappropriate choice of project contract type (unit price, lump sum, etc.)	●					●	
12	Inappropriate choice of project delivery system (design-build, design-bid-build, etc.)	●						
13	Involvement of designer as construction supervisor	●						●
	Consultant-related factors							
14.	Lack of project-stipulated data	●						
15.	Lack of skilled and experienced human resources in the design firms	●	●	●	●			●
16.	Lack of proper coordination between various disciplines of design team	●						●
17.	Lack of awareness about the construction knowledge and ongoing site operations	●						
18.	Lack of awareness about the availability of construction materials and equipment in the local market	●	●	●	●	●		
19.	Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications	●		●	●			
20.	Inaccurate estimation of project element costs and quantities	●						
21.	Insufficient geotechnical investigation	●	●	●	●			
22.	Vague and deficient drawings and specifications	●	●					●
23.	Mistakes and discrepancies in design documents	●			●			
24.	Lack of design quality assurance practices	●						
25.	Inflexibility or rigidity in supervising construction works	●						
26.	Time limitation in the design phase							●
	Contractor-related factors							
27.	Insufficient comprehension of design documents	●					●	
28.	Lack of skilled human resources at the construction site	●	●	●	●			

Continued

NO	Factors	(Sha'ar et al., 2016)	(Chen, Reichard, & Beliveau, 2008)	Huang et al. (2008)	Ku, H. K., Lin, J. D., Huang, C. T., & Shiu, R. H. (2010)	(Al-Hammad, 1995)	(Al-Hammad & Assaf, 1992)	(AL Mousli & El-Sayegh, 2016)
29.	Inadequate pre-construction study and review of design documents	●					●	
30.	Lack of experience about new construction technologies.	●	●		●		●	●
31.	Inaccurate estimation of construction costs	●						
32.	Construction errors and defective work at the construction site	●						●
33.	Lack of specialized quality-control team	●						
34.	Failure of construction equipment	●						
35.	Difficulties in financing project requirements	●	●	●	●	●		
36.	Involvement of subcontractor in several projects at the same time	●						
37.	Frequent changes of subcontractors	●			●			
	Project-related factors							
38.	Poor project organizational structure	●						
39.	Lack of professional construction management	●						
40.	Uncooperative managers and slow decision-making	●	●	●	●			
41.	Information problems leading to rework and variation orders	●						
42.	Lack of communication and coordination between various project teams	●	●	●	●			
43.	Adversarial relationship between consultant and contractor	●						
44.	Low design fee structure	●						
45.	Design complexity	●						
46.	Lack of experience-related project nature	●						
47.	Shop drawings' submission and approval	●	●		●			
48.	Work overload and lack of incentives	●						
49.	Time pressure due to unreasonable contract duration	●						

Continued

NO	Factors	(Sha'ar et al., 2016)	(Chen, Reichard, & Beliveau, 2008)	Huang et al. (2008)	Ku, H. K., Lin, J. D., Huang, C. T., & Shiu, R. H. (2010)	(Al-Hammad, 1995)	(Al-Hammad & Assaf, 1992)	(AL Mousli & El-Sayegh, 2016)
50.	Lack of unified design code	●	●				●	
51.	Violation of project contract conditions	●						
52.	Long period between time of bidding and awarding	●						
	External factors							
53.	Differing site conditions	●	●				●	
54.	Poor economic conditions	●						
55.	Labour shortage	●	●	●	●			
56.	Unsettlement of local currency in relation to dollar value	●						
57.	Bad weather	●	●	●		●		
58.	Country border closure External or internal military actions	●						
59.	Unexpected changes in material availability and prices	●	●	●	●	●		●
60.	Unexpected delay in construction material arrival	●	●	●	●	●		

2.10 Impact of the DCIPs:

Design–construction interface problems have a main impact on the construction projects. Weshah, Ghandour, Jergeas, and Falls (2013) asserted that the impact of interface problems for diverse projects does not delay the project only but also affects whole project performance.

Thus, six (6) impacts were identified from literature review as follows in Table (2.2).

Table (2.2): Impacts of DCIPs.

NO	Factors	**Weshah et al. (2013)**	(Mortaheb et al., 2010)	**(Chen et al., 2008)**	(Crumrine, Nelson, Cordeiro, Loudermilk, & Malbrel, 2005)	**Pavitt & Gibb (2003)**	**(AL Mousli & El-Sayegh, 2016)**
1.	Project scope control	●	●		●	●	●
2.	Project quality	●	●	●	●	●	
3.	Time overrun	●	●	●	●	●	●
4.	cost overrun	●	●	●	●	●	●
5.	Project safety	●	●		●	●	
6.	Poor team work performance	●	●		●	●	

2.11 Recommended Strategies to minimize the DCIPs:

The probable impact of the DCIPs can be reduced if conceivable strategies are obviously suggested. If strategies were suggested, it would support professionals in taking proactive measures for minimizing the DCIPs for construction projects.

List of strategies that recommended by different researchers (Wang, Tang, Qi, Shen, & Huang, 2016; AL Mousli & El-Sayegh, 2016; Sha'ar et al., 2016; Lin, 2015; Ndihokubwayo, 2008; Bin Ali, 2008) are identified as follows

These are:

1. All involved parties should plan adequately before works start on the site.
2. Contractor's involvement to provide their input in Design stages for not only improving the design but also providing a chance to overcome the dissonances in working drawing details.
3. The client should set their complete requirements before starting the design process.
4. The client should give adequate time for designers.

5. Tender's evaluation process regarding quality of services should have a considerable portion.
6. The interface among contractors and consultants needs to be improved through the project life cycle regarding the good communication – frequent, timely, succinct, high-grade, and reliable.
7. Clients should pay attention to do their work and achieve their responsibilities on time to close the door of rising claims from their side.
8. Design firms should improve the coordination process between the design team to decrease the probability of design errors' generation and reduce conflicts.
9. Provide training programs to cope up with lack skilled and experienced human resources, whether in construction sites or design firms.

Chapter 3

Research Methodology

Chapter 3

Research Methodology

This chapter contains a methodology description used and the community and the research sample, as well as the research tool used and the method of its preparation and the way of its construction and development, and the extent of its honesty and persistence. It also contains a description of the procedures conducted by the researcher in designing and codifying the study tool, and the tools used to gather the data of the study, and the chapter ends with the processors that have been used in the statistical analysis of the data and the conclusions extraction, and here is a description of these procedures.

3.1 Research Design:

This research aims to study the causes of DCIPs in building construction projects in Gaza Strip, their impact on overall project performance and recommended strategies to minimize it. According to the nature of the study and the objectives that it seeks to accomplish, the researcher has used the descriptive analytical method, which is regarding the study of the phenomenon as it is in fact, and it is interested in describing it precisely description and expressed it in a qualitatively, and quantitatively expression, and this approach does not content with the collecting information on the phenomenon in order to investigate its manifestations and its different relations, but it also extends to the analysis, connectivity and interpretation to reach the conclusions on which to build the proposed scenario, so that it increases the stock of knowledge on the subject.

Face to face interview was conducted on exact building construction projects in Gaza Strip. This research is quantitative because it deals measurements of the variables that recognized from the literature to get answers to the articulated questions. The study is also qualitative because it takes the opinions of projects manager of the certain building construction projects relative to the DCIPs in their projects, their impacts, and strategies to minimize it. Besides, open-ended questions were adopted in the questionnaire. This approach involves the combinations of quantitative and qualitative methods empowered with the literature review. The research was designed by eight main steps as described below and shown in Figure (3.1).

- **First Stage: Identification of the Problem:**

It was started to define the problem, illustrate the aim, objectives, and hypotheses. Moreover, enhanced a research approach and a appropriate technique.

- **Second Stage: Literature Review:**

Revising the previous studies from the literature, reading and writing notes from diverse sources like Academic research journals, Conferences, Web sites, and theses.

Sixteen (60) causes and six (6) impacts of the DCIPs in building construction projects were collected from the literature. They all were studied in a chapter (2) in Table (2.1) and Table (2.2) respectively. Some of those causes and impacts have been amended, others have been combined or have been removed through the process of evaluation of the questionnaire (piloting) in addition to some items have been added.

- **Third Stage: Face to face interviews:**

Semi-structured interviews with projects' managers of the selected building construction projects were done on six building construction projects to identify the causes, and impacts of the DCIPs and strategies to minimize it at their projects. This assist to understand the relationship among the theories and actual practices in the building construction projects.

- **Fourth Stage: Questionnaire Development:**

Regarding the literature review, all the information which could help in reaching the objectives of the research were gathered, studied and formed to be an appropriate for the study survey so, a questionnaire was developed with close-ended and open-ended questions. Subsequently, the pilot study was conducted to include two stages. The first stage was undertaken by consulting 10 experts (professionals and academics) in construction and experts in statistics to pre-test the survey and subsequently amended before a final questionnaire was formed. Hereafter, the second stage, before the main survey, was achieved by making analysis trial using some of the population for validation. The questionnaire was amended based on the results of the pilot study and the final list of questions was accepted to be used for the study.

- **Fifth Stage: The main survey:**

A quantitative approach in this stage was used as the major statistical component in the research. To get representative and reliable quantitative data, questionnaires were distributed to Consultant and Contractor. Thus, two hundred electronically questionnaire distributed among consultants and contractors who work in building construction projects.

- **Sixth Stage: Results and discussions:**

To achieve the study goal, the researcher used both quantitative and qualitative data analysis methods. The researcher used the statistical package for the Social Science (SPSS) for analyzing the data. The researcher has used the following statistical tools:

1. Kolmogorov-Smirnov test of Normality.
2. Pearson correlation coefficient for Validity.
3. Cronbach's Alpha for Reliability Statistics.
4. Split-Half Coefficient for Reliability Statistics.
5. Frequency and Descriptive analysis.
6. One-sample T-test.
7. Independent samples t-test.
8. One-way ANOVA.
9. Multiple Regression.
10. Path analysis using the IBM SPSS/AMOS-program.
11. Confirmatory Factor Analysis.

- **Seventh Stage: Conclusion and Recommendations:**

Conclusions and recommendations in this stage of the research were adopted. It includes the results summary with associated objectives, identifying problem areas from results and suggesting an appropriate solution.

- **Eighth Stage: Documentation:**

The final stage of the study involved editing the final text, formatting, and spelling and grammatical review.

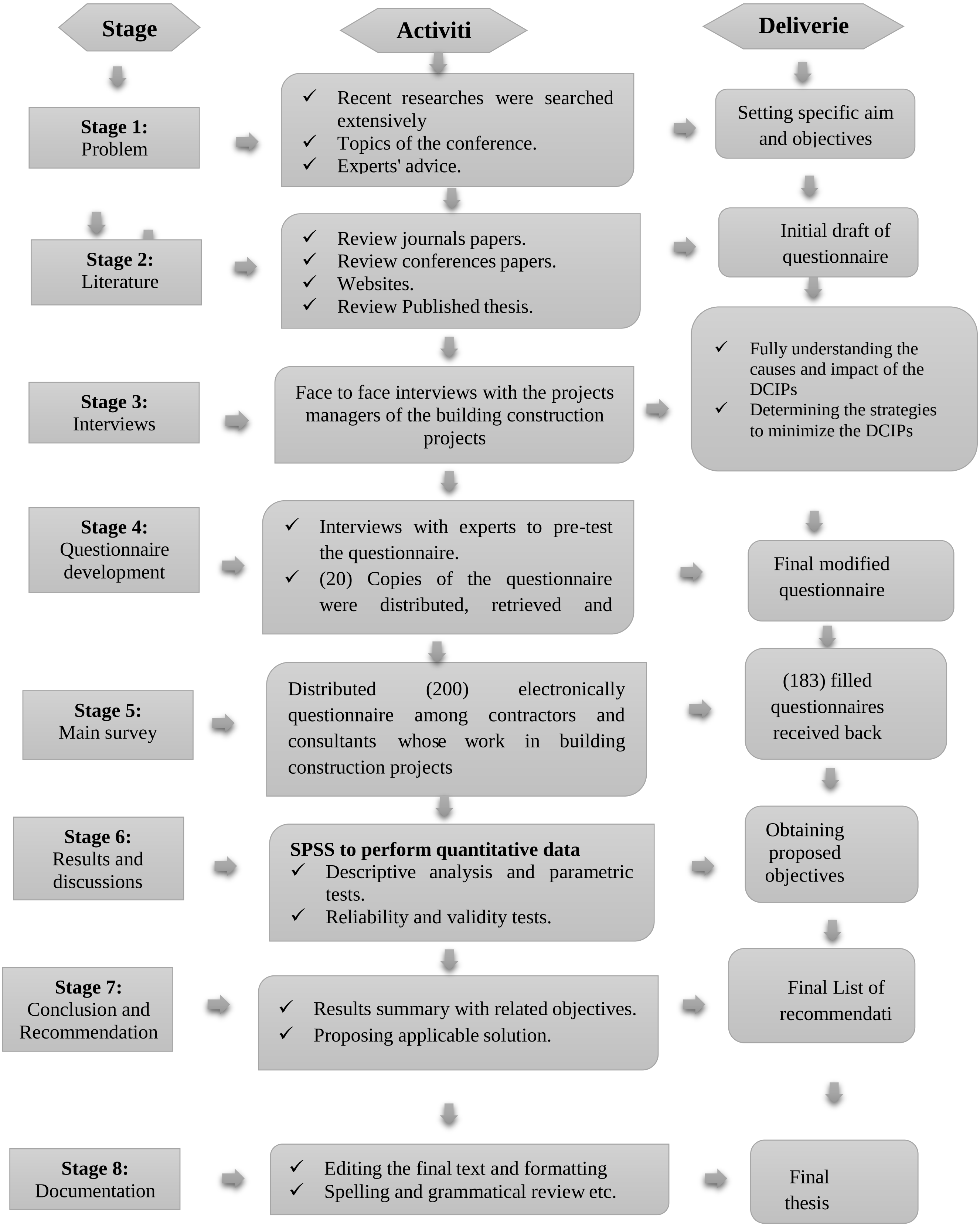

Figure (3.1): Research methodology framework.

3.2 Data Sources:

3.2.1 Literature study:

A literature review illustrates that the researcher is knowledgeable of the study area, shows how the previous studies support the current one and create new ideas for research by seeing what others left. The literature was gathered mainly from journals, websites, textbooks, conference, theses.

3.2.2 Interviews:

Interviews with the projects' managers of the selected building construction projects were done on six building construction projects.

Smith (2012) stated that an interview is defined as any interaction between two or more individuals with a definite purpose in mind. The interview may be conducted by telephone or face-to-face. It contains discussing subjects with people and it is observed to be a useful technique for gathering data that would perhaps not be accessible by techniques such questionnaires and observations. Kumar (2014) said that because of its flexibility, an interview is an appropriate method of acquisition opinions and information from experts throughout the early phases of the study. There are three types of interviews: structured, unstructured and semi-structured.

3.2.2.1 Structured interviews:

In structured interviews, a predetermined set of questions were asked by the researcher, which the questions used in the same order and wording as indicated in the interview schedule. The main advantage of the structured interview is that it provides uniform information that guarantees the comparability of data. Structured interviewing needs less interviewing skills than does unstructured (Kumar, 2014).

3.2.2.2 Unstructured Interviews:

Kumar (2014) explained that in unstructured interviews, the complete freedom they provide regarding the content and structure represents the strength of it. You are free to arrange these in whatever sequence you wish. You may formulate questions and raise issues at the same moment, regarding what occurs to you in the context of the discussion.

3.2.2.3 Semi-structured Interviews:

The interviewer in semi-structured interviews prepares a list of predetermined questions like the structured interview. Participants in a semi-structured interview have the chance to investigate issues in as much depth from as many angles as they prefer, through answering the open-ended questions. Furthermore, the interviewer has a freedom to investigate numerous areas and to raise specific inquiries throughout the semi-structured interview (Longhurst, 2009).

In this study, semi-structured interviews were conducted with the project's managers of the building construction projects to know the causes and impacts of the DCIPs as well as search for recommendation and strategies if any to minimize the DCIPs in the building construction projects.

3.2.3 Questionnaire:

Kumar (2014) clarified that the questionnaire is a written list of questions and the respondents recorded their answers. Respondents in the questionnaire read the questions, understand what is anticipated and then record the answers. It is the simplest and timesaving way to gather data effectively from a large number of respondents. The questionnaire design was extracted from the researches directly related to the topic of this research. After searching, consulting, amending and revising by the experts and supervisor, the questionnaire was ready for distribution. The questionnaire was written in both Arabic and English languages to assist the understanding the content for the population sample. Open-ended and Closed-ended questions were adopted.

The questionnaire was arranged in four sections as follows and shown in the table (3.1):

Section 1: General Information.

Section 2: Factors causing the Design–construction interface problems in construction projects in Gaza strip.

Section 3: Impacts of the DCIPs.

Section 4: Recommended Strategies to minimize the DCIPs.

Table (3.1): Questionnaire structure.

Description		**No. items**
Factors causing the Design–construction interface problems in construction projects in Gaza strip.	First: consultant related factors.	11
	Second: Contractor related factors.	11
	Third: Client related factors.	14
	Fourth: Donor related factors.	6
	Fifth: Project-related factors.	9
Impact of the DCIPs.		6
Recommended Strategies to minimize the DCIPs.		9
Total factor		**66**

The researcher used the five-point Likert scale to measure responses on questionnaire items. In addition, the researcher chose the scale from (1-5) where the answer closer of (5) indicated the high approval of what was mentioned in the concerned paragraph, each scale has a relative weight, as shown in Table (3.2):

Table (3.2): Likert Scale.

Level	**Never**	**Seldom**	**Sometimes**	**Often**	**Always**
scale	1	2	3	4	5

3.3 Population and Sample:

3.3.1 The Population:

The studied population contains consultants and contractors in Gaza Strip. The contracting companies have a valid registration to December 2017 under classification first and second. The classification of the company depends on building sector the company is working. According to the Palestinian Contractors Union (PCU) in Gaza strip, there are 190 contractor companies under classification first and second.

The consultant offices also have a valid registration to December 2017. Regarding the Engineers' Association in Gaza strip, there are 62 consultant offices.

3.3.2 The sample:

The sample is a part of a population chosen to participate in the research and its size indicates to the number of the elements to be involved in a research that can be individuals, groups, or organizations (Zikmund, Babin, Carr, & Griffin, 2013).

3.3.2.1 Probability sampling:

All population members are listed and subjects are chosen from that list in a random order in probability sampling thus, each member has an equivalent chance of being chosen. Free from bias is one of the advantages of this method and it enables generalizations from the sample to the wider population (Tansey, 2007). A random sampling was chosen in the survey so, the samples were chosen randomly from consultant offices and contracting companies in Gaza Strip.

3.3.2.2 Non-probability sampling:

Non-probability sampling is regarded as giving a weak base of generalization, it is a suitable method for some studies. This method of sampling is chosen when it is difficult to acquire a response from sample population chosen at random (Kumar, 2014). Known the nature of necessary data to be collected from the building construction projects and the expected assistance of selected participants, a non-random sampling method was the most appropriate thus, the purposive sampling method was accepted.

Purposive sampling contains hand-picking apparently interesting or typical cases. According to Kumar (2014), the purposive sampling technique allows the researcher to select a respondent who has good knowledge of the subject under discussion. Based on this, six building construction projects were selected. After that, interviews with the managers of the projects were conducted.

3.3.3 Sample Size:

To estimate the sample size for the research population, statistical equations were used. The following statistical equation was used to determine the sample size (Creative Research System, 2016).

$$\boldsymbol{SS = \frac{Z^2 \times P \times (1-P)}{C^2}} \qquad \textbf{(3.1)}$$

Where:

SS: The size of the sample

Z: Z value (e.g. 1.96 for 95% confidence interval)

P: Percentage picking a choice (0.50 used for sample size needed)

C: confidence interval (e.g., 0.05 = ±5)

So that:

$$SS = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.05^2} = 384$$

Correction for finite population

$$\boldsymbol{SS_{new} = \frac{SS}{1 + \frac{SS-1}{POP}}} \qquad \textbf{(3.2)}$$

Where: pop is the population;

For First and Second class of the contracting companies, Population = 190 companies.

So that:

$$SS_{new} = \frac{384}{1 + \frac{384 - 1}{190}} = 127$$

For the consulting offices, Population = 62 offices.

So that:

$$SS_{new} = \frac{384}{1 + \frac{384 - 1}{62}} = 54$$

Two hundred electronic questionnaires were distributed to the potential respondents. Of the two hundred electronic questionnaires distributed, one hundred and eighty-three questionnaires were returned that include 128 from contractors (69.9%) and 55 from consultants (30.1%).

3.4 Pilot study:

In order to test the validity, suitability, and reliability of the questionnaire before distribution to all population sample, a pilot study for the questionnaire was conducted. Naoum (2012) stated that the pilot study is a trial run for the questionnaire that includes identifying any vague questions, testing the wording of questions, testing the technique which used to gather the data, etc. The pilot study was divided generally into three steps as following:

Firstly, Experts in construction projects were consulted regarding the questionnaire and they have an academic background in questionnaires evaluation and experts in statistics. For that, the researcher interviewed a sample of ten (10) different experts in Gaza Strip to pre-test the questionnaire and consequently the questions were restated, simplified, and amended based on the expert's feedback, therefore questions have become obvious to be answered in a way that assists to accomplish the target of the research. In addition, the researcher was consulting two experts in statistics to know that the tool used was statistically valid and that the questionnaire was designed well sufficient to provide tests and relations between variables. The results of pre-testing the questionnaire shown in table (3.3).

Secondly, the questionnaire was distributed to limited number from the targeted population about 20 respondents chosen randomly. Twenty (20) questionnaire were distributed. The sample is chosen randomly from the population to test the validity and reliability.

Thirdly, Statistical tests used to analyze the questionnaire to check the questionnaire reliability and validity.

