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EVALUATING THE EFFECTS OF COST OVERRUN IN CONSTRUCTION PROJECTS

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Master's Thesis

Supervisor

Prof. Dr. Tuncer ÇELİK

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I hereby declare that all information/data presented in this graduation project has been obtained in full accordance with academic rules and ethical conduct. I also declare all unoriginal materials and conclusions have been cited in the text and all references mentioned in the Reference List have been cited in the text, and vice versa as required by the abovementioned rules and conduct.

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Signature

DEDICATION

I'd like to thank and be grateful to my supervisor, Prof. Dr. Tuncer ÇELİK and dedicate this study to him for his desire to build the right scientific method through discussions and ideas. and for his careful follow-up during this research project, as well as to all the people close to me who helped me get to this point. I'd also like to extend my gratitude to my illustrious professors and the head of the department for the important responsibilities that they share, as well as to everyone who has contributed in any way to the development and accomplishments of this university as a distinct scientific edifice.

ABSTRACT

EVALUATING THE EFFECTS OF COST OVERRUN IN CONSTRUCTION PROJECTS

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Overrun project cost is the main challenge in the construction industry It represents one of the important obstacles to economic development. this industry in Iraq faced the problem of overrun costs. for that, the present study investigates the various factors in causing cost overruns throughout the construction projects. The factors selected in this research were 35 factors. three processes have been used in the research methodology, the first is the Delphi method which is used to create the dataset for the investigation process. the second method is used the correlation coefficient which measures the strength between the factors. finally, the third is the AHP method which specifies the main effective factors of the overrun cost condition. the results observe seven effective parameters, they are Quality of Plans & Specifications, Size and Type of Construction Project, Skill level, Wrong estimation of time and budget, monitoring the time schedule, change orders, Materials and manufacturers' products are clearly defined. the evaluation process of these factors provides the most effective factor in AHP results is monitoring the time schedule which can overrun 16% of the project cost. According to the expert's opinion, it is significant results.

Keywords: AHP, Overrun Cost, Overrun Factors, Correlation Coefficient, ECM.

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ABBREVIATIONS

ECM	:	Estimated Cost Magnitude
ACWP	:	Actual Cost of the Work Performed
BIM	:	Building Information Modelling
AHP	:	Personal Area Network

1. INTRODUCTION

The primary objective of every construction professional is to finish projects on time, within budget, and to the desired quality standards. However, schedule and expense overruns are a common and global issue in building projects, and Iraq's construction projects are no exception. Factors such as time and cost overruns need to be addressed in order to ensure the effective completion of construction projects on time and on budget. A cost overrun, also known as a cost surge or a budget overrun, involves unexpected spending. These terms are used to characterize costs that are higher than expected because of a value engineering error in budgeting. Because of this, there are three basic reasons behind it: monetary issues that occur from a project's budget or scope flaws Technical problems include erroneous estimates and improper data collecting. A decrease in project commitment or an increase in scope creep are two instances of psychological influences. In order to be successful, efforts must avoid going over budget. The best precautions in place can still lead to a budget overrun. Managing budget overruns is an important first step [1]. The best way to minimize cost overruns is to plan for them before beginning a project. Estimates that are more specific and exact are better at keeping costs in check. Even while there are dangers, a well-rounded approach to effective management may help you deal with them. Any project's design must include every imaginable possibility, including past data, interviews, and personal experience. Once the plan has been prepared, have the project's stakeholders sign off on it so that everyone is on the same page as far as expectations are concerned. Cost overruns can be caused by a variety of circumstances, including a lack of communication with outside vendors and an increase in scope. In Malaysia, a number of studies were conducted to identify the main causes of project delays. Using a questionnaire, Ahiaga-Dagbui et al. [2] investigated the primary causes of time overrun. There were numerous reasons for cost overruns, including weather, poor management of the site, incomplete design documents, and the Errors in Administration, which also included financial difficulties, a lengthy approval process for major changes and a lack of coordination between the contractor and other construction stockholders, as well as poor quality work. Plebankiewicz's [3] technique for predicting building project overruns. A combination of primary and secondary sources provided the data for this investigation. Analysis of relevant literature led to the collection of secondary data. Architects, quantity surveyors, civil engineers, construction managers,

and project managers were asked to fill out a well-structured questionnaire to gather the primary data.

Researchers conducted a questionnaire survey to dig into the root reasons of building construction project schedule overruns [4]. Changes in the scope of the project, client financial difficulties, delays in decision-making, unforeseen circumstances on site, and delays in payment are all examples of project failure factors [5]. Time overruns were exacerbated by a lack of construction personnel, faults and mistakes in design, a sluggish process of drawing and document approval, and incompetent subcontractors, according to a survey. A response rate of 73% was achieved out of a total distribution of 200 questionnaires. Descriptive statistical approaches were used to evaluate the questionnaire data. According to the findings of the study, construction project schedule overruns in Gauteng, South Africa, are the primary causes of additional time, increased costs, lost profit, disagreements, poor quality work as a result of rushing the project, and stress for the customer. An investigation of the effects of building project schedule overruns in Gauteng, South Africa, has been published. It is the goal of Chandragiri et al [6] to identify the main causes of cost and schedule overruns in building projects so that they may take action to reduce these overruns. Analyze the variables that contribute to construction project delays and budget overruns. Because of this, a survey was created and distributed to various business owners, consultants, and contractors for them to contemplate. The main factors presented in table 1.1:

Table 1.1: The Main Cost Factor Overrun.

Table: 2 Important factors causing cost overrun								
Factors of Cost overruns	Owner		Contractor		Consultant		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Inflation and Escalation of material price	55.53	1	53.6	1	62.6	1	57.55	1
Change in project by owner	49.09	4	52.8	2	52.13	7	53.14	2
High transportation cost	47.37	6	49.2	11	50.43	8	52.85	3
Frequent breakdown of the construction plant and equipment	50.09	4	50.4	8	56.52	2	51.85	4
Rework due to errors during construction.	51.8	2	49.6	9	53.91	3	50.28	5
Additional project management, consultancy and administrative cost.	40.1	18	43.2	16	43.47	17	49.42	6
Poor communication and coordination with other parties	41.80	17	48	12	53.04	5	47.71	7
Inappropriate construction method	47.37	6	51.2	6	50.33	9	47.32	8
Additional work at owners request	47.37	6	49.6	9	46.08	13	46.97	9
High maintenance cost of machinery	41.60	14	52.1	3	48.