Table (3.3): Results of pre-testing the questionnaire.

NO	Factors	Note	Modified Factors
	DCIPs		
	Consultant-related factors		
1	Lack of project-stipulated data	Selected	
2	Lack of skilled and experienced human resources in the design firms	Selected	

Continued

NO	Factors	Note	Modified Factors
3	Lack of proper coordination between various disciplines of design team	Selected	
4	Lack of awareness about the construction knowledge and ongoing site operations	Selected	
5	Lack of awareness about the availability of construction materials and equipment in the local market	Selected	
6	Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications	Selected	
7	Inaccurate estimation of project element costs and quantities	Selected	
8	Insufficient geotechnical investigation	Deleted	
9	Vague and deficient drawings and specifications	Deleted	
10	Mistakes and discrepancies in design documents	Selected	
11	Gaps in the items description	added	
12	Lack of design quality assurance practices	Selected	
13	Inflexibility or rigidity in supervising construction works	Deleted	
14	Insufficient design duration	added	
	Contractor-related factors		
1	Insufficient comprehension of design documents	Selected	
2	Lack of skilled human resources at the construction site	Selected	
3	Unavailability of construction materials	added	
4	Inadequate pre-construction study and review of design documents	Modified	Inadequate study for tender document to observe discrepancies before tender awarding.
5	Lack of experience about new construction technologies.	Modified	Incapability to predict and resolve project's problems related to new technological techniques
6	Inaccurate estimation of construction costs	Selected	

Continued

NO	Factors	Note	Modified Factors
7	Construction errors and defective work at the construction site	Selected	
8	Lack of specialized quality-control team	Deleted	
9	Failure of construction equipment	Selected	
10	Difficulties in financing project requirements	Deleted	
11	Involvement of subcontractor in several projects at the same time	Selected	
12	Frequent changes of subcontractors	Selected	
13	Financial and technical status of the contractor	Added	
	Client related factors		
1	Unstable client requirements	Selected	
2	Unrealistic client expectations regarding project time, cost or quality	Selected	
3	Outsourcing of design services	Selected	
4	Lack of contractor involvement during the design phase	deleted	
5	Awarding contract to the lowest price regardless of the quality of services	Modified	Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.
6	Restricting the contractor classification and a specific experience for the subcontractors in the contract form by the client.	Added	
7	Unclear definition for scope of work	Selected	
8	Inappropriate work packaging and subcontracting	Selected	
9	Poorly written contract with insufficient detail	Selected	
10	Delaying the approval of completed tasks	Modified	Delaying in decision making
11	Delaying of dues payments	Selected	
12	Inappropriate choice of project contract type (unit price, lump sum, etc.)	Selected	
13	Interference of client during implementation	Added	

Continued

NO	Factors	Note	Modified Factors
14	Inappropriate choice of project delivery system (design-build, design-bid-build, etc.)	Selected	
15	Involvement of designer as construction supervisor	Modified	The designer work as a project supervisor
	Donor related factors		
1	Financial capability of donor.	Added	
2	Budget allocated constraints.	Added	
3	Time constraints.	Added	
4	Interference of donor in project requirements.	Added	
5	Insufficient donor experience in implementing projects according to local conditions	Added	
6	Political situation impact on fund continuity	Added	
	Project-related factors		
1	Poor project organizational structure	Selected	
2	Lack of professional construction management	Deleted	
3	Uncooperative managers and slow decision-making	Modified	Uncooperative managers and poor decision-making
4	Information problems leading to rework and variation orders	Modified	Shortage in flow of information lead to repeated works and variation order
5	Lack of communication and coordination between various project teams	Selected	
6	Adversarial relationship between consultant and contractor	Deleted	
7	Low design fee structure	Deleted	
8	Design complexity	Selected	
9	Lack of experience-related project nature	Selected	
10	Shop drawings submission and approval	Modified	Slow in Shop drawings submission and approval
11	Work overload and lack of incentives	Deleted	

Continued

NO	Factors	Note	Modified Factors
12	Time pressure due to unreasonable contract duration	Selected	
13	Lack of unified design code	Deleted	
14	Violation of project contract conditions	Deleted	
15	Long period between time of bidding and awarding	Selected	
	External factors		
1	Differing site conditions	Deleted	
2	Poor economic conditions	Deleted	
3	Labour shortage	Deleted	
4	Unsettlement of local currency in relation to dollar value	Deleted	
5	Bad weather	Deleted	
6	Country border closure External or internal military actions	Deleted	
7	Unexpected changes in material availability and prices	Deleted	
8	Unexpected delay in construction material arrival	Deleted	
	Impacts of DCIPs		
1.	Project scope control	Selected	
2.	Project quality	Modified	Quality degradation
3.	Time overrun	Modified	Completion schedule delay
4.	cost overrun	Selected	
5.	Project safety	Modified	Poor safety conditions
6.	Poor team work performance	Selected	

3.5 Statistical data analysis using SPSS:

After the researcher collected the twenty (20) questionnaire, data analyzed using SPSS to test the validity and the reliability of the questionnaire. The validity tested using Pearson correlation coefficient for both internal validity and structural validity of the questionnaire. The reliability tested using two types of tests the first was Half Split Coefficient and the second was Cronbach's Alpha Coefficient.

3.5.1 Questionnaire Validity:

The degree of an instrument to measure what it is supposed to be measured refers to validity (Polit and Hungler, 1985). Two substantial tests were used; firstly, criterion-related/internal validity test (Pearson test) that measure the correlation coefficient between each item in the field and the whole field. Secondly, structure validity test (Pearson test) which used to test the validity of the structure of questionnaire by testing the validity of each field and the validity of all questionnaire. It calculates the correlation coefficient among one field and whole the fields of the questionnaire which have the same level of the same scale.

3.5.1.1 External Validity:

The questionnaire has been given to a number of experts in construction projects who have an academic background in questionnaires evaluation and experts in statistics. The final copy of the questionnaire was amended and refined according to the experts' recommendations. (Refer to Appendix A and Appendix B for the final questionnaire in English and Arabic respectively).

3.5.1.2 Internal Validity:

The first statistical test used is the internal validity of the questionnaire to test the validity of the questionnaire by calculating the correlation coefficients among each item in one field and the whole field.

The correlation coefficient for each domain items was significant at $\alpha = 0.05$, where the probability value of each paragraph was less than 0.05 as shown in Table (C 1) to Table (C 3) in Appendix C. It can be concluded that the paragraphs of the questionnaire were valid to measure what it was set for.

3.5.1.3 Structure Validity:

The second statistical test is structure validity to measures the extent to which the objectives that you want to access the tool, and shows the extent to which each area of study college paragraphs questionnaire. It calculated the correlation coefficient between one field and all the questionnaires' fields that have the same level of the scale. Table (C 4) in Appendix C indicated the correlation coefficients between the degree of each dimension of the questionnaire and the total degree of the questionnaire. The correlation coefficients were statistically significant at $\alpha \leq 0.05$, while the probability value for all paragraphs is less than 0.05. Therefore, it can be seen that the dimensions were valid to measure what they were set out for to achieve the main aim of the research.

3.5.2 Questionnaire Reliability:

Reliability means to give this questionnaire the similar result if the questionnaire re-distributed more than once under the same conditions and circumstances, or in other words, stability in the questionnaire results not to vary significantly means the stability of the questionnaire, as if it were re-distributed to individuals several times during certain periods. Reliability is measured by two methods as follows:

2.5.2.1 Split-Half Method:

After the questionnaire is administered, questionnaire paragraphs are fragmented into two parts, namely the odd-number questions, and even-number questions. Then the correlation coefficient between individual questions degrees and degrees of even questions is calculated and corrected by Spearman-Brown. Average correlation coefficient= $\frac{2r}{1+r}$ where r correlation coefficient between degrees of odd-number questions and even-number questions (Kumar, 2014). The normal range of corrected correlation coefficient was between 0.0 and + 1.0 and the significant (α) is less than 0.05 so, all the corrected correlation coefficients were significant at α = 0.05. It can be declare that regarding the Half Split method, the questionnaire was reliable. Results were indicated in Table (C 5) in Appendix C.

2.5.2.2 Cronbach's Alpha Method:

Cronbach's Alpha Method is one of the most commonly used indicators of reliability analysis. Cronbach's Coefficient Alpha was used to calculate the questionnaire reliability among each field and the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value was among 0.0 and + 1.0. Greater values represent a higher degree of internal consistency (Pallant, 2013). The Cronbach's coefficient alpha was measured for each field of the questionnaire. The Cronbach's Alpha for the whole questionnaire is 0.953 that shows an excellent reliability of the whole questionnaire. Thus, the researcher was assured of the questionnaire reliability and validity for responding. Results were indicated in Table (C 5) in Appendix C.

3.5.3 Test of Normality:

The data frequently assumed to be a normal distribution in parametric statistical tests. It produces unqualified results when the data is not normal. Normality was measured by conducting One-Sample Kolmogorov-Smirnov (K-S). The One-Sample Kolmogorov-Smirnov test method compares a specified theoretical distribution that may be normal with the observed cumulative distribution function for a variable, uniform, exponential, or Poisson. Table (3.4) showed the results of Kolmogorov-Smirnov test of normality. From Table 3.4, the probability value (p-value) of each variable is greater than 0.05 level of significance, and then the distributions for these variables were normally distributed. Therefore, parametric tests can be used to complete the statistical data analysis.

Table (3.4): One-Sample Kolmogorov-Smirnov Test.

Dimension		Kolmogorov-Smirnov Z	P-value
Factors causing the Design–construction interface problems	First: consultant related factors	0.612	0.848
	Second: Contractor related factors	1.114	0.167
	Third: Client related factors	0.663	0.771
	Fourth: Donor related factors	0.630	0.822

Continued

Dimension	Kolmogorov-Smirnov Z	P-value
Fifth: Project-related factors	0.770	0.594
Factors causing the Design–construction interface problems	0.911	0.378
Impact of the DCIPs	1.322	0.061
Recommended Strategies to minimize the DCIPs	0.848	0.468
Total factor	0.604	0.859

3.5.4 Relative Importance Index (RII):

The RII or relative weight was used to determine the ranks of all factors and calculated as (Field, 2009).

$$\text{Relative importance index method (RII)} = \frac{\sum w}{AN} = \frac{5n_5+4n_4+3n_3+2n_2+1n_1}{5N} \qquad (3.3)$$

Where W is the weighting given to each factor by the respondent, ranging from 1 to 5 (n1 = number of respondents for very low, n2 = number of respondents for low, n3 = number of respondents for medium, n4 = number of respondents for high, n5 = number of respondents for very high). N is all number of participants in the sample. The RII value had a range of 0 to 1, the greater the value of RII, the more impact of the attribute.

3.5.5 Parametric tests:

The test that needs data from one of the large catalog of distributions, which statisticians have described, is a parametric test.

3.5.5.1 Pearson product-moment / Pearson's correlation coefficient:

It is an index of the relationship among two variables. It reveals the degree of linear relationship among two variables. Pearson correlation is symmetric, i.e. the correlation among y and x is the same among x and y. A correlation of 0 indicates no linear relationship among two variables. It's range between +1 and -1, where +1 means a perfect positive linear relationship among variables while -1 means a perfect negative linear relationship among variables.

3.5.5.2 One sample t-test:

The t-test is used to measure the difference between the paragraph's mean and medium of a hypothesized value 3 (Middle value of Likert scale).

3.5.5.3 Sample Independent t-test:

It is used to check if there is a significant difference in the mean among two groups. Differences among groups could be measured with independent t-test in one condition, which the members of each group are practically representative of the population.

3.5.5.4 One way ANOVA:

One-way ANOVA test is used if there are more than two independent groups being compared. If the parametric assumptions are satisfied that is, interval scale variable nearly normally distributed.

3.5.6 Multiple Regression:

The Multiple Regression used to study more about the relationship between several a dependent variable and independent variables. It also a powerful technique utilized to predict the unknown value of a variable from the known value of two or more variables.

3.5.7 Path analysis using the IBM SPSS/AMOS-program:

IBM SPSS/AMOS allows you simply use structural equation modeling for testing hypotheses on complicated variable relationships and get new visions from data. It is powerful structural equation modeling software that allows you to strengthen your theories and study by extending standard multivariate analysis methods, including factor analysis, regression, correlation, and analysis of variance.

You can build behavioral and attitudinal models with SPSS Amos which reflect complicated relationships more precisely than with standard multivariate statistics techniques.

3.5.8 Confirmatory Factor Analysis:

It is a multivariate statistical method which used for testing how well the measured variables show the number of constructs. It is a tool that used to confirm or reject the measurement theory. Before applying the questionnaire in its first shape, the researcher carried out the Confirmatory Factor Analysis to verify the structural truth of the scale. The procedures used in the Confirmatory Factor Analysis are to define the supposed model (the structural model) which consists of the underlying variables that represent the assumed dimensions of the scale, from it march out some arrows which are destined to the second type of variables, known as the measured variables or dependent variables or internal variables that represent the expressions for each dimension or special dimensions (Brown & Moore, 2014).

3.5.8.1 Confirmatory Factor Analysis to consultant related factors:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (84.52), a function at the level ($\alpha < 0.05$), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.924) and (0.899) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.076) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.2).

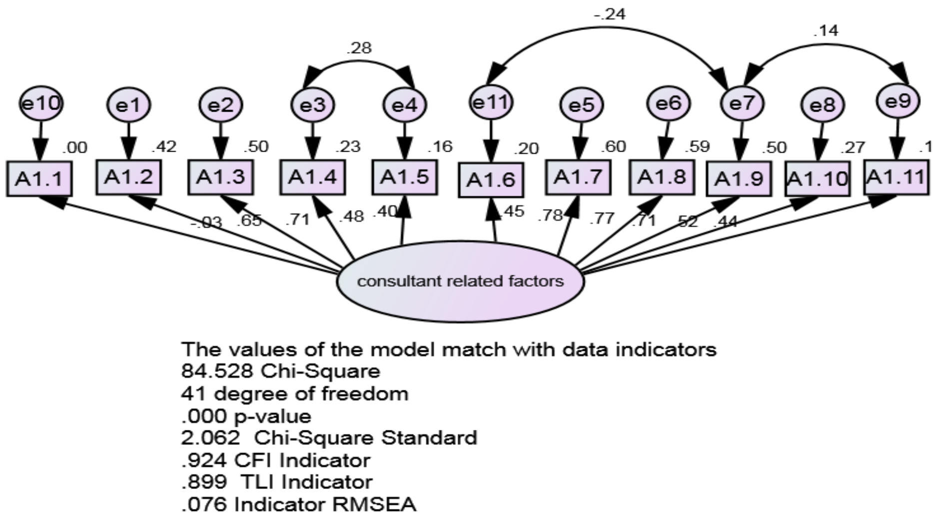

Figure (3.2): Confirmatory factor analysis of consultant related factors.

3.5.8.2 Confirmatory Factor Analysis of Contractor related factors:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (75.06), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.959) and (0.946) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.066) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.3).

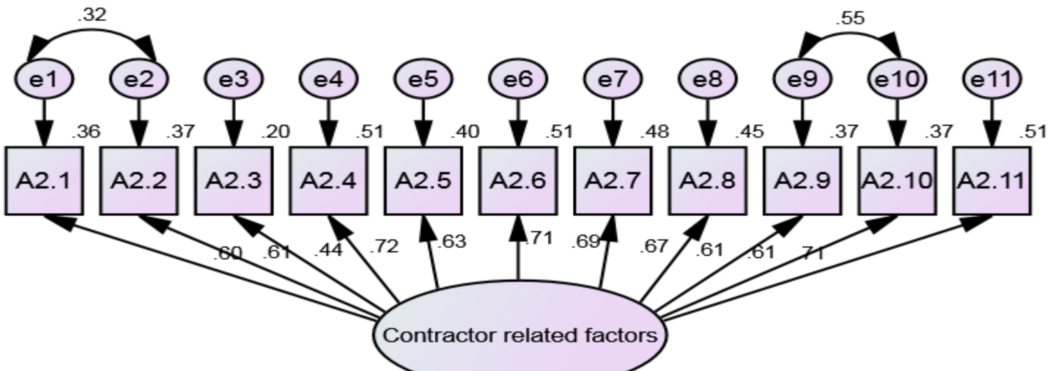

Figure (3.3): Confirmatory factor analysis of contractor related factors.

3.5.8.3 Confirmatory Factor Analysis of Client related factors:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (133.0), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.912) and (0.888) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.069) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.4).

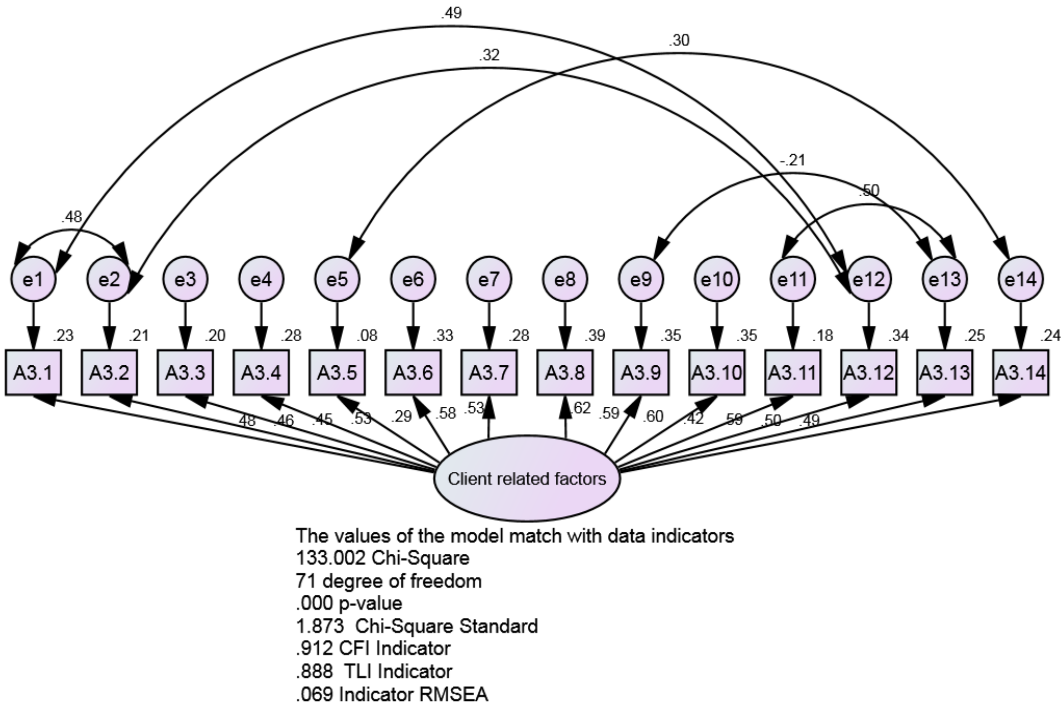

Figure (3.4): Confirmatory factor analysis of client related factors.

3.5.8.4 Confirmatory Factor Analysis of Donor related factors:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (14.303), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.975) and (0.947) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.076) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.5).

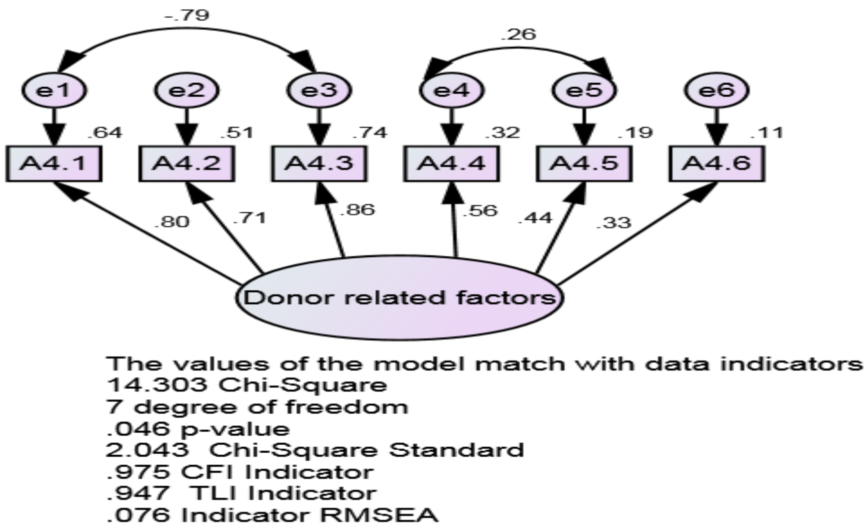

Figure (3.5): Confirmatory factor analysis of donor related factors.

3.5.8.5 Confirmatory Factor Analysis of Project related factors:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (54.76), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.949) and (0.920) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.087) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.6).

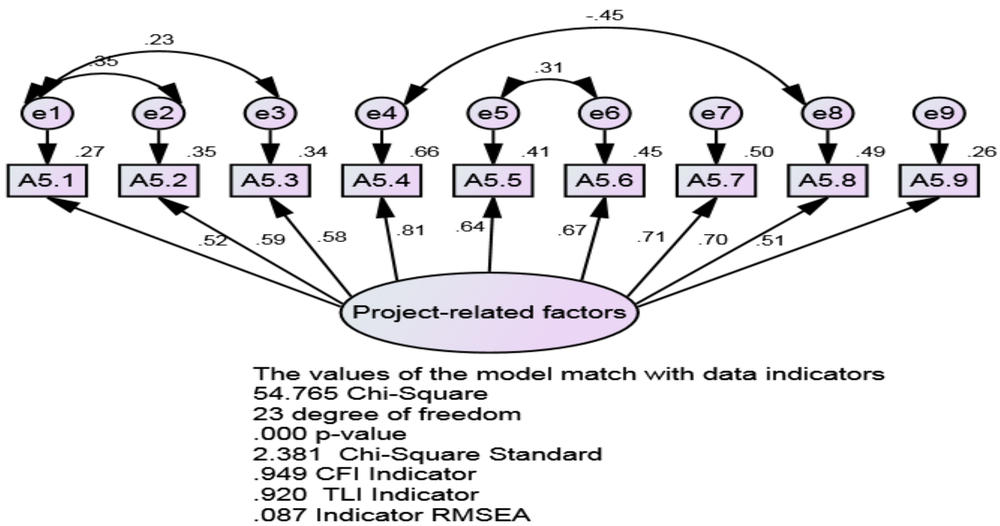

Figure (3.6): Confirmatory factor analysis of project related factors.

3.5.8.6 Confirmatory Factor Analysis of factors causing the Design–construction interface problems:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (1932.4), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.808) and (0.795) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.058) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.7).

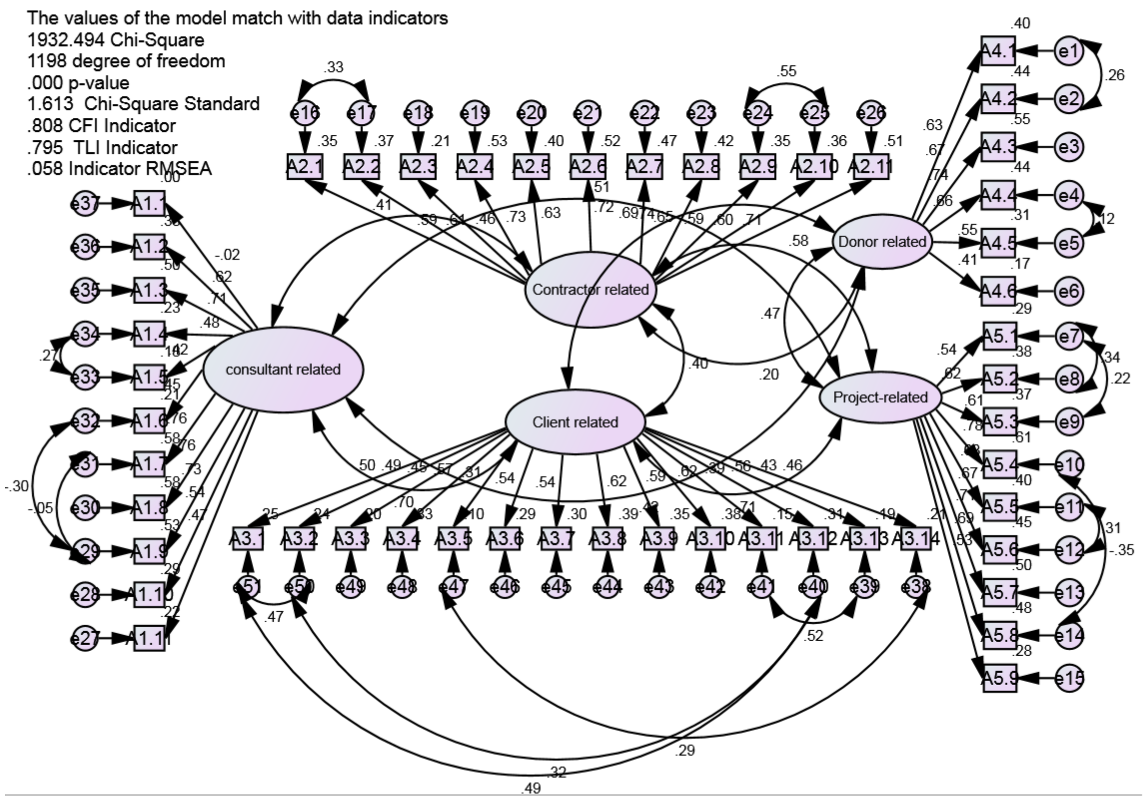

Figure (3.7): Confirmatory factor analysis of factors causing the Design–construction interface problems.

3.5.8.7 Confirmatory Factor Analysis of Impact of the DCIPs:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (17.39), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.962) and (0.929) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.08) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.8).

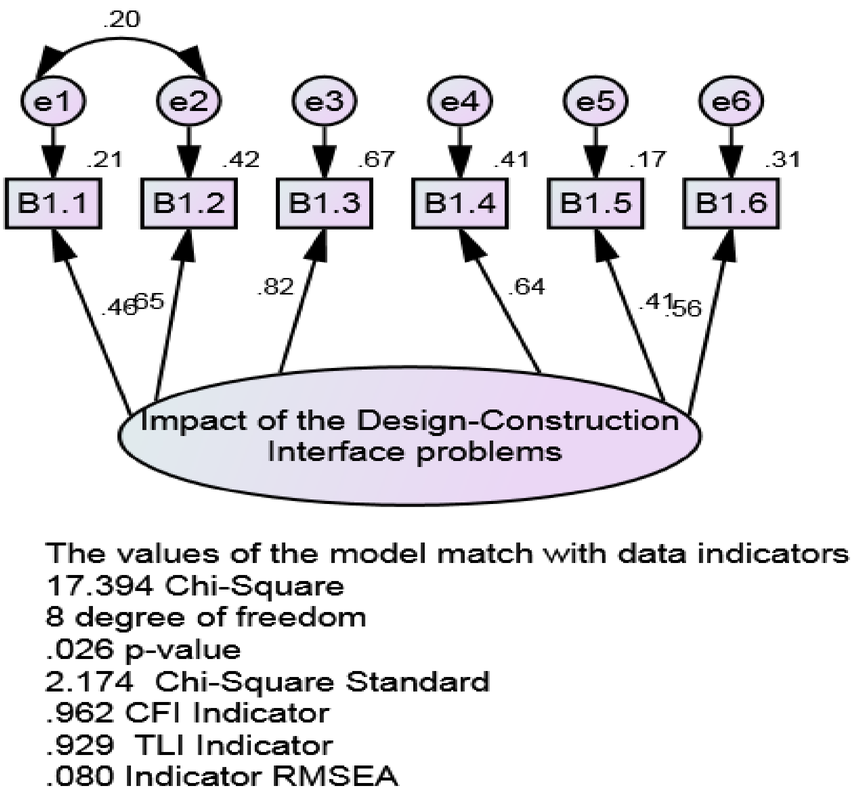

Figure (3.8): Confirmatory factor analysis of impact of the DCIPs.

3.5.8.8 Confirmatory Factor Analysis of Recommended Strategies to minimize the Design-Construction Interface:

The results showed that the value of ch² (kai square) after making some relations between the indicators related to the measurement of variables was (43.73), a function at the level (0.05 ≥α), which reflects the level of good correlation, the value of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) was equal to (0.963) and (0.950) respectively which is close to the value of one. The root square of the Mean Square Error of Approximation (0.058) is very close to the zero value that indicates the quality of conformity of paragraphs, where the accuracy coefficients exceeded the specified rate of 0.4, as shown in Figure (3.9).

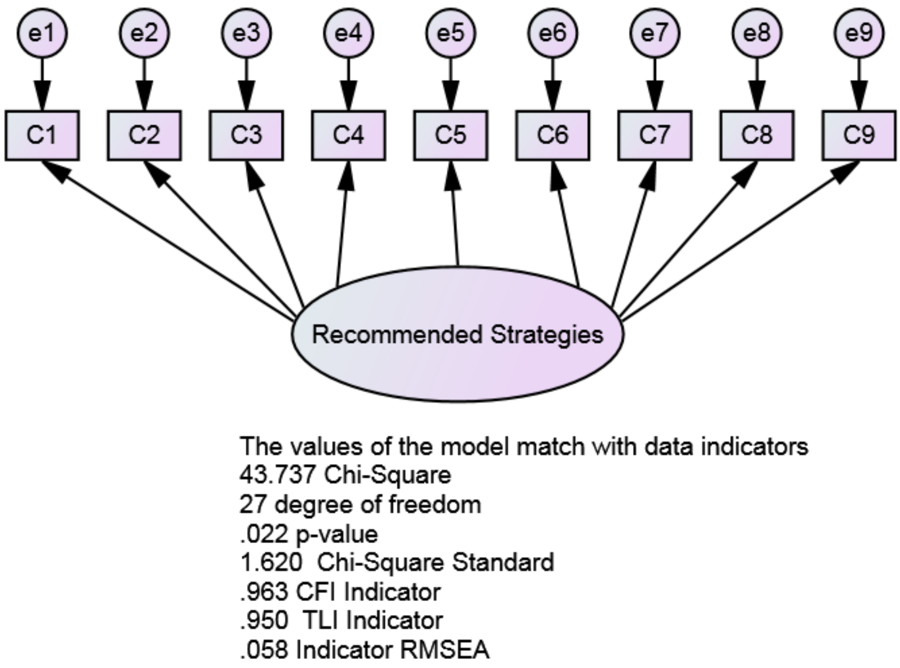

Figure (3.9): Confirmatory factor analysis of recommended strategies to minimize the Design-Construction Interface.

3.6 Chapter Summary:

The chapter clarified the method used in this research step by step. The chapter discussed the primary research framework for the study, population, and sample size. The source of secondary and primary data was drawn and the questionnaire review was detailed through the pilot study. Furthermore, quantitative data analysis has been used that included normality, relative weight, Pearson correlation analysis and other methods using an analytical tool like SPSS. The results were shown in tables.

Chapter 4

Results and discussion

Chapter 4

Results and discussion

This chapter contains a brief analysis of interviews and questionnaire. By answering questions about the study and review the most prominent results of the questionnaire, which was reached through paragraphs of analysis, and the stand on the variables of the study, which included. A statistical treatment of the data gathered from a questionnaire study was done, by the use of statistical packages for Social Studies (SPSS) program to get the results of the study that will be presented and analyzed in this chapter.

4.1 Analysis of Data from Interview:

4.1.1 General Information about the desk study projects:

Six building projects, which the DCIPs appeared, were selected for an interview with their projects' managers in order to identify the causes, and impacts of the DCIPs and strategies to minimize it at their projects. The list of selected projects is as shown in Table (4.1).

Table (4.1): List of selected building construction projects.

Project Code	Project Name
Project A	Construction of a hospital
Project B	Construction of a Celebration Hall
Project C	Construction of a Laboratory building
Project D	Construction of a mosque building
Project E	Construction of building three units
Project F	Construction of a school

1. **Project A:**

The tender sum for project A is $7071000 and the Completion rate is 90%. This project is the construction of a hospital with an area of 2300 m2 and five floors. The owner was the designer and the consultant was another party, as well as the part of the hospital, included foundations, ground beams, and the ground floor was implemented as a first stage. Regarding the second stage. There were numerous of important DCIPs: Firstly, the design team of the first stage was changed with no information about what was implemented previously (as-built drawings) and design duration was short resulting in many problems in the design drawings. Secondly, the lack of experience of the design office resulting in a conflict between different disciplines, especially the architecture between the plans and elevations. Thirdly, lack of experience of the design team in the government regulations, especially in Gaza Electricity Distribution Corporation (GEDCO), whereas the design was without prior knowledge of the requirements of GEDCO resulting in repeated work due to non-conforming to GEDCO requirements. Fourthly, the variation of the design team and their absence during the implementation of the project where the engineer who responsible of the design of air conditioning was traveling resulting in variation order and cost about $ 60,000. Fifthly, the donor relies on the reports without visiting the site. Finally, project complexity as well as lack of experience related to the nature of the project (a hospital building) and its impact negatively during the project implementation.

2. **Project B:**

The tender sum for project B is $12800000 and the Completion rate is 80%. This project is the construction of a Celebration Hall with an area of 5500 m^2 and seven floors. The project was externally designed but the designer has previous experience in designing similar projects in Gaza Strip so, the quality of the design, specifications, and contract was reliable as the designer is an external consultant office and has high experience in the design of quality projects. There were numerous of important DCIPs: Firstly, lack of knowledge of the construction processes and local capabilities and lack of equipment needed was one of the most important problems especially in the installation of the ceiling of the hall. Secondly, Interference of client during implementation. Thirdly, the complexity of the project and lack of experience in the implementation of previous projects and similar, but It has been overcome by searching and through websites. Fourthly, several variation orders were increased due to the absence of some of the required materials so it replaced by other materials in the local market. Finally, the deterioration of the quality of some work performed due to the use of alternatives to some of the required materials.

3. Project C:

The tender sum for project C is $9000000 and the Completion rate is 100%. This project is the construction of a Laboratory building with an area of 2000 m^2 and 8 floors. The owner was the designer and the consultant was another party. This project has been implemented in two phases: the first phase is construction and finishing of three floors and the second phase is finishing of the five floors through different contracting companies for each phase. There were numerous of important DCIPs: Firstly, the building was implemented on the place of rubble of the previous building that has large rigid foundations so, several problems occurred during implementation as a result of preparing and designing the new building and preparation of tender documents without soil investigation by the design office and therefore not mentioned well in the tender documents. Secondly, Lack of communication and coordination between various project teams. Thirdly, several variation orders were increased due to the absence of some of the required materials so it replaced by other materials in the local market. Fourthly, improper selection for subcontracting by the contractor led to many problems during implementation. Fifthly, the designer worked as a top supervision led to the interference of the owner during the implementation and made many changes. Finally, Slow in Shop drawings' submission and approval.

4. Project D:

The tender sum for project D is $1465000 and the Completion rate is 100%. This project is the construction of a mosque building with an area of 1650 m^2 and 4 floors. The project is the establishment of a mosque, which is a project implemented continuously in Gaza Strip so there is no complexity or lack of experience in the implementation. However, there were numerous of important DCIPs: Firstly, lack of project-stipulated data related to the site and area of the project. Secondly, gaps in the items description led to several variation orders. Thirdly, insufficient design duration led to mistakes and discrepancies in design documents. Fourthly, improper selection of subcontractors has a significant impact on work performance. Fifthly, unstable client requirements. Finally, delays in decision-making by the owner during the implementation.

5. Project E:

The tender sum for project E is $9043000 and the Completion rate is 90%. This project is the construction of building three units. The first and second unit had six floors with an area 1450 m^2 and 1250 m^2 respectively but the third unit had four floors with an area 300 m^2. The project is traditional and has been implemented several times. What distinguishes this project is that the designer is the supervisor of the implementation of the project and non-awarding contract to the lowest price regardless of the contractor technical evaluation and C.V whereas the tender was awarded to the fourth contractor. This has a positive impact on the implementation of the project. However, there were numerous of important DCIPs: Firstly, lack of proper coordination between various disciplines especially in the mechanic works. Secondly, mistakes and discrepancies in tender documents especially in external works. Thirdly, Lack of communication and coordination between various project teams. Fourthly, design duration was short resulting in many problems. Finally, Time pressure due to unreasonable contract duration.

6. Project F:

The tender sum for project F is $950000 and the Completion rate is 100%. This project is the construction of a school with an area of 700 m2 and 3 floors. The owner was the designer and the consultant was another party. The project is traditional and has been implemented several times. There were numerous of important DCIPs: Firstly, the designer was a government entity and the project is executed for more than once and in the same designs. The site investigation is not considered well before design. Upon implementation, a soil investigation was carried out and the foundations designed non-conform with the nature of the soil so, Replacement layer was added as a variation order because of lack of project information. Secondly, using the as-built drawings for more than one project leads to many problems during implementation due to the specificity of each site. Thirdly, gaps in the items description led to several implementation problems. Fourthly, Lack of proper coordination between various disciplines of the design team led to several problems during the implementation. Fifthly, bad financial and technical status of the contractor led to postponing the work for a short period waiting for dues payments also, poor project organizational structure. Finally, awarding the contract to the lowest price neglected, of the contractor technical evaluation and C.V led to inappropriate selection for subcontractors.

4.1.2 Analysis of Interviews with the projects' managers:

Interviews were conducted between the projects' managers of the selected building construction projects focusing on fully understanding the causes and impacts of the DCIPs to recognize the relationship among the theories and actual practices in the building construction projects and determining the recommendations or strategies could be taken to minimize the occurrence of the DCIPs in the building construction projects as shown in Table (4.2) below.

Table (4.2): Interviews results.

Question	Interviewee A	Interviewee B	Interviewee C	Interviewee D	Interviewee E	Interviewee F
What are the causes of the Design–construction interface problems in the selected construction projects?	1. Lack of project-stipulated data. 2. Lack of skilled and experienced human resources in the design firms 3. Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications. 4. Inaccurate estimation of project element costs and quantities. 5. Mistakes and discrepancies in design documents. 6. Lack of design quality assurance practices. 7. Insufficient design duration 8. Insufficient comprehension of design documents . 9. Lack of skilled human resources at the construction site.	1. Lack of awareness about the availability of construction materials and equipment in the local market. 2. Insufficient comprehension of design documents. 3. Inadequate study for tender document to observe discrepancies before tender awarding. 4. Unavailability of construction materials 5. Financial and technical status of the contractor 6. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V. 7. Interference of client during implementation 8. Interference of donor in project	1. Lack of project-stipulated data. 2. Lack of skilled and experienced human resources in the design firms. 3. Lack of proper coordination between various disciplines of design team. 4. Lack of awareness about the availability of construction materials and equipment in the local market. 5. Lack of design quality assurance practices. 6. Insufficient design duration 7. Insufficient comprehension of design documents. 8. Unavailability of construction materials 9. Inadequate study for tender document to observe	1. Lack of project-stipulated data. 2. Lack of skilled and experienced human resources in the design firms. 3. Lack of proper coordination between various disciplines of design team. 4. Lack of awareness about the availability of construction materials and equipment in the local market. 5. Gaps in the items description 6. Insufficient design duration 7. Unavailability of construction materials 8. Construction errors and defective work at the construction site. 9. Failure of construction	1. Mistakes and discrepancies in design documents. 2. Lack of design quality assurance practices. 3. Insufficient design duration 4. Inaccurate estimation of construction costs. 5. Financial and technical status of the contractor 6. Inappropriate work packaging and subcontracting. 7. Delaying in decision making 8. Lack of communication and coordination between various project teams. 9. Time pressure due to unreasonable contract duration.	1. Lack of project-stipulated data. 2. Insufficient comprehension of design documents. 3. Unavailability of construction materials 4. Inadequate study for tender document to observe discrepancies before tender awarding. 5. Frequent changes of subcontractors. 6. Financial and technical status of the contractor 7. Unstable client requirements. 8. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V. 9. Inappropriate work packaging and subcontracting.

Question	Interviewee A	Interviewee B	Interviewee C	Interviewee D	Interviewee E	Interviewee F
	10. Unavailability of construction materials 11. Incapability to predict and resolve project's problems related to new technological techniques. 12. Inaccurate estimation of construction costs. 13. Construction errors and defective work at the construction site. 14. Financial and technical status of the contractor 15. Unstable client requirements. 16. Unrealistic client expectations regarding project time, cost and quality 17. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V. 18. Delaying in decision making 19. Design	requirements. 9. Design complexity. 10. Lack of experience-related project nature. 11. Long period between time of bidding and awarding.	discrepancies before tender awarding. 10.Construction errors and defective work at the construction site. 11.Unstable client requirements. 12.Delaying in decision making 13.Interference of client during implementation 14.Political situation impact on fund continuity 15.Slow in Shop drawings’ submission and approval.	equipment. 10. Frequent changes of subcontractors. 11. Unstable client requirements. 12. Inappropriate work packaging and subcontracting. 13. Delaying in decision making 14. Design complexity. 15. Lack of experience-related project nature . 16. Slow in Shop drawings’ submission and approval.		10. Interference of client during implementation 11. Political situation impact on fund continuity 12. Lack of communication and coordination between various project teams. 13. Slow in Shop drawings’ submission and approval.

Question	Interviewee A	Interviewee B	Interviewee C	Interviewee D	Interviewee E	Interviewee F
	complexity. 20. Lack of experience-related project nature. 21. Time pressure due to unreasonable contract duration.					
What are the various impacts of the DCIPs in the selected construction projects?	1. Quality degradation. 2. Completion schedule delay	1. Completion schedule delay 2. Cost overrun	1. Quality degradation 2. Cost overrun 3. Poor safety conditions	1. Cost overrun	1. Quality degradation 2. Completion schedule delay 3. Cost overrun	1. Quality degradation 2. Completion schedule delay 3. Poor team work performance
What do you suggest to minimize the DCIPs in the construction projects?	1. All involved parties should plan adequately before works start on the site. 2. Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details	1. Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts. 2. Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.	1. Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details 2. Client should give adequate time for designers. 3. Quality of services should have a considerable portion of tender's	1. Client should give adequate time for designers. 2. Quality of services should have a considerable portion of tender's evaluation process . 3. The interface between consultants and contractors needs to be improved throughout the project life cycle according to the good communication –	1. All involved parties should plan adequately before works start on the site. 2. Quality of services should have a considerable portion of tender's evaluation process. 3. Clients should pay attention to do their work and perform their responsibilities on time to close the door of rising claims from their side.	1. Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details 2. Clients should pay attention to do their work and perform their responsibilities on time to close the

Question	Interviewee A	Interviewee B	Interviewee C	Interviewee D	Interviewee E	Interviewee F
	3. Client should set their complete requirements in advance before starting the design process. 4. Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts. 5. Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.		evaluation process.	frequent, timely, succinct, high-grade, and reliable.		door of rising claims from their side. 3. Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.

4.2 Findings from Interviews:

The interviews were conducted between the projects' managers of the selected building construction projects focusing on fully understanding the causes and impacts of the DCIPs. The finding as following:

4.2.1 Causes of the DCIPs:

Thirty-four (34) causes of the DCIPs were identified to be used in the questionnaire to assess their degree of importance. However, all the thirty-four causes were already identified from the literature review. Below are the interview finding of summary of causes of the DCIPs in the construction projects in Gaza Strip from the six building projects as shown in Table (4.3).

Table (4.3): Causes of the DCIPs from the interviews.

SN	Causes of the DCIPs	% of occurrence
1	Lack of project-stipulated data.	66.7
2	Lack of skilled and experienced human resources in the design firms.	50.0
3	Lack of proper coordination between various disciplines of design team.	33.3
4	Lack of awareness about the availability of construction materials and equipment in the local market.	83.3
5	Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.	16.7
6	Inaccurate estimation of project element costs and quantities.	16.7
7	Mistakes and discrepancies in design documents.	33.3
8	Gaps in the items description	16.7
9	Lack of design quality assurance practices.	50.0
10	Insufficient design duration	66.7
11	Insufficient comprehension of design documents.	66.7
12	Lack of skilled human resources at the construction site.	16.7
13	Unavailability of construction materials	83.3
14	Inadequate study for tender document to observe discrepancies before tender awarding.	50.0

Continued

SN	Causes of the DCIPs	% of occurrence
15	Incapability to predict and resolve project's problems related to new technological techniques.	16.7
16	Inaccurate estimation of construction costs.	16.7
17	Construction errors and defective work at the construction site.	50.0
18	Failure of construction equipment.	16.7
19	Frequent changes of subcontractors.	33.3
20	Financial and technical status of the contractor	66.7
21	Unstable client requirements.	66.7
22	Unrealistic client expectations regarding project time, cost and quality	16.7
23	Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.	50.0
24	Inappropriate work packaging and subcontracting.	50.0
25	Delaying in decision making	66.7
26	Interference of client during implementation	50.0
27	Interference of donor in project requirements.	16.7
28	Political situation impact on fund continuity	33.3
29	Lack of communication and coordination between various project teams.	33.3
30	Design complexity.	50.0
31	Lack of experience-related project nature.	50.0
32	Slow in Shop drawings' submission and approval.	50.0
33	Time pressure due to unreasonable contract duration.	33.3
34	Long period between time of bidding and awarding.	16.7

4.2.2 Impact of the DCIPs:

Five (5) impacts of the DCIPs were identified to evaluate their degree of importance. However, all the variables were in the literature review. Below are the interview finding of summary of impacts of the DCIPs in the construction projects in Gaza Strip from the six building projects as shown in Table (4.4).

Table (4.4): Impacts of the DCIPs from the interviews.

SN	Impacts of the DCIPs	% of occurrence
1	Quality degradation	66.7
2	Completion schedule delay	66.7
3	Cost overrun	66.7
4	Poor safety conditions	16.7
5	Poor team work performance	16.7

4.3 Analysis of Data from the Questionnaires:

This section describes results that gathered from a field survey of one hundred and eighty-three questionnaires. The questionnaires were analyzed using SPSS. The questionnaire was organized to be completed by the consultants and contractors operating in the construction projects and limited to the last five years.

4.3.1 General Information:

It provides a general information regarding the respondents in terms of the type of organization, position in the organization, years of experience, years of experience of Organization/Company and size of the projects implemented by the Organization/Company in the last five years.

4.3.1.1 Respondents' type of the organization:

Through Table (4.5) shows that 42.6% of Organization/Company are Contractor 1st building classification, 27.3% are Contractor 2nd building classification, and 30.1% are consultants.

4.3.1.2 Respondents' position in the organization:

It is clear from Table (4.5) 25.1% of respondents working as a site/office engineer, 19.7% is project manager /deputy, 3.3% is Organization manager/deputy, 51.9% others.

4.3.1.3 Respondents' years of experience:

Table (4.5) shows that 35.5% of respondents have 15 years of experience and more, 29% "from 10 years to less than 15years", 13.7% "from 5 years to less than 10 years", 21.9% "less than 5".

4.3.1.4 Organization/Company years of experience:

The table (4.5) shows that 44.3% of Organization/Company has years of an experience less than 5 years, 21.3% "15 years and over", 17.5% "from 10 years to less than 15", 16.9% "from 5 years to less than 10 years".

4.3.1.5 Size of the projects implemented by the Organization/Company in the last five years:

Table (4.5) shows that 46.4% of the projects that the company /organization has managed in the last five years are less than $ 1 million, 30.1% "from 5 to less than $ 10 million", 15.8% "$ 10 million or more", while 7.7% " from $1 to less than $ 5 million".

Table (4.5): Respondent's general information.

General information	Frequency (No.)	Percentage (%)
Type of organization		
Consulting	55	30.1
Contractor 1st building classification	78	42.6
Contractor 2nd building classification	50	27.3
Position in the organization		
Organization manager/Deputy	6	3.3
Project manager/Deputy	36	19.7
Site/Office engineer	46	25.1
Others	95	51.9
Respondents' years of experience		
Less than5years	40	21.9
From 5 years to less than 10 years	25	13.7

Continued

General information	Frequency (No.)	Percentage (%)
From 10 years to less than 15years	53	29.0
15 years and Over	65	35.5
Organization/Company years of experience		
Less than5years	81	44.3
From 5 years to less than 10 years	31	16.9
From 10 years to less than 15years	32	17.5
15 years and Over	39	21.3
Size of the projects implemented by the Organization/Company in the last five years		
Less than $1million	85	46.4
From $1 to less than $5million	14	7.7
From $5 to less than $10million	55	30.1
$10 million and more	29	15.8

4.3.2 Analysis of factors causing the Design–construction interface problems:

This section discusses the obtained results regarding the factors that cause the Design–construction interface problems. To analyze the questionnaire, parametric tests (T-test) for one sample was used to see whether the mean scores of the response where it is considered a Class 3 neutrality and represent 60% of the study scale. Table (4.6) shows the degrees approved by t-test for one sample.

Table (4.6): degrees approved by t test for one sample.

significantly Approval	moderately approval	low approval
Significance level is less than 0.05	significance level is greater than the 0.05	significance level is less than 0.05
average > overall average supposed (3)	average or close to the overall average is assumed (3)	average <overall average supposed (3)

The descriptive statistics (means, SD, RII, and ranks) were calculated for the all causes of the Design–construction interface problems according to each party of the respondents and to overall respondents and presented in Table (4.7). The rank column represents the consecutive ranking based on the highest mean and RII and the lowest SD. If some factors have same means and RII ranking will depend on the lowest SD. Moreover, If the dimension had a p-value more than "0.05" then the respondents were neutral regarding this dimension and if the dimension had a p-value less than "0.05", there are two cases firstly, a mean less "3" so the respondents were disagreed with this dimension secondly, a mean more than "3" so the respondents were agreed on this dimension.

A. The Top five Most Important Factors:

It's shown in Table (4.7) that the most five important causes of the Design–construction interface problems in the building construction projects in Gaza Strip as observed by all respondents and to each party of the respondents included; Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V, Political situation impact on fund continuity, Lack of skilled human resources at the construction site, Delaying of dues payments, Incapability to predict and resolve project's problems related to new technological techniques.

1. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.

This factor is the most important cause of the Design–construction interface problems in the building construction projects in Gaza Strip. It was ranked, according to overall respondents in the first position with RII = 0.8197. There is an agreement between all parties. Contractor and consultant also ranked it in the first position with RII = 0.7895 and RII = 0.8232 respectively. The owners frequently award the lowest bidder to implement their projects, but generally, the lowest bidder is low qualified contractors with a shortage of resources and low competencies that lead to low performance and cause Design–construction interface problems in the work. In addition, this factor leading to defects/errors due to a contractor administration and his staff group in the construction stage. This result inline with several researchers Sha'ar et al (2016) and Tayeh, Hallaq, and Sabha (2016) whose found that awarding contract to the lowest price regardless of the contractor technical evaluation and C.V was one of the top five most important factors cause of the Design–construction interface problems in the building construction projects.

2. Political situation impact on fund continuity.

"Political situation impact on fund continuity" was ranked in the second position with RII = 0.8022 based on overall respondent's feedback. There is an agreement among all parties that this factor is one of the most important causes, it was ranked by contractor and consultant in 3rd and 2nd position with RII = 0.7474 and 0.8085.The political situation in the Gaza Strip is described as unstable due to the conflict and occupation between the Israeli and Palestinian. This condition leads to an impact on fund continuity. No previous studies investigated this factor because it is a particular case in Gaza Strip, there is a political situation has severed impact on found continuity.

3. Lack of skilled human resources at the construction site.

"Lack of skilled human resources at the construction site" was ranked in the third position with RII = 0.6809 based on overall respondent's feedback. There is an agreement among parties toward the importance of this factor, the contractor and consultant ranked it in 14th position with RII = 0.6632 and RII = 0.6829 respectively. Timely schedule and quality work would be influenced in the absence of suitable manpower support because some jobs may need certain expertise that is not existing in the local market so the consultant may agree to change the method of construction If such manpower could not be available, many problems may arise during project construction which can affect the construction efficiency. Moreover, in this case, design entirety may not be applicable due to the deficiency of skilled construction staff. This result inline with Sha'ar et al., (2016), Chen et al. (2008) and Arain (2002) whose found that Lack of skilled human resources at the construction site was one of the top five most important factors cause of the Design–construction interface problems in the building construction projects. In contrast, This result doesn't inline with Huang et al. (2008).

4. **Delaying of dues payments.**

"Delaying of dues payments" was ranked in the fourth position with RII = 0.7399 based on overall respondent's feedback. There is a difference among parties toward the importance of this factor, the contractor and consultant ranked it in 5th and 4th position with RII = 0.7158 and RII = 0.7427 respectively. Any construction party whether it is a designer or a constructor usually bases his financial plan on an anticipated cash flow payment from the client. Any delay occurs in the payment for any reason such as improper work or financial problems will influence the financial plan for a specific construction party that in turn influences the performance of the party and it may not be able to finish the job. Therefore, designers should make specifications s and plan clear so that an agreement of progress payments to the contractor can be arranged easily. If this is not done correctly, then a disagreement will happen on the explanation of the progress of work and this will turn back to the designer that again makes a problem of the interface between contractor and designer. This result match with Sha'ar et al., (2016) but doesn't match with Al-Hammad (1995).

5. **Incapability to predict and resolve project's problems related to new technological techniques.**

"Incapability to predict and resolve project's problems related to new technological techniques" was ranked in the 5th position with RII = 0.6492 based on overall respondent's feedback. There is a difference among parties toward the importance of this factor, the contractor and consultant ranked it in 33rd and 29th position with RII = 0.6316 and RII = 0.6512 respectively. The unfamiliarity of the designer with construction techniques will generate designs that are hard to perform, or cannot practically be applied. In addition, unclear methods can be specified which would generate difficulties in interfacing between contractor and designer. New technological techniques need very detailed clarifications by the designer to make them understandable to the other participants. This result match with Al-Hammad and Assaf (1992), Chen et al. (2008) and AL Mousli and El-Sayegh (2016). In contrast, This result doesn't match with Sha'ar et al., (2016) who found that Lack of experience about new construction technologies was one of the least important factors cause of the Design–construction interface problems.

B. The least five important factors:

It's shown in Table (4.7) that the least five important causes of the Design–construction interface problems in the building construction projects in Gaza Strip as observed by all respondents and to each party of the respondents included; The designer work as a project supervisor, Outsourcing of design services, Inappropriate choice of project delivery system (design-build, design-bid-build, etc.), Unclear definition for scope of work, Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.

1. **Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.**

"Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications" was ranked in 51st position as the least important causes of the Design–construction interface problems in the building construction projects in Gaza Strip with RII = 0.5464 as per perceptions of all respondents. There is a difference between contractor and consultant toward this factor, they ranked it in 45th, and 51st position with RII = 0.5368, and 0.5476 respectively. Obviously, local authorities may have specific regulations that should be accommodated in the design. These regulations are reviewed occasionally for compliance by. Lack of awareness about such regulations will cause problems among the client and the designer as it delays the design approval by the concerned authority. Besides, the client may require designing an element that is in conflict with the imposed regulations and leads to problems between both parties. Therefore, successfully execution of the project and elimination of such problems require the designer to be familiar with such regulations. This will reduce the design time as well as improve the overall design performance. This result match with Sha'ar et al., (2016) who found that this factor as the least significant causes of DCIPs but doesn't match with Huang et al. (2008) who explain that this factor one of the main reasons of DCIPs.

2. **Unclear definition for scope of work.**

"Unclear definition for scope of work" was ranked according to overall respondents in the 50th position as one of the five least important causes of the Design–construction interface problems with RII = 0.5530 as per perceptions of all respondents. All project parties agreed that it was one of the five least important causes of the Design–construction interface problems. It was ranked by the contractor and consultant in 46th and 50th position with RII = 0.5789 and RII = 0.5500.

Client should be able to provide comprehensive and consistent project briefs before awarding the contract. If he is unsure of his requirements, this should be clearly stated in the tender documents to let the tenderers know the actual situation. If the scope of work is unclearly defined whether in design or construction, then work boundaries cannot be well-adjusted and thus many discrepancies may occur between design and construction. This result somewhat matches with AL Mousli and El-Sayegh (2016) and Sha'ar et al., (2016).

3. **Inappropriate choice of project delivery system (design-build, design-bid-build, etc.).**

"Inappropriate choice of project delivery system (design-build, design-bid-build, etc.)" was ranked according to overall respondents in the 49th position with RII = 0.5628. There is almost an agreement between contractor and consultant toward this factor, they ranked it in 51st, and 49th position with RII = 0.5263, and 0.5671 respectively. Contractually, there are many systems of project delivery whose selection is based on the objectives of the client. Each system has its pros and cons also specific rules applied during the project completion and handing over. Generally, in Palestine, tendered projects used to be delivered according to the design-bid-build system. This can lead to many inconsistencies between designer and constructor as it essentially separates both design and construction processes from each other. This result match with Sha'ar et al., (2016) who found this factor as one of the five least significant problems.

4. **Outsourcing of design services.**

"Outsourcing of design services" was ranked according to overall respondents in the 48th position with RII = 0.5705. There is a difference between contractor and consultant toward this factor, they ranked it in 44th, and 47th position with RII = 0.5895, and 0.5683 respectively.

Foreign designers usually have inadequate experience about the culture, nature, and environment of the country in which the project is going to be executed especially in Gaza strip. Therefore, they might need more time to produce a compatible design with the client's needs and with local environmental requirements. Furthermore, it was commonly acknowledged that employ foreign design companies could be the source of many coordination problems that may not be happened if local firms had been used. In Palestine, most clients prefer making a design contract with a foreign firm instead of the local one. Numerous problems might be considered in this regard, such as the unsuitability of foreign design's standards and specifications with the local market. This may lead to many changes in the design and adversely affect the construction process as well as the relationship between the designer and constructor. This result match with Sha'ar et al., (2016) who found this factor as one of the five least significant problems.

5. **The designer work as a project supervisor.**

"The designer work as a project supervisor" was ranked according to overall respondents in the 47th position with RII = 0.5738. There is a difference between contractor and consultant toward this factor, they ranked it in 39th, and 48th position with RII = 0.6211, and 0.5683 respectively. Frequently, in Palestine, the designer used to be involved as a construction supervisor.

However, this practice may lead to problems as the construction supervisor in this situation tries to put the blame for design errors on the constructor and evade the responsibilities for design issues. Such behavior increases the level of rivalry between the two parties and initiate problems at the project interface. This result match with Sha'ar et al., (2016) and AL Mousli and El-Sayegh (2016) whose found this factor as one of the five least significant problems.

Table (4.7): RII and Ranks for factors causing the Design–construction interface problems.

Factors causing the Design–construction interface problems in construction projects in Gaza strip	Contractor (1st and 2nd)			Consultant			Over all		
	mean	RII	Rank	mean	RII	Rank	mean	RII	Rank
1. Lack of project-stipulated data.	2.63	52.63	50	3.05	61.10	43	3.01	60.22	44
2. Lack of skilled and experienced human resources in the design firms.	3.32	66.32	11	3.24	64.76	31	3.25	64.92	29
3. Lack of proper coordination between various disciplines of design team.	3.32	66.32	12	3.38	67.68	17	3.38	67.54	17
4. Lack of awareness about the construction knowledge and ongoing site operations.	2.84	56.84	48	2.99	59.76	45	2.97	59.45	45
5. Lack of awareness about the availability of construction materials and equipment in the local market.	3.16	63.16	34	3.15	63.05	36	3.15	63.06	37
6. Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.	2.68	53.68	45	2.74	54.76	51	2.73	54.64	51
7. Inaccurate estimation of project element costs and quantities.	3.32	66.32	13	3.26	65.24	28	3.27	65.36	28
8. Mistakes and discrepancies in design documents.	3.26	65.26	18	3.12	62.44	39	3.14	62.73	39
9. gaps in the items description	3.42	68.42	9	3.41	68.17	15	3.41	68.20	12
10. Lack of design quality assurance practices.	3.05	61.05	42	3.22	64.39	32	3.20	64.04	33
11. gaps in the items description	3.26	65.26	21	3.07	61.34	42	3.09	61.75	41
12. Insufficient comprehension of design documents.	3.26	65.26	20	3.32	66.34	22	3.31	66.23	22
13. Lack of skilled human resources at the construction site.	3.32	66.32	14	3.41	68.29	14	3.40	68.09	3
14. Unavailability of construction materials	3.11	62.11	37	3.49	69.76	9	3.45	68.96	15
15. Inadequate study for tender document to observe discrepancies before tender awarding.	3.74	74.74	4	3.65	73.05	5	3.66	73.22	9
16. Incapability to predict and resolve project's problems related to new technological techniques.	3.16	63.16	33	3.26	65.12	29	3.25	64.92	5
17. Inaccurate estimation of construction costs.	3.26	65.26	19	3.39	67.80	16	3.38	67.54	30
18. Construction errors and defective work at the construction site.	3.26	65.26	22	3.36	67.20	19	3.35	66.99	18

Continued

Factors causing the Design–construction interface problems in construction projects in Gaza strip	Contractor (1st and 2nd)			Consultant			Over all		
	mean	RII	Rank	mean	RII	Rank	mean	RII	Rank
19. Failure of construction equipment.	3.16	63.16	32	3.30	65.98	26	3.28	65.68	20
20. Involvement of subcontractor in several projects at the same time.	3.16	63.16	35	3.56	71.22	6	3.52	70.38	26
21. Frequent changes of subcontractors.	2.84	56.84	47	3.27	65.49	27	3.23	64.59	6
22. Financial and technical status of the contractor	3.79	75.79	2	3.86	77.20	3	3.85	77.05	31
23. Unstable client requirements.	3.21	64.21	24	3.34	66.83	21	3.33	66.56	21
24. Unrealistic client expectations regarding project time, cost and quality	3.47	69.47	6	3.37	67.44	18	3.38	67.65	16
25. Outsourcing of design services.	2.95	58.95	44	2.84	56.83	47	2.85	57.05	48
26. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.	3.95	78.95	1	4.12	82.32	1	4.10	81.97	1
27. Restricting the contractor classification and a specific experience for the subcontractors in the contract formby the client.	3.11	62.11	36	3.07	61.46	41	3.08	61.53	42
28. Unclear definition for scope of work.	2.89	57.89	46	2.75	55.00	50	2.77	55.30	50
29. Inappropriate work packaging and subcontracting.	3.47	69.47	7	3.36	67.20	20	3.37	67.43	19
30. Poorly written contract with insufficient detail.	3.16	63.16	31	3.20	64.02	34	3.20	63.93	34
31. Delaying in decision making	3.21	64.21	25	3.47	69.39	11	3.44	68.85	10
32. Delaying of dues payments.	3.58	71.58	5	3.71	74.27	4	3.70	73.99	4
33. Inappropriate choice of project contract type (unit price, lump sum, etc.).	2.79	55.79	49	2.90	58.05	46	2.89	57.81	46
34. Interference of client during implementation	3.21	64.21	30	3.32	66.34	23	3.31	66.12	23
35. Inappropriate choice of project delivery system (design-build, design-bid-build, etc.).	2.63	52.63	51	2.84	56.71	49	2.81	56.28	49
36. The designer work as a project supervisor	3.11	62.11	39	2.84	56.83	48	2.87	57.38	47
37. Financial capability of donor.	3.32	66.32	16	3.18	63.54	35	3.19	63.83	35
38. Budget allocated constraints.	3.26	65.26	23	3.13	62.56	38	3.14	62.84	38
39. Time constraints.	3.32	66.32	15	3.42	68.41	12	3.41	68.20	13

Continued

Factors causing the Design–construction interface problems in construction projects in Gaza strip	Contractor (1st and 2nd)			Consultant			Over all		
	mean	RII	Rank	mean	RII	Rank	mean	RII	Rank
40. Interference of donor in project requirements.	3.11	62.11	38	3.09	61.83	40	3.09	61.86	40
41. Insufficient donor experience in implementing projects according to local conditions	3.21	64.21	27	3.15	63.05	37	3.16	63.17	36
42. Political situation impact on fund continuity	3.74	74.74	3	4.04	80.85	2	4.01	80.22	2
43. Poor project organizational structure.	3.11	62.11	41	3.32	66.34	24	3.30	65.90	24
44. Uncooperative managers and poor decision-making.	3.11	62.11	40	3.48	69.51	10	3.44	68.74	11
45. Shortage in flow of information lead to repeated works and variation order	3.42	68.42	10	3.51	70.12	8	3.50	69.95	8
46. Lack of communication and coordination between various project teams.	3.21	64.21	26	3.30	66.10	25	3.30	65.90	25
47. Design complexity.	3.21	64.21	29	3.21	64.27	33	3.21	64.26	32
48. Lack of experience-related project nature.	3.42	68.42	8	3.26	65.12	30	3.27	65.46	27
49. Slow in Shop drawings' submission and approval.	3.32	66.32	17	3.42	68.41	13	3.41	68.20	14
50. Time pressure due to unreasonable contract duration.	3.21	64.21	28	3.54	70.85	7	3.51	70.16	7
51. Long period between time of bidding and awarding.	3.00	60.00	43	3.05	61.10	44	3.05	60.98	43
total	**3.24**	**64.83**		**3.30**	**66.04**		**3.30**	**65.91**	

4.3.2.1 Analysis of Consultant related factors:

Table (4.8) showed RII and the rank of consultant related factors in terms of the Design–construction interface problems and according to each party and to overall respondents as follows.

It's shown from Table (4.8) that "Gaps in the items description" was ranked as the most occurred cause of the Design–construction interface problems with mean equals "3.41" and RII = 0.6820, that means the respondents were agreed on this factor. In contrast, “Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications” was ranked as the least occurred cause the Design–construction interface problems with mean equals "2.73" and RII = 0.5464, that means the respondents were disagreed on this factor. In general, the results of all factors of consultant related factors showed that the mean equals "3.17" and RII = 0.6332, that means the respondents were agreed on this dimension.

Table (4.8): Ranks of consultant related factors.

Consultant related factors	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. Lack of project-stipulated data.	52.63	**11**	61.10	**9**	3.01	1.04	0.14	0.89	60.22	**9**
2. Lack of skilled and experienced human resources in the design firms.	66.32	**2**	64.76	**4**	3.25	0.92	3.62	0.00	64.92	**4**
3. Lack of proper coordination between various disciplines of design team.	66.32	**3**	67.68	**2**	3.38	0.92	5.53	0.00	67.54	**2**
4. Lack of awareness about the construction knowledge and ongoing site operations.	56.84	**9**	59.76	**10**	2.97	0.98	-0.38	0.71	59.45	**10**
5. Lack of awareness about the availability of construction materials and equipment in the local market.	63.16	**7**	63.05	**6**	3.15	0.96	2.16	0.03	63.06	**6**
6. Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.	53.68	**10**	54.76	**11**	2.73	0.91	-3.99	0.00	54.64	**11**
7. Inaccurate estimation of project element costs and quantities.	66.32	**4**	65.24	**3**	3.27	1.00	3.62	0.00	65.36	**3**
8. Mistakes and discrepancies in design documents.	65.26	**5**	62.44	**7**	3.14	1.00	1.84	0.07	62.73	**7**
9. Gaps in the items description	68.42	**1**	68.17	**1**	3.41	0.98	5.63	0.00	68.20	**1**

Continued

Consultant related factors	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
10. Lack of design quality assurance practices.	61.05	**8**	64.39	**5**	3.20	1.04	2.63	0.01	64.04	**5**
11. Insufficient design duration	65.26	**6**	61.34	**8**	3.09	1.01	1.17	0.24	61.75	**8**
	63.73		**63.27**		**3.17**	**0.60**	**3.73**	**0.00**	**63.32**	

4.3.2.2 Analysis of Contractor related factors:

Table (4.9) showed RII and the rank of contractor related factors in terms of the Design–construction interface problems and according to each party and to overall respondents as follows.

It's shown from Table (4.9) that “Financial and technical status of the contractor” was ranked as the most occurred cause of the Design–construction interface problems with mean equals "3.85" and RII = 0.7705, that means the respondents were agreed on this factor. Potential financial problems in a construction project contain the contractor’s underbids or cash flow problems. These problems impair project processes and cause poor quality. This result inline with Al-Hammad and Al-Hammad, 1996) and Al-Hammad (2000). In contrast, “Frequent changes of subcontractors” was ranked as the least occurred cause the Design–construction interface problems with mean equals "3.17" and RII = 0.6459, that means the respondents were agreed on this factor. This result inline with Sha’ar et al. (2016). In general, the results of all factors of consultant related factors showed that the mean equals "3.43" and RII = 0.6851, that means the respondents were agreed on this dimension.

Table (4.9): Ranks of Contractor related factors.

Second: Contractor related factors	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. Insufficient comprehension of design documents.	65.26	4	66.34	8	3.31	0.85	4.96	0.00	66.23	8
2. Lack of skilled human resources at the construction site.	66.32	3	68.29	5	3.40	1.02	5.35	0.00	68.09	5
3. Unavailability of construction materials	62.11	10	69.76	4	3.45	1.01	6.01	0.00	68.96	4
4. Inadequate study for tender document to Observe discrepancies before tender awarding.	74.74	2	73.05	2	3.66	1.01	8.87	0.00	73.22	2
5. Incapability to predict and resolve project's problems related to new technological techniques.	63.16	9	65.12	11	3.25	0.99	3.35	0.00	64.92	10
6. Inaccurate estimation of construction costs.	65.26	5	67.80	6	3.38	1.01	5.06	0.00	67.54	6
7. Construction errors and defective work at the construction site.	65.26	6	67.20	7	3.35	1.00	4.71	0.00	66.99	7
8. Failure of construction equipment.	63.16	7	65.98	9	3.28	1.01	3.81	0.00	65.68	9
9. Involvement of subcontractor in several projects at the same time.	63.16	8	71.22	3	3.52	0.99	7.07	0.00	70.38	3
10. Frequent changes of subcontractors.	56.84	11	65.49	10	3.23	0.98	3.17	0.00	64.59	11
11. Financial and technical status of the contractor	75.79	1	77.20	1	3.85	0.99	11.63	0.00	77.05	1
	65.55		68.86		3.43	0.68	8.53	0.00	68.51	

4.3.2.3 Analysis of Client related factors:

Table (4.10) showed RII and the rank of client-related factors in terms of the Design–construction interface problems and according to each party and to overall respondents as follows.

It's shown from Table (4.10) that "Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V" was ranked as the most occurred cause of the Design–construction interface problems with mean equals "4.10" and RII = 0.8197, that means the respondents were agreed on this factor. In contrast, “Unclear definition for scope of work” was ranked as the least occurred cause the Design–construction interface problems with mean equals "2.77" and RII = 0.5530, that means the respondents were disagreed on this factor. In general, the results of all factors of consultant related factors showed that the mean equals "3.22" and RII = 0.6442, that means the respondents were agreed on this dimension.

Table (4.10): Ranks of Client related factors.

Third: Client related factors	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. Unstable client requirements.	64.21	5	66.83	6	3.33	0.87	5.09	0.00	66.56	6
2. Unrealistic client expectations regarding project time, cost and quality	69.47	4	67.44	4	3.38	0.87	5.92	0.00	67.65	4
3. Outsourcing of design services.	58.95	11	56.83	10	2.85	0.94	-2.12	0.04	57.05	12
4. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.	78.95	1	82.32	1	4.10	1.02	14.61	0.00	81.97	1
5. Restricting the contractor classification and a specific experience for the subcontractors in the contract formby the client.	62.11	10	61.46	9	3.08	1.07	0.97	0.33	61.53	9
6. Unclear definition for scope of work.	57.89	12	55.00	14	2.77	0.88	-3.61	0.00	55.30	14
7. Inappropriate work packaging and subcontracting.	69.47	3	67.20	5	3.37	0.96	5.25	0.00	67.43	5
8. Poorly written contract with insufficient detail.	63.16	8	64.02	8	3.20	0.97	2.73	0.01	63.93	8
9. Delaying in decision making	64.21	7	69.39	3	3.44	0.98	6.14	0.00	68.85	3
10. Delaying of dues payments.	71.58	2	74.27	2	3.70	0.98	9.66	0.00	73.99	2

Continued

Third: Client related factors	Contractor (1^{st} and 2^{nd})		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
11. Inappropriate choice of project contract type (unit price, lump sum, etc.).	55.79	13	58.05	13	2.89	0.97	-1.52	0.13	57.81	10
12. Interference of client during implementation	64.21	6	66.34	7	3.31	1.02	4.06	0.00	66.12	7
13. Inappropriate choice of project delivery system (design-build, design-bid-build, etc.).	52.63	14	56.71	12	2.81	0.93	-2.70	0.01	56.28	13
14. The designer work as a project supervisor	62.11	9	56.83	11	2.87	1.17	-1.52	0.13	57.38	11
	63.91		64.48		3.22	0.56	5.38	0.00	64.42	

4.3.2.4 Analysis of Donor related factors:

Table (4.11) showed RII and the rank of donor-related factors in terms of the Design–construction interface problems and according to each party and to overall respondents as follows.

It's shown from Table (4.11) that “Political situation impact on fund continuity” was ranked as the most occurred cause of the Design–construction interface problems with mean equals "4.01" and RII = 0.8022, that means the respondents were agreed on this factor. In contrast, “Interference of donor in project requirements” was ranked as the least occurred cause the Design–construction interface problems with mean equals "3.09" and RII = 0.6186, that means the respondents were neutral on this factor. The Donors always have the particular policy in execution methods and characteristics of the project. In general, the results of all factors of consultant related factors showed that the mean equals "3.33" and RII = 0.6668, that means the respondents were agreed on this dimension.

Table (4.11): Ranks of Donor related factors.

Fourth: Donor related factors	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. Financial capability of donor.	66.32	3	63.54	3	3.19	1.11	2.34	0.02	63.83	3
2. Budget allocated constraints.	65.26	4	62.56	5	3.14	0.87	2.22	0.03	62.84	5
3. Time constraints.	66.32	2	68.41	2	3.41	0.88	6.32	0.00	68.20	2
4. Interference of donor in project requirements.	62.11	6	61.83	6	3.09	0.94	1.34	0.18	61.86	6
5. Insufficient donor experience in implementing projects according to local conditions	64.21	5	63.05	4	3.16	1.05	2.04	0.04	63.17	4
6. Political situation impact on fund continuity	74.74	1	80.85	1	4.01	0.99	13.83	0.00	80.22	1
	66.49		66.71		3.33	0.68	6.70	0.00	66.68	

4.3.2.5 Analysis of Project-related factors:

Table (4.12) showed RII and the rank of project related factors in terms of the Design–construction interface problems and according to each party and to overall respondents as follows.

It's shown from Table (4.12) that “Time pressure due to unreasonable contract duration” was ranked as the most occurred cause of the Design–construction interface problems with mean equals "3.51" and RII = 0.7016, that means the respondents were agreed on this factor. Using unachievable work time-schedule, especially in the design phase as it is the basis on which the subsequent phases are built, can lead to many problems. This may assign more work pressure on staff as they have to finish on time and causing different errors and conflicts between various engineering disciplines contributing to the design. This result somewhat inline with Sha’ar et al. (2016). In contrast, “Long period between time of bidding and awarding” was ranked as the least occurred cause the Design–construction interface problems with mean equals "3.05" and RII = 0.6098, that means the respondents were neutral on this factor. Delaying the project procurement process has negative impacts on the other following stages of the project lifecycle. It sometimes happens during this period a kind of prices differentiation or building regulations changes that will make a confusion to the contractor if he won the bid later on. This result inline with Sha'ar et al. (2016). In general, the results of all factors of consultant related factors showed that the mean equals "3.33" and RII = 0.6662, that means the respondents were agreed on this dimension.

Table (4.12): Ranks of Project-related factors.

Fifth: Project-related factors	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. Poor project organizational structure.	62.11	6	66.34	5	3.30	0.93	4.31	0.00	65.90	5
2. Uncooperative managers and poor decision-making.	62.11	7	69.51	3	3.44	0.94	6.29	0.00	68.74	3
3. Shortage in flow of information lead to repeated works and variation order	68.42	1	70.12	2	3.50	0.91	7.42	0.00	69.95	2
4. Lack of communication and coordination between various project teams.	64.21	4	66.10	6	3.30	0.96	4.18	0.00	65.90	6
5. Design complexity.	64.21	8	64.27	8	3.21	0.93	3.09	0.00	64.26	8
6. Lack of experience-related project nature.	68.42	2	65.12	7	3.27	0.94	3.94	0.00	65.46	7
7. Slow in Shop drawings' submission and approval.	66.32	3	68.41	4	3.41	0.96	5.77	0.00	68.20	4
8. Time pressure due to unreasonable contract duration.	64.21	5	70.85	1	3.51	1.02	6.77	0.00	70.16	1
9. Long period between time of bidding and awarding.	60.00	9	61.10	9	3.05	1.12	0.60	0.55	60.98	9
	64.44		66.87		3.33	0.67	6.71	0.00	66.62	

4.3.3 Analysis of the Impact of the DCIPs:

In this section, the DCIPs impact has been analyzed. Responses of contractors and consultants have been sorted and analyzed about the impact of the DCIPs. The descriptive statistics, i.e. means, SD, RII, and ranks were established for the all factors impact of the DCIPs according to each party of the respondents and to overall respondents and presented in Table (4.13).

Table (4.13) showed the RII and the rank of factors impact of the Design-Construction Interface in terms of the occurrence of the Design-Construction Interface and according to each party and to overall respondents as follows.

“Completion schedule delay” was the most commonly occurred factor and ranked in the 1st position with RII = 0.7902 according to overall respondents. There is an agreement between all parties. The contractor and consultant ranked it in the 1st position with RII = 0.8211 and RII = 0.7866 respectively. The contract schedule for a project may be impacted or delayed by the work solving design-construction problems. This result match with Sugumaran and Lavanya (2013) who explained that interface issues leads to delays.

“Cost overrun” was ranked in the 2nd position with RII = 0.7530 according to overall respondents. There is an agreement between all parties. The contractor and consultant also ranked it in the 2nd position with RII = 0.7684and RII = 0.7512 respectively. Many building construction projects incur increased costs because of DCIPs.

“Quality degradation” was ranked in the 3rd position with RII = 0.7311 according to overall respondents. There is an agreement between all parties. The contractor and consultant also ranked it in the 3rd position with RII = 0.74744and RII = 0.7293 respectively. The owner who has financial problems may need the substitution of quality standard expensive materials to sub-standard cheap materials.

It's shown from Table (4.13) that “Completion schedule delay” was ranked as the most occurred impact of the Design–construction interface problems with mean equals "3.95" and RII = 0.7902, that means the respondents were agree on this factor. In contrast, “Project scope control” was ranked as the least occurred impact of the Design–construction interface problems with mean equals "3.32" and RII = 0.6645, that means the respondents were agree on this factor. In general, the results of all factors impact of the Design–construction interface problems showed that the mean equals "3.62" and RII = 0.7250, that means the respondents were agree on this dimension.

Table (4.13): RII and Ranks of the Impact of the DCIPs.

Impact of the DCIPs	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. Project scope control	70.53	5	65.98	6	3.32	0.86	5.05	0.00	66.45	6
2. Quality degradation	74.74	3	72.93	3	3.66	0.96	9.20	0.00	73.11	3
3. Completion schedule delay	82.11	1	78.66	1	3.95	0.87	14.74	0.00	79.02	1
4. Cost overrun	76.84	2	75.12	2	3.77	0.93	11.15	0.00	75.30	2
5. Poor safety conditions	74.74	4	70.00	5	3.52	0.98	7.22	0.00	70.49	4
6. Poor team work performance	68.42	6	70.85	4	3.53	0.92	7.76	0.00	70.60	5
	74.56		72.26		3.62	0.62	13.56	0.00	72.50	

4.3.4 Analysis of the recommended Strategies to minimize the DCIPs:

In this section, the recommended Strategies to minimize the DCIPs has been analyzed. The RII and ranks were established and presented in Table (4.14).

4.3.4.1 Contractors responses relative to the recommended Strategies to DCIPs:

It's shown from Table (4.14) below, the most important recommended strategies to minimize the DCIPs according to the contractor's point of view was “All involved parties should plan adequately before works start on the site” with RII= 0.9053 followed by “Quality of services should have a considerable portion of tender’s evaluation process” with RII=0.8526 and then “Client should set their complete requirements in advance before starting the design process” with RII= 0.8421. According to these respondents, “Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details” with RII= 0.6737 was the least important recommended strategies to minimize the DCIPs.

4.3.4.2 Consultant responses relative to the recommended Strategies to DCIPs:

It's shown from Table (4.14) below, the most important recommended strategies to reduce the DCIPs according to the consultant's point of view was “All involved parties should plan adequately before works start on the site” with RII= 0.8695 followed by “Quality of services should have a considerable portion of tender’s evaluation process” with RII=0.8500 and then “The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable” with RII= 0.8476. According to these respondents, “Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details” with RII= 0.6415 was the least important recommended strategies to minimize the DCIPs.

It's shown from Table (4.14) that “All involved parties should plan adequately before works start on the site” was ranked as the most recommended Strategies to minimize the DCIPs with mean equals "4.37" and RII = 0.8732, that means the respondents were agreed on this factor. In contrast, “Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details” was ranked as the least recommended Strategies to minimize the DCIPs with mean equals "3.22" and RII = 0.6448, that means the respondents were agreed on this factor. In general, the results of all factors of the recommended Strategies to minimize the DCIPs showed that the mean equals "3.83" and RII = 0.7661, that means the respondents were agreed on this dimension.

Table (4.14): RII and Ranks of the recommended Strategies to minimize the DCIPs.

Recommended Strategies to minimize the DCIPs	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
1. All involved parties should plan adequately before works start on the site.	90.53	1	86.95	1	4.37	0.76	24.16	0.00	87.32	1
2. Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details	67.37	9	64.15	9	3.22	1.18	2.57	0.01	64.48	9
3. Client should set their complete requirements in advance before starting the design process.	84.21	3	83.66	4	4.19	0.86	18.72	0.00	83.72	4
4. Client should give adequate time for designers.	84.21	4	83.66	5	4.19	0.77	20.85	0.00	83.72	5
5. Quality of services should have a considerable portion of tender's evaluation process.	85.26	2	85.00	2	4.25	0.76	22.14	0.00	85.03	2
6. The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable.	82.11	6	84.76	3	4.22	0.77	21.51	0.00	84.48	3
7. Clients should pay attention to do their work and perform their responsibilities on time to close the door of rising claims from their side.	83.16	5	79.88	7	4.01	0.85	16.06	0.00	80.22	7
8. Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts.	81.05	7	80.49	6	4.03	0.83	16.78	0.00	80.55	6

Continued

Recommended Strategies to minimize the DCIPs	Contractor (1st and 2nd)		Consultant		Over all					
	RII	Rank	RII	Rank	mean	SD	T-test	p- value	RII	Rank
9. Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.	78.95	8	76.34	8	3.83	0.93	12.07	0.00	76.61	8
	81.87		80.54		3.83	0.93	12.07	0.00	76.61	

4.3.5 Research Hypotheses Testing:

Test hypotheses about the relationship between two variables of the study variables (the first major premise): Null hypothesis: There is no statistically significant relationship between the two variables of the study variables. Alternative hypothesis: There were statistically significant between the two variables of the study variables relationship.

If Sig. value (P-value) is greater than the significance level ($\alpha \leq 0.05$) it cannot be rejected the null hypothesis and thus there is no statistically significant relationship between the two variables of the variables of the study, but if the Sig. value (P-value) is less than the significance level ($\alpha \leq 0.05$) are rejected the null hypothesis and accept the alternative hypothesis that there is a statistically significant relationship between the two variables of the study variables. Five hypotheses were tested through applying One-Way ANOVA as follow.

4.3.5.1 First hypothesis:

H1: There are differences in responses to DCIPs in Construction Projects in Gaza Strip: Impacts and Minimization due to the General Information at significance level ($\alpha \leq 0.05$).

H_{1A}: There are differences in responses to DCIPs in Construction Projects in Gaza Strip: Impacts and Minimization due to the type of your Organization / Company at significance level ($\alpha \leq 0.05$).

By using one-way ANOVA test, the results are illustrated in table (4.15) which shows that the p-value is more than (0.05) for each criterion, and p-value for all the (Factors causing the Design–construction interface problems in construction projects) criteria equals (0.586), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Factors causing the Design–construction interface problems in construction projects) according to their Type of your Organization/Company and p-value for all the (Impact of the DCIPs) criteria equals (0.605), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Impact of the DCIPs) according to their Type of your Organization/Company. In addition, p-value for all the (Recommended Strategies to minimize the DCIPs) criteria equals (0.809), which is more than (0.05). Therefore, there are not substantial differences in respondents' answers toward applying the (Recommended Strategies to minimize the DCIPs) according to their Type of your Organization/Company.

Table (4.15): One-way ANOVA test for the differences between the answers of the respondents due to the (Type of your Organization / Company).

		Sum of Squares	Degree of freedom (df)	Mean Square	F	p-value
First: consultant related factors	Between Groups	.066	2	.033	.090	.914
	Within Groups	65.954	180	.366		
	Total	66.020	182			
Second: Contractor related factors	Between Groups	2.220	2	1.110	2.473	.087
	Within Groups	80.801	180	.449		
	Total	83.022	182			
Third: Client related factors	Between Groups	.224	2	.112	.361	.698
	Within Groups	55.987	180	.311		
	Total	56.211	182			
Fourth: Donor related factors	Between Groups	.112	2	.056	.121	.886
	Within Groups	82.860	180	.460		
	Total	82.972	182			

Continued

		Sum of Squares	Degree of freedom (df)	Mean Square	F	p-value
Fifth: Project-related factors	Between Groups	.426	2	.213	.476	.622
	Within Groups	80.684	180	.448		
	Total	81.110	182			
Factors causing the Design–construction interface problems in construction projects	Between Groups	.240	2	.120	.536	.586
	Within Groups	40.400	180	.224		
	Total	40.641	182			
Impact of the DCIPs	Between Groups	.393	2	.197	.503	.605
	Within Groups	70.286	180	.390		
	Total	70.679	182			
Recommended Strategies to minimize the DCIPs	Between Groups	.134	2	.067	.213	.809
	Within Groups	56.815	180	.316		
	Total	56.949	182			

H_{1B}: There are differences in responses to DCIPs in Construction Projects in Gaza Strip: Impacts and Minimization due to the position in the organization /company at significance level ($\alpha \leq 0.05$).

By using one-way ANOVA test, the results are showed in table (4.16) which present that the p-value is more than (0.05) for each criterion, and p-value for all the (Factors causing the Design–construction interface problems in construction projects) criteria equals (0.915), which is more than (0.05). This means that there are not significant differences in respondents' answers toward applying the (Factors causing the Design–construction interface problems in construction projects) according to their Position in the organization/company and p-value for all the (Impact of the DCIPs) criteria equals (0.105), which is more than (0.05). This means that there are not significant differences in respondents' answers toward applying the (Impact of the DCIPs) according to their Position in the organization/company and p-value (Sig.) for all the (Recommended Strategies to minimize the DCIPs) criteria equals (0.977), which is more than (0.05). Therefore, there are not substantial differences in respondents' answers toward applying the (Recommended Strategies to minimize the DCIPs) according to their Position in the organization/company.

Table (4.16): One-way ANOVA test for the differences between the answers of the respondents due to their Position in the organization/company.

		Sum of Squares	df	Mean Square	F	p-value
First: consultant related factors	Between Groups	.509	3	.170	.464	.708
	Within Groups	65.511	179	.366		
	Total	66.020	182			
Second: Contractor related factors	Between Groups	1.392	3	.464	1.017	.386
	Within Groups	81.630	179	.456		
	Total	83.022	182			
Third: Client related factors	Between Groups	.196	3	.065	.209	.890
	Within Groups	56.015	179	.313		
	Total	56.211	182			
Fourth: Donor related factors	Between Groups	1.548	3	.516	1.134	.337
	Within Groups	81.424	179	.455		
	Total	82.972	182			
Fifth: Project-related factors	Between Groups	.672	3	.224	.498	.684
	Within Groups	80.438	179	.449		
	Total	81.110	182			
Factors causing the Design–construction interface problems in construction projects	Between Groups	.117	3	.039	.172	.915
	Within Groups	40.524	179	.226		
	Total	40.641	182			
Impact of the DCIPs	Between Groups	2.377	3	.792	2.077	.105
	Within Groups	68.301	179	.382		
	Total	70.679	182			
Recommended Strategies to minimize the DCIPs	Between Groups	.065	3	.022	.068	.977
	Within Groups	56.884	179	.318		
	Total	56.949	182			

H_{1c}: There are differences in responses to DCIPs in Construction Projects in Gaza Strip: Impacts and Minimization due to the Years of experience for respondent at significance level ($\alpha \leq 0.05$).

By using one-way ANOVA test, the results are showed in table (4.17) which present that the p-value (Sig.) is more than (0.05) for each criterion, and p-value for all the (Factors causing the Design–construction interface problems in construction projects) criteria equals (0.413), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Factors causing the Design–construction interface problems in construction projects) according to their Years of experience for respondent and p-value for all the (Impact of the DCIPs) criteria equals (0.446), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Impact of the DCIPs) according to their Years of experience for respondent and p-value for all the (Recommended Strategies to minimize the DCIPs) criteria equals (0.716), which is more than (0.05). Therefore, there are not substantial differences in respondents' answers toward applying the (Recommended Strategies to minimize the DCIPs) according to their Years of experience for respondent.

Table (4.17): One-way ANOVA test for the differences between the answers of the respondents due to their Years of experience for respondent.

		Sum of Squares	df	Mean Square	F	Sig.
First: consultant related factors	Between Groups	.948	3	.316	.869	.458
	Within Groups	65.072	179	.364		
	Total	66.020	182			
Second: Contractor related factors	Between Groups	4.660	3	1.553	3.549	.016
	Within Groups	78.361	179	.438		
	Total	83.022	182			
Third: Client related factors	Between Groups	.080	3	.027	.085	.968
	Within Groups	56.131	179	.314		
	Total	56.211	182			

Continued

		Sum of Squares	df	Mean Square	F	Sig.
Fourth: Donor related factors	Between Groups	1.154	3	.385		
	Within Groups	81.818	179	.457	.842	.473
	Total	82.972	182			
Fifth: Project-related factors	Between Groups	1.578	3	.526		
	Within Groups	79.532	179	.444	1.184	.317
	Total	81.110	182			
Factors causing the Design–construction interface problems in construction projects	Between Groups	.643	3	.214		
	Within Groups	39.998	179	.223	.959	.413
	Total	40.641	182			
Impact of the DCIPs	Between Groups	1.042	3	.347		
	Within Groups	69.637	179	.389	.892	.446
	Total	70.679	182			
Recommended Strategies to minimize the DCIPs	Between Groups	.428	3	.143		
	Within Groups	56.521	179	.316	.452	.716
	Total	56.949	182			

H_{1D}: There are differences in responses to DCIPs in Construction Projects in Gaza Strip: Impacts and Minimization due to the years of experience for Organization/Company at significance level ($\alpha \leq 0.05$).

By using one-way ANOVA test, the results are illustrated in table (4.18) which shows that the p-value (Sig.) is more than (0.05) for each criterion, and p-value (Sig.) for all the (Factors causing the Design–construction interface problems in construction projects) criteria equals (0.680), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Factors causing the Design–construction interface problems in construction projects) according to their years of experience for Organization/Company and p-value (Sig.) for all the (Impact of the DCIPs) criteria equals (0.210), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Impact of the DCIPs) according to their Years of experience for Organization/Company and p-value

(Sig.) for all the (Recommended Strategies to minimize the DCIPs) criteria equals (0.348), which is more than (0.05). Therefore, there are not substantial differences in respondents' answers toward applying the (Recommended Strategies to minimize the DCIPs) according to their Years of experience for Organization/Company.

Table (4.18): One-way ANOVA test for the differences between the answers of the respondents due to their Years of experience for Organization/Company.

		Sum of Squares	df	Mean Square	F	Sig.
First: consultant related factors	Between Groups	2.365	3	.788	2.217	.088
	Within Groups	63.655	179	.356		
	Total	66.020	182			
Second: Contractor related factors	Between Groups	.950	3	.317	.691	.559
	Within Groups	82.072	179	.459		
	Total	83.022	182			
Third: Client related factors	Between Groups	1.335	3	.445	1.452	.229
	Within Groups	54.876	179	.307		
	Total	56.211	182			
Fourth: Donor related factors	Between Groups	.600	3	.200	.435	.728
	Within Groups	82.372	179	.460		
	Total	82.972	182			
Fifth: Project-related factors	Between Groups	1.126	3	.375	.840	.473
	Within Groups	79.984	179	.447		
	Total	81.110	182			
Factors causing the Design–construction interface problems in construction projects	Between Groups	.341	3	.114	.505	.680
	Within Groups	40.300	179	.225		
	Total	40.641	182			
Impact of the DCIPs	Between Groups	1.761	3	.587	1.525	.210
	Within Groups	68.917	179	.385		
	Total	70.679	182			
Recommended Strategies to minimize the DCIPs	Between Groups	1.036	3	.345	1.105	.348
	Within Groups	55.913	179	.312		
	Total	56.949	182			

H_{1E}: There are differences in responses to DCIPs in Construction Projects in Gaza Strip: Impacts and Minimization due to the size of the projects implemented by your Organization/Company in the last five years at significance level ($\alpha \leq 0.05$).

By using one-way ANOVA test, the results are demonstrated in table (4.19) which shows that the p-value (Sig.) is more than (0.05) for each criterion, and p-value (Sig.) for all the (Factors causing the Design–construction interface problems in construction projects) criteria equals (0.552), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Factors causing the Design–construction interface problems in construction projects) according to their Size of the projects implemented by your Organization/Company in the last five years and p-value (Sig.) for all the (Impact of the DCIPs) criteria equals (0.576), which is more than (0.05). This means that there are no significant differences in respondents' answers toward applying the (Impact of the DCIPs) according to their Size of the projects implemented by your Organization/Company in the last five years and p-value (Sig.) for all the (Recommended Strategies to minimize the DCIPs) criteria equals (0.591), which is more than (0.05). Therefore, there are not substantial differences in respondents' answers toward applying the (Recommended Strategies to minimize the DCIPs) according to their Size of the projects implemented by your Organization/Company in the last five years.

Table (4.19): One-way ANOVA test for the differences between the answers of the respondents due to their Size of the projects implemented by your Organization/Company in the last five years.

		Sum of Squares	df	Mean Square	F	Sig.
First: consultant related factors	Between Groups	1.891	3	.630	1.760	.157
	Within Groups	64.129	179	.358		
	Total	66.020	182			
Second: Contractor related factors	Between Groups	1.318	3	.439	.963	.412
	Within Groups	81.703	179	.456		
	Total	83.022	182			
Third: Client related factors	Between Groups	1.201	3	.400	1.303	.275
	Within Groups	55.010	179	.307		
	Total	56.211	182			
Fourth: Donor related factors	Between Groups	.708	3	.236	.513	.674
	Within Groups	82.264	179	.460		
	Total	82.972	182			
Fifth: Project-related factors	Between Groups	.098	3	.033	.072	.975
	Within Groups	81.012	179	.453		
	Total	81.110	182			
Factors causing the Design–construction interface problems in construction projects	Between Groups	.473	3	.158	.703	.552
	Within Groups	40.168	179	.224		
	Total	40.641	182			
Impact of the DCIPs	Between Groups	.777	3	.259	.663	.576
	Within Groups	69.902	179	.391		
	Total	70.679	182			
Recommended Strategies to minimize the DCIPs	Between Groups	.603	3	.201	.639	.591
	Within Groups	56.346	179	.315		
	Total	56.949	182			

4.3.5.2 Second hypothesis:

H2. There is a significant effect of the DCIPs in Construction Projects causes, statistically at α ≤ 0.05, on impacts of the DCIPs in Construction Projects in Gaza Strip.

To determine the effect level control requirements (Contractor- related factors, Consultant-related factors, Client-related factors, Donor-related factors, Project-related factors) combined on the (Impact of the DCIPs), the researcher used multiple regression testing using the method of Stepwise and it can be concluded the following:

A. Shows the final regression model using the method of Stepwise that the (Impact of the DCIPs), which represents the dependent variable is affected substantially and statistically significant in all of the variables (Project-related factors, Contractor-related factors, Donor-related factors).

B. It has been excluded the following variable (consultant-related factors**,** Client-related factors).

C. Results of the analysis showed that the Pearson Correlation 0.592, and the coefficient of determination equal to 0.351, and this means that 35.1% of the change in (Impact of the DCIPs) dates back to the effects of the following independent variables (Project-related factors, Contractor-related factors, Donor-related factors) and the remaining 64.9% is due to other factors affecting the dependent variable Impact of the DCIPs.

Table (4.20): Multiple regression analysis for regression coefficients.

Dependent variable	(R) Correlation	(R^2)	F	DF		Sig.	(Unstandardized Coefficients) ß		T.test	Sig.
Impact of the DCIPs	0.592	0.351	32.23	Regression	3	0.000	(Constant)	1.241	4.953	0.000
							Project-related factors	0.275	3.914	0.000
				Residual	179		Contractor related factors	0.246	3.884	0.000
							Donor related factors	3.002	0.000	

An equation effect:

Impact of the DCIPs 1.241+0.275* (Project-related factors) + 0.246 *(Contractor related factors)+ 3.002*(Donor related factors).

If you install the value of (Contractor –related factors, Donor –related factors) and when increasing (Project-related factors) is incremented by one unit leads to increase in the dependent variable (Impact of the DCIPs) by (0.275). If you install the value of (Project-related factors, Donor-related factors) and when increasing (Contractor-related factors) is incremented by one unit leads to increase in the dependent variable (Impact of the DCIPs) by (0.246). If you install the value of (Project-related factors, Contractor-related factors) and when increasing (Donor-related factors) is incremented by one unit leads to increase in the dependent variable (Impact of the DCIPs) by (3.002).

4.3.5.3 Third hypothesis:

H3. There is a significant effect of causes of the DCIPs in Construction Projects causes, statistically at $\alpha \leq 0.05$, on minimization of the DCIPs in Construction Projects in Gaza Strip.

To determine the effect level control requirements (consultant-related factors, Contractor-related factors, Client-related factors, Donor-related factors, Project-related factors) combined on the (minimization of the DCIPs in Construction Projects), the researcher used multiple regression testing using the method of Stepwise and it can be concluded the following:

A. Shows the final regression model using the method of Stepwise that the (minimization of the DCIPs in Construction Projects), which represents the dependent variable is affected substantially and statistically significant in all of the variables (consultant-related factors, Donor-related factors).

B. It have been excluded the following variable (Contractor-related factors**,** Client-related factors, Project-related factors).

C. Results of the analysis showed that the Pearson Correlation 0.404, and the coefficient of determination equal to 0.164, and this means that 16.4% of the change in (Impact of the DCIPs) dates back to the effects of the following independent variables (Project-related factors, Contractor-related factors, Donor-related factors) and the remaining 83.6% is due to other factors affecting the dependent variable minimization of the DCIPs in Construction Projects.

Table (4.21): multiple regression analysis for regression coefficients.

Dependent variable	(R) Correlation	(R^2)	F	DF		Sig.	(Unstandardized Coefficients) ß		T.test	Sig.
minimization of the DCIPs in Construction Projects	0.404	0.164	17.60	Regression	2	**0.000**	(Constant)	2.968	11.156	0.00
							consultant related factors	0.337	3.926	0.000
				Residual	180		Donor related factors	0.161	2.630	0.000

An equation effect:

minimization of the DCIPs in Construction Projects= 2.968+0.337*(consultant-related factors)+0.161 *(Donor-related factors).

If you install the value of (Donor-related factors) and when increasing (consultant-related factors) is incremented by one unit leads to increase in the dependent variable (minimization of the DCIPs in Construction Projects) by (0.337). If you install the value of (consultant-related factors) and when increasing (Donor-related factors) is incremented by one unit leads to increase in the dependent variable (minimization of the DCIPs in Construction Projects) by (0.161).

4.3.5.4 Fourth hypothesis:

H4. There is a significant effect of the impacts of the DCIPs in Construction Projects in Gaza Strip, statistically at $\alpha \leq 0.05$, on minimization of the DCIPs in Construction Projects in Gaza Strip.

To determine the effect level control requirements (impacts of the DCIPs in Construction Projects causes) combined on the (minimization of the DCIPs in Construction Projects), the researcher used simple regression testing using the method of enter as following: results of the analysis showed that the Pearson Correlation 0.324,and the coefficient of determination equal to 0.105, and this means that 10.5% of the change in (Impact of the DCIPs) dates back to the effects of the following independent variable (impacts of the DCIPs in Construction Projects causes) and the remaining 89.5% is due to other factors affecting the dependent variable minimization of the DCIPs in Construction Projects.

Table (4.22): simple regression analysis for regression coefficients.

Dependent variable	(R) Correlation	(R^2)	F	DF		Sig.	(Unstandardized Coefficients) ß		T.test	Sig.
minimization of the DCIPs in Construction Projects	0.324	0.105	21.23	Regression	1	0.000	(Constant)	0.298	12.836	0.000
				Residual	181		impacts of DCIPs in Construction Projects causes	0.291	4.608	0.000

An equation effect:

Minimization of the DCIPs in Construction Projects = 0.298+0.291* (impacts of DCIPs in Construction Projects causes) when increasing (impacts of DCIPs in Construction Projects causes) is incremented by one unit leads to increase in the dependent variable (minimization of the DCIPs in Construction Projects) by (0.291).

4.3.5.5 Fifth hypothesis:

H5. Impact of the DCIPs will significantly mediate the relationship between effects of the DCIPs in Construction Projects causes, on minimization of the DCIPs in Construction Projects in Gaza Strip statistically at $\alpha \leq 0.05$.

Path Analysis was used by Amos Ver.23 supported by the SPSS program to verify the existence of the value of (Chi^2) calculated (22.11), which is significant level ($\alpha \leq$

0.05) and the value of the GFI Goodness of Fit Index, a quality index of value (0.997) is approaching the correct one (fully appropriate), in the same context, The comparative CFI Comparative Fit Index (0.991) approximates the value of the correct one, and the average RMSEA Root Mean Square Error of Approximation (0.08) is near zero.

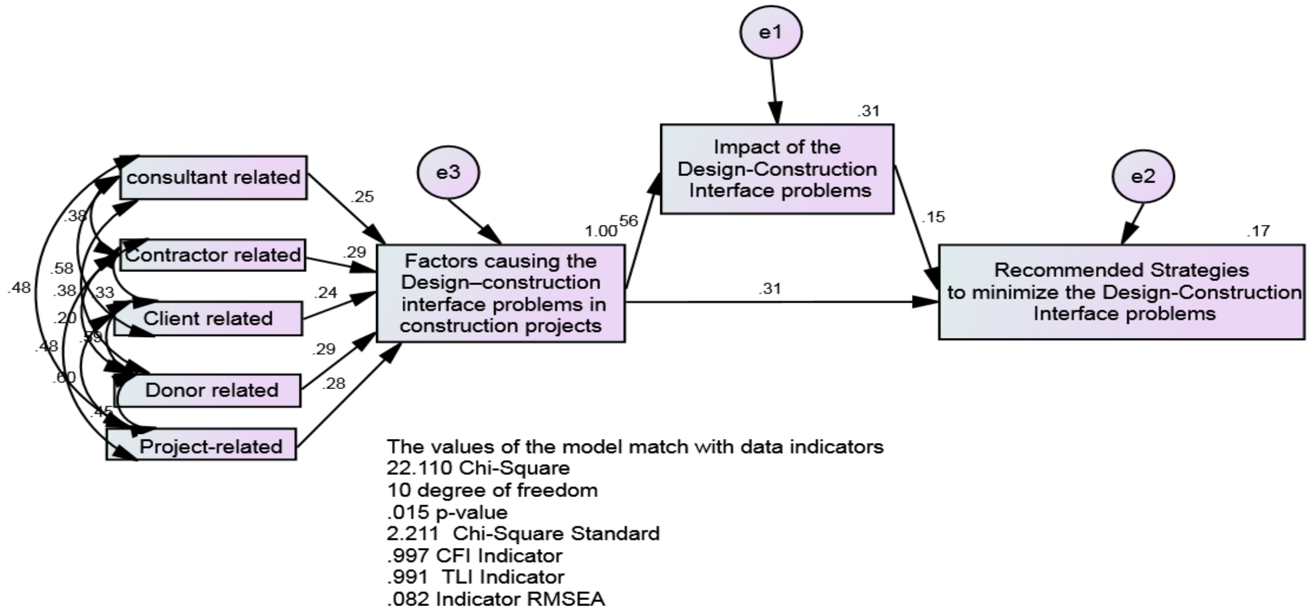

Figure (4.1): Path Analysis.

Table (4.23): Results of path analysis to show direct and indirect impact.

	Chi^2	DF	Sig *	GFI	CFI	RMSEA	Indirect effect	Direct effect			
								path	Direct effect	T .test	Sig*
Impact of the DCIPs will significantly mediate the relationship between effect of the DCIPs in Construction Projects causes, on minimization of the DCIPs in Construction Projects in Gaza Strip statistically at α ≤ 0.05.	22.11	10	0.015	0.997	0.991	0.08	0.368	A ← B	0.736	9.075	.000
								B ← **C**	0.256	2.543	.001

GFI: Goodness of Fit Index must Proximity to one

CFI: Comparative Fit Index must Proximity to one

RMSEA: Root Mean Square Error of Approximation

A= Factors causing the Design–construction interface problems in construction projects

B= Impact of the DCIPs

C= Recommended Strategies to minimize the DCIPs

Chapter 5

Conclusions and Recommendations

Chapter 5

Conclusions and Recommendations

This chapter concludes the study and aims to extract recommendations and conclusions for the DCIPs in Gaza Strip: Impacts and Minimization. The research objectives and key findings were revised, an overview discussed to evaluate the extent to which the research objectives were met.

5.1 Summary of the research:

An investigation into the DCIPs in Gaza Strip, their impact on the building construction projects in Gaza Strip and the recommended strategies to minimize it was conducted. An extensive review of the literature was carried out to achieve the aim of the study. The purpose of the research was to develop a clear understanding of causes and impact of the DCIPs and recommended strategies to minimize it. An interviews with project's managers of specific six building construction projects for obtaining their perceptions relative to the DCIPs in their projects. Besides, the results of 183 collected questionnaires were analyzed quantitatively and then presented by using an "interpretive-descriptive" method for qualitative data analysis. Finally, recommendations for the issue of the DCIPs in the building construction projects in Gaza Strip were drawn.

5.2 Conclusions of the research objectives, questions, and hypotheses:

Three primary objectives have been identified to achieve the aim of the research and made through the findings of the analysed gathered questionnaires. The outcomes were found as follows:

5.2.1 Outcomes related to objective one:

The objective was: To identify causes of the DCIPs in building construction projects in Gaza Strip from the perspective of the local contractors and consultants.

A study findings investigated the causes of DCIPs.

The most important factors according to contractor's interviews in their projects were:

1. Lack of awareness about the availability of construction materials and equipment in the local market.
2. Unavailability of construction materials.
3. Lack of project-stipulated data.
4. Insufficient design duration.
5. Insufficient comprehension of design documents.
6. Financial and technical status of the contractor.
7. Unstable client requirements.
8. Delaying in decision making.

The most occurred important factors according to consultant's point of view in the questionnaire were:

1. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.
2. Political situation impact on fund continuity.
3. Financial and technical status of the contractor.
4. Delaying of dues payments.
5. Inadequate study for the tender document to observe discrepancies before tender awarding.
6. Involvement of subcontractor in several projects at the same time.
7. Time pressure due to unreasonable contract duration.
8. Shortage in flow of information leads to repeated works and variation order.
9. Unavailability of construction materials.
10. Uncooperative managers and poor decision-making.

The most important factors according to contractor's point of view in the questionnaire were:

1. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.
2. Financial and technical status of the contractor.
3. Political situation impact on fund continuity.
4. Inadequate study for the tender document to observe discrepancies before tender awarding.

5. Delaying of dues payments.
6. Unrealistic client expectations regarding project time, cost, and quality.
7. Inappropriate work packaging and subcontracting.
8. Lack of experience-related project nature.
9. gaps in the items description.
10. Shortage in flow of information leads to repeated works and variation order.

5.2.2 Outcomes related to objective two:

The objective was: To identify the impact of the DCIPs on overall project performance.

The most occurred impact of the design-construction interface according to contractor's interviews in their projects were:

1. Quality degradation.
2. Completion schedule delay.
3. Cost overrun.
4. Poor safety conditions.
5. Poor team work performance.

The most occurred impact of the design-construction interface according to consultant's point of view in the questionnaire were:

1. Completion schedule delay.
2. Cost overrun.
3. Quality degradation.
4. Poor team work performance.
5. Poor safety conditions.
6. Project scope control.

The most occurred impact of the design-construction interface according to contractor's point of view in the questionnaire were:

1. Completion schedule delay.
2. Cost overrun.
3. Quality degradation.
4. Poor safety conditions.

5. Project scope control.
6. Poor team work performance.

5.2.3 Outcomes related to objective three:

The objective was: To provide suggestions and recommendations to eliminate the problems at the design construction interface.

The most occurred suggestions and recommendations to eliminate the problems at the DCIPs according to consultant's point of view in the questionnaire were:

1. All involved parties should plan adequately before works start on the site.
2. Quality of services should have a considerable portion of tender's evaluation process.
3. The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable.
4. The client should set their complete requirements in advance before starting the design process.
5. The client should give adequate time for designers.
6. Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts.
7. Clients should pay attention to do their work and perform their responsibilities on time to close the door of rising claims from their side.
8. Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.
9. Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details.

The most occurred suggestions and recommendations to eliminate the problems at the DCIPs according to contractor's point of view in the questionnaire were:

1. All involved parties should plan adequately before works start on the site.
2. Quality of services should have a considerable portion of tender's evaluation process.

3. The client should set their complete requirements in advance before starting the design process.
4. The client should give adequate time for designers.
5. Clients should pay attention to do their work and perform their responsibilities on time to close the door of rising claims from their side.
6. The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable.
7. Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts.
8. Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.
9. Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details.

5.3 Recommendations:

As stated earlier based on the achieved objectives of this research, the recommendations below were drawn because of the study findings discussed in chapter four. The following recommendations are hereby made with the view of reducing the occurrence and mitigating the impact of the DCIPs in the building construction projects in Gaza Strip. The recommendations presented in Table (5.1).

Table (5.1): Recommendation for the DCIPs.

Finding	Recommendation
The study showed that the most important causes of the DCIPs in the building construction projects in Gaza Strip were: 1. Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V. 2. Political situation impact on fund continuity 3. Lack of skilled human resources at the construction site. 4. Delaying of dues payments. 5. Incapability to predict and resolve	1. The good communication – frequent, timely, succinct, high-grade, and reliable for effective interfacing throughout the project lifecycle. 2. Client's should set their complete needs in advance before starting the process of design. However, if variations are inevitable, they should be handled by a controlled process and properly coordinated and retained throughout the project life cycle. 3. An open tendering process, technical evaluation of the tenderer should be done carefully and the decision should be made before evaluating the price. 4. To reduce the chance of rising claims, clients should perform their responsibilities on time. Delaying

Finding	Recommendation
project's problems related to new technological techniques. 6. Frequent changes of subcontractors. 7. Time pressure due to unreasonable contract duration. 8. Shortage inflow of information leads to repeated works and many variation orders 9. Inadequate study for the tender document to observe discrepancies before tender awarding. 10. Delaying in decision making	payments and approvals on completed activities have its bad effect on other parties' performance and will surely lead to conflicts. 5. The coordination process should be improved in design firms among the design team to minimize the possibility of errors from the design and eliminate conflicts. 6. Firms need to provide training programs. Such training programs supply the employees and the company with many benefits whether they are accurately planned and properly executed. In addition, good incentives and salaries, and competitive rates can help in attracting skilled workforce to meet the company requirements.
The study showed that the most important recommended strategies to minimize the DCIPs in the building construction projects in Gaza Strip were: 1. All involved parties should plan adequately before works start on the site. 2. Quality of services should have a considerable portion of tender's evaluation process. 3. The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable. 4. The client should set their complete requirements in advance before starting the design process. 5. The client should give adequate time for designers.	It's recommended concentrating on achieving this recommended strategies to minimize the DCIPs.

5.4 Recommendation for future studies:

1. It is recommended to extend this study to include all of the contracting companies under all classification (first, Second, third, fourth and fifth).

2. Since both contractors and consultants agreed that the most important cause of DCIPs is attributed to the owner, it is worthy to take the owner's opinion in order to respond to their allegations in the context of this study.
3. This study mainly directed towards building construction projects in the Gaza Strip. Here, it is interesting to expand this study to include civil engineering projects, such that a comparison can be done between the results of them both.
4. The survey was conducted in the Gaza Strip in a period where the construction business was deteriorated or even paralyzed, which in turn was reflected in the results of the research. It is recommended to conduct another survey when the construction industry recovers and make a comparative analysis of the results.
5. Since this research was conducted within the area of Gaza Strip, it deserves also to be conducted in West Bank in order to evaluate the differences in perceptions among construction practitioners in both bisects of the country.

References

References

Acharya, N. K., Lee, Y. D., & Kim, J. K. (2006). Conflicting factors in Korean construction industry. *Korean journal of construction engineering and management*, *7*(2), 171-180.

Al-Hammad, A. (1990). A study of the interface problems between owners and contractors over the construction of residential houses in Saudi Arabia. *Housing Science*, *14*(4), 245-257.

Al-Hammad, A. M. (1995). Interface problems between owners and maintenance contractors in Saudi Arabia. *Journal of performance of constructed facilities*, *9*(3), 194-205.

Al-Hammad, A. M. (2000). Common interface problems among various construction parties. *Journal of Performance of Constructed Facilities*, *14*(2), 71-74.

Al-Hammad, A. M., & Al-Hammad, I. (1996). Interface problems between building owners and designers. *Journal of Performance of constructed Facilities*, *10*(3), 123-126.

Al-Hammad, A., & Assaf, S. (1992). Design—Construction interface problems in Saudi Arabia: Survey showed that working drawing details, unfamiliarity with local conditions and buildability ranked as highest interface problems. *Building research and information*, *20*(1), 60-63.

Al-Mansouri, O. (1988). *The relationship between the designer and contractor in Saudi Arabia.* (Unpublished P.h.D Thesis), University of Reading.

Al-Hammad, A. (1993). Factors affecting the relationship between contractors and their sub-contractors in Saudi Arabia: About 70% of contract work is subcontracted in Saudi Arabia, this paper highlights literature search and pilot interview findings. *Building Research and Information*, *21*(5), 269-273.

AL Mousli, M. H., & El-Sayegh, S. M. (2016). Assessment of the design–construction interface problems in the UAE. *Architectural Engineering and Design Management*, *12*(5), 353-366.

Alarcón, L. F., & Mardones, D. A. (1998, August). Improving the design-construction interface. In *Proceedings of the 6th Annual Meeting of the International Group for Lean Construction*.

Alimrani, N. S. (2015). Donors ´ influence in the quality of construction projects in Gaza Strip from a beneficiary perspective .

AL Mousli, M. H., & El-Sayegh, S. M. (2016). Assessment of the design–construction interface problems in the UAE. *Architectural Engineering and Design Management*, *12*(5), 353-366

Anees, M. M., Mohamed, H. E., & Razek, M. E. A. (2013). Evaluation of change management efficiency of construction contractors. *HBRC Journal*, *9*(1), 77-85.

Arain, F. M. (2002). Design-Construction Interface Dissonances. (Unpublished MS Thesis). King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia.

Arain, F. M., & Assaf, S. A. (2007). Consultant's Prospects of the Sources of Design and Construction Interface Problems in Large Building Projects in Saudi Arabia. *JKAU: Environmental Design Sciences*, *5*(2), 15-37.

Arain, F. M., Pheng, L. S., & Assaf, S. A. (2006). Contractors' views of the potential causes of inconsistencies between design and construction in Saudi Arabia. *Journal of performance of constructed facilities*, *20*(1), 74-83

Asamaoh, R. O., & Offei-Nyako, K. (2013). Variation Determinants in Building Construction: Ghanaian Professionals Perspective. *Journal of Construction Engineering and Project Management*, *3*(4), 20-25

Ashworth, A. (2014). *Civil engineering contractual procedures.* Routledge.

Assaf, S. A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. *International journal of project management*, *24*(4), 349-357

Berends, T. C. (2000). Cost plus incentive fee contracting—experiences and structuring. *International Journal of Project Management*, *18*(3), 165-171.

Bin-Ali, A. Z. (2008). Causes and Steps to Minimize Variations in Construction Projects. *(Unpublished Master Thesis), University Technology Malaysia*.

Brown, T. A., & Moore, M. T. (2014). Confirmatory Factor Analysis, (May).

Carmona, M. (2010). *Public places, urban spaces: the dimensions of urban design*. Routledge.

Chang, A. S., Shen, F. Y., & Ibbs, W. (2010). Design and construction coordination problems and planning for design–build project new users. *Canadian journal of civil engineering*, *37*(12), 1525-1534.

Chen, Q., Reichard, G., & Beliveau, Y. (2008). Multiperspective approach to exploring comprehensive cause factors for interface issues. *Journal of Construction Engineering and Management*, *134*(6), 432-441.

Creative Research Systems. (2016). *Creative Research Systems*., Retrived: 13 12 2017, from: https://www.surveysystem.com/sample-size-formula.htm

Crumrine, T. W., Nelson, R. N., Cordeiro, C. M. P., Loudermilk, M. D., & Malbrel, C. A. (2005, January). Interface management for subsea sand-control-completion systems. In *SPE Latin American and Caribbean Petroleum Engineering Conference*. Society of Petroleum Engineers.

Davis, R. P., Love, P., & Baccarini, D. (2008). Building procurement methods.

Design Build Institution of America. (2015). C*hoosing a Project Delivery Method*. A Design-Build Done Right Primer, (April), 2–3.

Dmaidi, N., Dwaikat, M., & Shweiki, I. (2013). Construction contracting management obstacles in Palestine. *International Journal of Construction Engineering and Management*, *2*(1), 15-22.

Donold, R. M. (2013). *Causes, Effects and Possible Solutions of Variation Order in*

Project Performance. (Unpublished P.h.D Thesis), UMP.

Eigbe, S. (2016). Empirical Study of the Origins and Causes of Variation Orders in Building Projects. *International Journal of Engineering Research and Applications*, *6*(10), 34-48.

El-namrouty, K. A. (2012). The Impact of Construction Sector on Palestinian Economy-Case Study:(Gaza Strip). *American Academic & Scholarly Research Journal*, *4*(5), 1.

Enshassi, A., Arain, F., & Al-Raee, S. (2010). Causes of variation orders in construction projects in the Gaza Strip. *Journal of Civil Engineering and Management*, *16*(4), 540-551.

Enshassi, A., Arain, F., & Tayeh, B. (2012). Major causes of problems between contractors and subcontractors in the Gaza Strip. *Journal of Financial Management of Property and Construction*, *17*(1), 92-112

Field, A. (2009). *Discovering statistics using SPSS*. Sage publications.

Harrington, D. (2009). *Confirmatory factor analysis*. Oxford University Press.

Huang, R. Y., Huang, C. T., Lin, H., & Ku, W. H. (2008). Factor analysis of interface problems among construction parties-A case study of MRT. *Journal of Marine Science and Technology*, *16*(1), 52-63

Ibbs, C. W., Kwak, Y. H., Ng, T., & Odabasi, A. M. (2003). Project delivery systems and project change: Quantitative analysis. *Journal of Construction Engineering and Management*, *129*(4), 382-387

Ismail, I., Abdul Rahman, I., & Memon, A. H. (2013). Study of factors causing time and cost overrun throughout life cycle of construction project.

Jabar, I. L., Ismail, F., & Mustafa, A. A. (2013). Issues in managing construction phase of IBS projects. *Procedia-Social and Behavioral Sciences*, *101*, 81-89.

Ku, H. K., Lin, J. D., Huang, C. T., & Shiu, R. H. (2010, October). Development interface knowledge management system for the Mass Rapid Transit system construction. In *Supply Chain Management and Information Systems (SCMIS), 2010 8th International Conference on* (pp. 1-6). IEEE.

Ku, W. H. (2000). *A Study of Establishing Lessons-Learned Database for Contractor* (Unpublished P.h.D Thesis), National Taiwan University.

Kumar, R. (2014). *Research methodology: A step-by-step guide for beginners*. Sage.

Larson, E. W., & Gray, C. (2013). *Project Management: The Managerial Process with MS Project*. McGraw-Hill.

Lin, Y. C. (2015). Use of BIM approach to enhance construction interface management: a case study. *Journal of Civil Engineering and Management*, *21*(2), 201-217.

Lin, C. L., & Jeng, C. H. (2017). Exploring Interface Problems in Taiwan's Construction Projects Using Structural Equation Modeling. *Sustainability*, *9*(5), 822

Longhurst, R. (2009). *Interviews: in-depth and semi-structured. International Encyclopaedia of Human Geography*. Elsevier, Oxford.

Love, P. E. (2002). Influence of project type and procurement method on rework costs in building construction projects. *Journal of construction engineering and management*, *128*(1), 18-29.

Mahamid, I. (2011). Analysis of cost deviations in road construction activities: A case study from Palestine. *Jordan Journal of Civil Engineering*, *5*(4), 552-567

Mahdi, I. M., & Alreshaid, K. (2005). Decision support system for selecting the proper project delivery method using analytical hierarchy process (AHP). *International Journal of Project Management*, *23*(7), 564-572

Mbamali, I., & Okotie, A. (2012). An assessment of the threats and opportunities of globalization on building practice in Nigeria.

McCarthy, T. J., Kahn, H. J., Elhag, T. M. S., Williams, A. R., Milburn, R., & Patel, M. B. (2000). Knowledge management in the designer/constructor interface. In *Computing in Civil and Building Engineering (2000)* (pp. 836-843).

Mendelsohn, R. (1997). The Constructibility Review Process: A Constructor's Perspective. *Journal of Management in Engineering*, *13*(3), 17-19.

Mitchell, A., Frame, I., Coday, A., & Hoxley, M. (2011). A conceptual framework of the interface between the design and construction processes. *Engineering, Construction and Architectural Management*, *18*(3), 297-311

Mitchell, A., Frame, I., Coday, A., & Hoxley, M. (2011). A conceptual framework of the interface between the design and construction processes. *Engineering, Construction and Architectural Management*, *18*(3), 297-311

Mohammad, N., Ani, A. C., Rakmat, R. A. O. K., & Yusof, M. A. (2010). Investigation on the causes of variation orders in the construction of building project–a study in the state of Selangor, Malaysia. *Journal of Building Performance*, *1*(1)

Mortaheb, M. M., & Rahimi, M. (2010, October). Interface management in mega oil refinery projects. In *6th International Project Management Conference. Tehran, Iran* (pp. 26-27).

Naoum, S. G. (2012). *Dissertation research and writing for construction students*. Routledge

Navon, R. (2005). Automated project performance control of construction projects. *Automation in construction*, *14*(4), 467-476

Ndihokubwayo, R. (2008). *An analysis of the impact of variation orders on project performance* (Doctoral dissertation, Cape Peninsula University of Technology)

O'Connor, J. T., Torres, N., & Woo, J. (2016). Sustainability actions during the construction phase. *Journal of Construction Engineering and Management*, *142*(7).

Pallant, J. (2013). *SPSS survival manual*. McGraw-Hill Education (UK).

Pavitt, T. C., & Gibb, A. G. F. (2003). Interface management within construction: In particular, building façade. *Journal of Construction Engineering and Management*, *129*(1), 8-15.

PCBS (2017). Palestine in Numbers 2013. Issued by the Palestinian Central Bureau of Statistics, PCBS. Website (http://www.pcbs.gov.ps/).

Polit, D. F., & Hungler, B. P. (1985). *Essentials of nursing research: Methods and applications*. Lippincott Williams & Wilkins.

Rojas, E. M., & Kell, I. (2008). Comparative analysis of project delivery systems cost performance in Pacific Northwest public schools. *Journal of Construction Engineering and Management*, *134*(6), 387-397.

Saad, A., & Engineers, M. C. (2011). Factors Impacting The Project's Life Cycle. *Retrieved from g-casa. com*.

Sarsour, S., Naser, R., & Atallah, M. (2011). The Economic And Social Effects Of Foreign Aid In Palestine, *35*(4), 28–43.

Sha'ar, K. Z., Assaf, S. A., Bambang, T., Babsail, M., & Fattah, A. M. A. El. (2016). Design–construction interface problems in large building construction projects. *International Journal of Construction Management*, *3599*(June), 1–13.

Shokri, S., Ahn, S., Czerniawski, T., Haas, C. T., & Lee, S. H. (2014). Current state of interface management in mega-construction projects. In *Construction Research Congress 2014: Construction in a Global Network* (pp. 2266-2275).

Shokri, S., Haas, C. T., G. Haas, R. C., & Lee, S. H. (2015). Interface-management process for managing risks in complex capital projects. *Journal of Construction Engineering and Management*, *142*(2)

Smith, A. M. (2012). Research methodology: A step-by-step guide for beginners. *Nurse Education in Practice*, *12*(3), 25.

Sugumaran, B., & Lavanya, M. (2013). Evaluation of design construction interface in construction industry. *International Journal of Engineering Research & Technology*, *2*(1), 1-14.

Sweeney, N. J. (1998). FEATURE: Who Pays for Defective Design?. *Journal of Management in Engineering*, *14*(6), 65-68

Tansey, O. (2007). Process tracing and elite interviewing: a case for non-probability sampling. *PS: Political Science & Politics*, *40*(4), 765-772

Tayeh, B. A., Al Hallaq, K., & Sabha, F. A. (2016). Effects of Faulty Design Phase on School Buildings Maintenance in Gaza Strip. *American Journal of Civil Engineering and Architecture*, *4*(6), 199-210.

Vanegas, J. A., & Op den Bosch, A. (1994, December). Using simulation and visualization technologies to strengthen the design/construction interface. In *Proceedings of the 26th conference on Winter simulation* (pp. 1137-1144). Society for Computer Simulation International

Wang, T., Tang, W., Qi, D., Shen, W., & Huang, M. (2015). Enhancing design management by partnering in delivery of international EPC projects: Evidence from Chinese construction companies. *Journal of Construction Engineering* *and Management*, *142*(4)

Wang, Y. (2000). Coordination issues in Chinese large building projects. *Journal of Management in Engineering*, *16*(6), 54-61

Weshah, N., Ghandour, W. E., Jergeas, G., & Falls, L. C. (2013). Factor analysis of the interface management (IM) problems for construction projects in Alberta. *Canadian Journal of Civil Engineering*, *40*(9)

Wideman, R. M. (2002). Wideman comparative glossary of project management terms v3. 1. *Max's project management wisdom*.

Yun, S., Mulva, S. P., & O'Brien, W. J. (2012). A quantitative approach for measuring managerial interfaces in the development of a capital project. In *Construction Research Congress 2012: Construction Challenges in a Flat World* (pp. 1410-1419)

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2013). *Business research methods*. Cengage Learning

Appendix

Appendix A:

Islamic University of Gaza
Dean of Graduate Studies
College of Engineering - Master's program
Engineering project management

Questionnaire about

Design-Construction Interface Problems in Construction Projects in Gaza Strip: Impacts and Minimization

To start, I would like to present my appreciation and thanks to you for taking part of your time and effort to complete this questionnaire, which considered as a basic requirement for the completion of my research in order to award the master of science degree in engineering project management at Islamic university of Gaza.

This questionnaire aims to study the Design-Construction Interface Problems (DCIPs) in construction projects in Gaza Strip and their impact on overall project performance and provide suggestions and recommendations to eliminate the problems.

Please kindly we request your assistance in mobilizing the required data with level of accuracy and honesty as usual in your work, knowing that all responses and facts will remain fully confidential, and will be used for the research purposes only.

All appreciations and thanks for your contribution to support scientific research.

Researcher:
Mohammed Nassar

Supervisor:
Dr. Bassam Tayeh

Please tick √ versus the convenient option for you.

Section 1: General Information

1. Type of your Organization/Company:		
☐Consulting	☐Contractor 1st building classification	☐Contractor 2nd building classification

2. Position in the organization/company:	
☐ Organization manager/Deputy	☐ Project manager/Deputy
☐ Site/Office engineer	☐ Others (Please Specify)……..…
3. Years of experience for respondent:	
☐ Less than 5 years	☐ From 5 years to less than 10 years
☐ From 10 years to less than 15 years	☐ 15 years and Over
4. Years of experience for Organization/Company:	
☐ Less than 5 years	☐ From 5 years to less than 10 years
☐ From 10 years to less than 15 years	☐ 15 years and Over
5. Size of the projects implemented by your Organization/Company in the last five years:	
☐ Less than $1 million	☐ From $1 to less than $5 million
☐ From $5 to less than $10 million	☐ $10 million and more

Section 2: Factors causing the DCIPs in construction projects in Gaza strip

6. From your point of view, Please indicate the degree of occurrence that lead to the presence of Design–construction interface problems.

No.	**Factors**	**Occurrence**				
		Never	**Seldom**	**Sometimes**	**Often**	**Always**
	First: consultant related factors					
1	Lack of project-stipulated data.	1	2	3	4	5
2	Lack of skilled and experienced human resources in the design firms.	1	2	3	4	5
3	Lack of proper coordination between various disciplines of design team.	1	2	3	4	5
4	Lack of awareness about the construction knowledge and ongoing site operations.	1	2	3	4	5
5	Lack of awareness about the availability of construction materials and equipment in the local market.	1	2	3	4	5
6	Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.	1	2	3	4	5
7	Inaccurate estimation of project element costs and quantities.	1	2	3	4	5
8	Mistakes and discrepancies in design documents.	1	2	3	4	5
9	Gaps in the items description	1	2	3	4	5
10	Lack of design quality assurance practices.	1	2	3	4	5
11	Insufficient design duration	1	2	3	4	5
	Second: Contractor related factors					
1	Insufficient comprehension of design documents.	1	2	3	4	5
2	Lack of skilled human resources at the construction site.	1	2	3	4	5
3	Unavailability of construction materials	1	2	3	4	5
4	Inadequate study for tender document to observe discrepancies before tender awarding.	1	2	3	4	5
5	Incapability to predict and resolve project's problems related to new technological	1	2	3	4	5

No.	Factors	Occurrence				
		Never	Seldom	Sometimes	Often	Always
	techniques.					
6	Inaccurate estimation of construction costs.	1	2	3	4	5
7	Construction errors and defective work at the construction site.	1	2	3	4	5
8	Failure of construction equipment.	1	2	3	4	5
9	Involvement of subcontractor in several projects at the same time.	1	2	3	4	5
10	Frequent changes of subcontractors.	1	2	3	4	5
11	Financial and technical status of the contractor	1	2	3	4	5
	Third: Client related factors					
1	Unstable client requirements.	1	2	3	4	5
2	Unrealistic client expectations regarding project time, cost and quality	1	2	3	4	5
3	Outsourcing of design services.	1	2	3	4	5
4	Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.	1	2	3	4	5
5	Restricting the contractor classification and a specific experience for the subcontractors in the contract form by the client.	1	2	3	4	5
6	Unclear definition for scope of work.	1	2	3	4	5
7	Inappropriate work packaging and subcontracting.	1	2	3	4	5
8	Poorly written contract with insufficient detail.	1	2	3	4	5
9	Delaying in decision making	1	2	3	4	5
10	Delaying of dues payments.	1	2	3	4	5
11	Inappropriate choice of project contract type (unit price, lump sum, etc.).	1	2	3	4	5
12	Interference of client during implementation	1	2	3	4	5
13	Inappropriate choice of project delivery system (design-build, design-bid-build, etc.).	1	2	3	4	5
14	The designer work as a project supervisor	1	2	3	4	5
	Fourth: Donor related factors					
1	Financial capability of donor.	1	2	3	4	5
2	Budget allocated constraints.	1	2	3	4	5
3	Time constraints.	1	2	3	4	5
4	Interference of donor in project requirements.	1	2	3	4	5
5	Insufficient donor experience in implementing projects according to local conditions	1	2	3	4	5
6	Political situation impact on fund continuity	1	2	3	4	5
	Fifth: Project-related factors					
1	Poor project organizational structure.	1	2	3	4	5
2	Uncooperative managers and poor decision-making.	1	2	3	4	5
3	Shortage in flow of information lead to repeated works and variation order	1	2	3	4	5
4	Lack of communication and coordination between various project teams.	1	2	3	4	5
5	Design complexity.	1	2	3	4	5
6	Lack of experience-related project nature.	1	2	3	4	5
7	Slow in Shop drawings' submission and approval.	1	2	3	4	5
8	Time pressure due to unreasonable contract duration.	1	2	3	4	5
9	Long period between time of bidding and awarding.	1	2	3	4	5

Section 3: Impact of the DCIPs

7. From your point of view, select the degree of influence of the DCIPs on overall project performance.

No.	Factors	Influence				
		Never	Seldom	Sometimes	Often	Always
1	Project scope control	1	2	3	4	5
2	Quality degradation	1	2	3	4	5
3	Completion schedule delay	1	2	3	4	5
4	Cost overrun	1	2	3	4	5
5	Poor safety conditions	1	2	3	4	5
6	Poor team work performance	1	2	3	4	5

Section 4: Recommended Strategies to minimize the DCIPs

8. To which extent do you agree with the following recommendations?

No.	Recommended Strategies to minimize the DCIPs	Un important	Less important	Important	Very important	Very High important
1	All involved parties should plan adequately before works start on the site.					
2	Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details					
3	Client should set their complete requirements in advance before starting the design process.					
4	Client should give adequate time for designers.					
5	Quality of services should have a considerable portion of tender's evaluation process.					
6	The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable.					
7	Clients should pay attention to do their work and perform their responsibilities on time to close the door of rising claims from their side.					
8	Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts.					
9	Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.					

9. Do you have any further comments or suggestions relative to the DCIPs

…………………………………………………………………………………………
…………………………………………………………………………………………
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Appendix B:

الجامعة الإسلامية – غزة
عمادة الدراسات العليا
كلية الهندسة – برنامج الماجستير
إدارة المشروعات الهندسية

استبانة حول:

المشاكل التي تواجه المشاريع الإنشائية في مرحلتي التصميم والتنفيذ في قطاع غزة: آثارها والحد منها

بداية أتقدم لكم بالشكر والامتنان على إعطاء جزء من وقتكم الثمين لتعبئة هذه الاستبانة التي تعد جزءاً أساسياً من الدراسة البحثية المطلوبة لنيل درجة الماجستير في إدارة المشروعات الهندسية بالجامعة الإسلامية.

تهدف هذه الدراسة إلى دراسة تأثير المشاكل التي تواجه مرحلتي التصميم والتنفيذ على المشاريع الانشائية في قطاع غزة ووضع الاستراتيجيات اللازمة للحد منها.

يرجى التكرم بالمساعدة في تعبئة البيانات المطلوبة بمستوى الدقة والأمانة المعهودة في عملكم مع العلم أنه سيتم استخدام البيانات التي ستجمع لأغراض البحث العلمي فقط.

<u>ولكم كل الشكر والتقدير على مساهمتكم في دعم البحث العلمي</u>

الباحث:

محمد رسمي نصار

إشراف:

د. بسام تايه

يرجى وضع علامة √ مقابل الخيار الذي ترونه مناسباً.

القسم الأول: معلومات عامة

1. نوع المؤسسة / الشركة:		
☐ استشاري	☐ مقاول درجة أولى أبنية	☐ مقاول درجة ثانية أبنية
2. المسمى الوظيفي:		
☐ مدير المؤسسة / نائب	☐ مدير المشروع / نائب	
☐ مهندس موقع/ مكتب	☐ أخرى (يرجى التحديد)	
3. سنوات الخبرة لمعبئ الاستبانة		
☐ أقل من 5 سنوات	☐ من 5 إلى أقل من 10 سنوات	
☐ من 10 إلى أقل من 15 سنة	☐ 15 سنة فأكثر	
4. سنوات الخبرة للمؤسسة/ للشركة		
☐ أقل من 5 سنوات	☐ من 5 إلى أقل من 10 سنوات	
☐ من 10 إلى أقل من 15 سنة	☐ 15 سنة فأكثر	
5. حجم المشاريع التي قمت قامت شركتكم \ مؤسستكم بإدارتها في السنوات الخمس الماضية:		
☐ أقل من مليون دولار	☐ من 1 إلى أقل من 5 ملايين دولار	
☐ من 5 إلى أقل من 10 ملايين دولار	☐ 10 ملايين دولار فأكثر	

القسم الثاني: العوامل التي تؤدي إلى وجود مشاكل تواجه مرحلتي التصميم والتنفيذ للمشروع الإنشائي في قطاع غزة

6. من وجهة نظرك، يرجى بيان درجة حدوث المشاكل في مرحلتي التصميم والتنفيذ للمشروع الإنشائي في قطاع غزة وفق العوامل المختلفة

الرقم	العوامل	درجة الحدوث				
		مطلقاً	نادراً	أحياناً	غالباً	دائماً
	أولاَ: العوامل المتعلقة بالإستشاري					
1	نقص المعلومات الخاصة بالمشروع.	1	2	3	4	5
2	نقص الخبرة والمهارة لدي العاملين في مكاتب التصميم.	1	2	3	4	5
3	نقص التنسيق السليم بين التخصصات المتعددة في فريق التصميم.	1	2	3	4	5
4	نقص المعرفة في عمليات الانشاء والأنشطة التي تنفذ بالموقع.	1	2	3	4	5
5	نقص المعرفة في توفر مواد الانشاء والمعدات في السوق المحلية.	1	2	3	4	5
6	نقص المعرفة في اللوائح الحكومية ومتطلبات البلديات.	1	2	3	4	5
7	التقدير غير الدقيق لتكلفة عناصر المشروع وكمياته.	1	2	3	4	5
8	الاخطاء والتناقضات في وثائق العطاء	1	2	3	4	5
9	وجود ثغرات في وصف الأعمال	1	2	3	4	5
10	عدم وجود اليات لضمان جودة التصميم.	1	2	3	4	5
11	الوقت المخصص لمرحلة التصميم غير كافي	1	2	3	4	5
	ثانياً: العوامل المتعلقة بالمقاول					
1	الفهم غير الكافي لوثائق التصميم	1	2	3	4	5
2	نقص الموارد البشرية الماهرة في موقع العمل	1	2	3	4	5
3	عدم توفر المواد الإنشائية	1	2	3	4	5
4	عدم دراسة وثائق العطاء بشكل كافي للاطلاع على المتناقضات وطرحها قبل الترسية	1	2	3	4	5

الرقم	العوامل	درجة الحدوث				
		مطلقاً	نادراً	أحياناً	غالباً	دائماً
5	عدم القدرة على التنبؤ وحل مشاكل المشروع المتعلقة بالتقنيات التكنولوجية الجديدة.	1	2	3	4	5
6	التقدير غير الدقيق لتكلفة المشروع	1	2	3	4	5
7	وجود أخطاء في التنفيذ	1	2	3	4	5
8	استخدام معدات انشاء غير مؤهلة.	1	2	3	4	5
9	اشراك مقاول الباطن في عدة مشاريع في نفس الوقت.	1	2	3	4	5
10	التغير المتعدد لمقاولي الباطن	1	2	3	4	5
11	الوضع المالي والفني للمقاول	1	2	3	4	5
	ثالثاً: العوامل المتعلقة بالمالك					
1	متطلبات المالك غير ثابتة	1	2	3	4	5
2	التوقعات غير الواقعية من قبل المالك بالنسبة للوقت والتكلفة والجودة.	1	2	3	4	5
3	الاستعانة بمكاتب استشارية غير محلية لخدمات التصميم.	1	2	3	4	5
4	ترسية العطاء علي اقل الاسعار دون اعتبار تقييم المقاول وسابقة الأعمال.	1	2	3	4	5
5	تحديد درجة تصنيف المقاول من قبل المالك واشتراط خبرة معينة لمقاولي الباطن في صيغة العقد.	1	2	3	4	5
6	عدم وجود تعريف واضح للعمل وهدفه.	1	2	3	4	5
7	الاختيار غير المناسب لمنفذي الاعمال ومقاولي الباطن.	1	2	3	4	5
8	كتابة العقد بشكل سيئ مع شروط وقيود غير كافية	1	2	3	4	5
9	التأخير في اتخاذ القرارات	1	2	3	4	5
10	التأخير في الدفعات المستحقة.	1	2	3	4	5
11	الاختيار غير المناسب لنوع عقد المشروع (unit price, lump sum, etc.)	1	2	3	4	5
12	تدخل المالك أثناء التنفيذ	1	2	3	4	5
13	الاختيار غير المناسب لنظام تسليم المشروع (design-build, design-bid-build, etc.)	1	2	3	4	5
14	عمل المصمم كمشرف للمشروع	1	2	3	4	5
	رابعاً: العوامل المتعلقة بالممول					
1	القدرة المالية لممول المشروع.	1	2	3	4	5
2	قيود على استخدام الموازنة حسب الاتفاق الموقع.	1	2	3	4	5
3	قيود على مدة المنحة.	1	2	3	4	5
4	تدخل الممول في متطلبات المشروع أثناء التنفيذ	1	2	3	4	5
5	عدم وجود خبرة كافية للممول في تنفيذ المشاريع وفقاً للظروف المحلية	1	2	3	4	5
6	تأثير العوامل السياسية على استمرارية الدعم	1	2	3	4	5
	خامساً: العوامل المتعلقة بتنفيذ المشروع					
1	ضعف الهيكل التنظيمي للمشروع.	1	2	3	4	5
2	عدم تعاون المدراء والبطء في اتخاذ القرارات.	1	2	3	4	5
3	Shortage in flow of information lead to repeated works and variation orders	1	2	3	4	5
4	نقص التواصل والتنسيق بين فريق العمل.	1	2	3	4	5
5	درجة تعقيد المشروع.	1	2	3	4	5
6	نقص الخبرة المتعلقة بطبيعة المشروع	1	2	3	4	5

الرقم	العوامل	درجة الحدوث				
		مطلقاً	نادراً	أحياناً	غالباً	دائماً
7	البطء في تقديم المخططات التنفيذية والاعتمادات	1	2	3	4	5
8	ضغط العمل مع مدة عقد غير كافية.	1	2	3	4	5
9	طول الفترة الزمنية بين طرح العطاء والترسية	1	2	3	4	5

القسم الثالث: آثار المشاكل التي تواجه مرحلتي التصميم والتنفيذ للمشروع الإنشائي

7. من وجهة نظرك حدد درجة تأثير العوامل التالية على المشروع، والتي قد تنشأ نتيجة المشاكل التي تواجه مرحلتي التصميم والتنفيذ للمشروع الإنشائي في قطاع غزة

الرقم	العامل	درجة التأثير				
		مطلقاً	نادراً	أحياناً	غالباً	دائماً
1	ضبط أهداف المشروع. Project scope control	1	2	3	4	5
2	تدهور جودة العمل. Quality degradation	1	2	3	4	5
3	تأخر تسليم المشروع. Completion schedule delay	1	2	3	4	5
4	زيادة تكلفة المشروع. Cost overrun	1	2	3	4	5
5	ضعف اعتبارات السلامة والأمان في الموقع. Poor safety conditions	1	2	3	4	5
6	سوء أداء فريق العمل. Poor team work performance	1	2	3	4	5

القسم الرابع: استراتيجيات وتوصيات لتقليل المشاكل تواجه مرحلتي التصميم والتنفيذ للمشروع الإنشائي

8. إلى أي مدى تتفق مع الاستراتيجيات والتوصيات الآتية لتقليل المشاكل التي تواجه مرحلتي التصميم والتنفيذ **للمشروع الإنشائي**

الرقم	الاستراتيجيات والتوصيات لتقليل المشاكل تواجه مرحلتي التصميم والتنفيذ	غير مهمة	أقل أهمية	مهمة	مهمة بشكل كبير	مهمة بشكل كبير جدا
1	يجب على جميع الأطراف المعنية التخطيط بشكل كاف قبل بدء العمل في الموقع.					
2	إشراك المقاولين لتقديم آرائهم في مرحلة التصميم ليس فقط لتحسين التصميم ولكن أيضا لتوفير فرصة للتغلب على التناقضات في تفاصيل الرسومات					
3	يجب على المالك وضع متطلباته الكاملة قبل بدء عملية التصميم.					
4	يجب على المالك إعطاء الوقت الكافي للتصميم.					
5	يجب أن تكون جودة العمل جزءا كبيرا من عملية تقييم العطاء					
6	التواصل الفعال بين الاستشاري والمقاول طوال فترة المشروع بشكل متكرر وفي الوقت					
7	يجب على المالك الانتباه إلى القيام بعمله وأداء مسؤولياته في الوقت المناسب لإغلاق باب المطالبات claims.					
8	ينبغي لشركات التصميم تحسين عملية التنسيق بين فريق التصميم للحد من إمكانية حدوث أخطاء في التصميم وتقليل النزاعات.					
9	توفير برامج تدريبية للتعامل مع نقص الموارد البشرية الماهرة والخبرة، سواء في شركات التصميم أو مواقع البناء.					

9. هل يوجد لديكم أي تعليقات أو اقتراحات بخصوص المشاكل تواجه مرحلتي التصميم والتنفيذ للمشروع الإنشائي؟

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Appendix C: Correlation coefficient

Table (C1): Internal validity for causes DCIPs

No	Paragraph	Pearson Correlation coefficient	P-value
First: consultant related factors			
1	Lack of project-stipulated data.	0.424*	0.006
2	Lack of skilled and experienced human resources in the design firms.	0.709*	0.000
3	Lack of proper coordination between various disciplines of design team.	0.717*	0.000
4	Lack of awareness about the construction knowledge and ongoing site operations.	0.667*	0.000
5	Lack of awareness about the availability of construction materials and equipment in the local market.	0.536*	0.000
6	Lack of awareness about governmental regulations, municipality requirements, statutes and their modifications.	0.567*	0.000
7	Inaccurate estimation of project element costs and quantities.	0.717*	0.000
8	Mistakes and discrepancies in design documents.	0.717*	0.000
9	gaps in the items description	0.721*	0.000
10	Lack of design quality assurance practices.	0.598*	0.000
11	gaps in the items description	0.599*	0.000
Second: Contractor related factors			
1	Insufficient comprehension of design documents.	0.434*	0.005
2	Lack of skilled human resources at the construction site.	0.595*	0.000
3	Unavailability of construction materials	0.566*	0.000
4	Inadequate study for tender document to Observe discrepancies before tender awarding.	0.769*	0.000
5	Incapability to predict and resolve project's problems related to new technological techniques.	0.665*	0.000
6	Inaccurate estimation of construction costs.	0.622*	0.000
7	Construction errors and defective work at the construction site.	0.756*	0.000
8	Failure of construction equipment.	0.610*	0.000
9	Involvement of subcontractor in several projects at the same time.	0.723*	0.000
10	Frequent changes of subcontractors.	0.656*	0.000
11	Financial and technical status of the contractor	0.770*	0.000
Third: Client related factors			
1	Unstable client requirements.	0.618*	0.000
2	Unrealistic client expectations regarding project time, cost and quality	0.683*	0.000

3	Outsourcing of design services.	0.636*	0.000
4	Awarding contract to the lowest price regardless of the contractor technical evaluation and C.V.	0.688*	0.000
5	Restricting the contractor classification and a specific experience for the subcontractors in the contract formby the client.	0.484*	0.000
6	Unclear definition for scope of work.	0.616*	0.000
7	Inappropriate work packaging and subcontracting.	0.631*	0.000
8	Poorly written contract with insufficient detail.	0.704*	0.000
9	Delaying in decision making	0.680*	0.000
10	Delaying of dues payments.	0.749*	0.000
11	Inappropriate choice of project contract type (unit price, lump sum, etc.).	0.642*	0.000
12	Interference of client during implementation	0.636*	0.000
13	Inappropriate choice of project delivery system (design-build, design-bid-build, etc.).	0.629*	0.000
14	The designer work as a project supervisor	0.638*	0.000
Fourth: Donor related factors			
1	Financial capability of donor.	0.831*	0.000
2	Budget allocated constraints.	0.648*	0.000
3	Time constraints.	0.685*	0.000
4	Interference of donor in project requirements.	0.785*	0.000
5	Insufficient donor experience in implementing projects according to local conditions	0.684*	0.000
6	Political situation impact on fund continuity	0.592*	0.000
Fifth: Project-related factors			
1	Poor project organizational structure.	0.662*	0.000
2	Uncooperative managers and poor decision-making.	0.560*	0.000
3	Shortage in flow of information lead to repeated works and variation order	0.711*	0.000
4	Lack of communication and coordination between various project teams.	0.716*	0.000
5	Design complexity.	0.661*	0.000
6	Lack of experience-related project nature.	0.860*	0.000
7	Slow in Shop drawings' submission and approval.	0.813*	0.000
8	Time pressure due to unreasonable contract duration.	0.860*	0.000
9	Long period between time of bidding and awarding.	0.753*	0.000

Table (C2): Internal validity for Impacts DCIPs

No	Paragraph	Pearson Correlation coefficient	P-value
1	Project scope control	0.533*	0.000
2	Quality degradation	0.836*	0.000
3	Completion schedule delay	0.766*	0.000
4	Cost overrun	0.696*	0.000
5	Poor safety conditions	0.614*	0.000
6	Poor team work performance	0.669*	0.000

Table (C3): Internal validity for Recommended Strategies to minimize the DCIPs

No	Paragraph	Pearson Correlation coefficient	P-value
1	All involved parties should plan adequately before works start on the site.	0.592*	0.000
2	Contractors involvement to provide their input in Design phases for not only improving the design but also providing an opportunity to overcome the dissonances in working drawing details	0.576*	0.000
3	Client should set their complete requirements in advance before starting the design process.	0.711*	0.000
4	Client should give adequate time for designers.	0.781*	0.000
5	Quality of services should have a considerable portion of tender's evaluation process.	0.497*	0.001
6	The interface between consultants and contractors needs to be improved throughout the project lifecycle according to the good communication – frequent, timely, succinct, high-grade, and reliable.	0.629*	0.000
7	Clients should pay attention to do their work and perform their responsibilities on time to close the door of rising claims from their side.	0.717*	0.000
8	Design firms should improve the coordination process among the design team to reduce the possibility of design errors' generation and reduce conflicts.	0.757*	0.000
9	Provide training programs to cope up with lack skilled and experienced human resources, whether in design firms or construction sites.	0.587*	0.000

Table (C4): Correlations coefficient between each dimension and the total degree of the questionnaire

Dimension		Pearson Correlation coefficient	P-value
Factors causing the Design–construction interface problems	First: consultant related factors	0.705*	0.000
	Second: Contractor related factors	0.415*	0.000
	Third: Client related factors	0.714*	0.000
	Fourth: Donor related factors	0.750*	0.000
	Fifth: Project-related factors	0.777*	0.000
Factors causing the Design–construction interface problems		0.839*	0.000
Impact of the DCIPs		0.835*	0.000
Recommended Strategies to minimize the DCIPs		0.691*	0.000

Table (C5): Reliability coefficients by Split-half and Cronbach's Alpha method

Dimension		Number of paragraphs	Cronbach's Alpha	Split-Half Coefficient
Factors causing the Design–construction interface problems	First: consultant related factors	11	0.853	0.908
	Second: Contractor related factors	11	0.867	0.941
	Third: Client related factors	14	0.891	0.890
	Fourth: Donor related factors	6	0.793	0.879
	Fifth: Project-related factors	9	0.892	0.948
Factors causing the Design–construction interface problems		51	0.951	0.978
Impact of the DCIPs		6	0.778	0.869
Recommended Strategies to minimize the DCIPs		9	0.813	0.777
Total factor		66	0.953	0.939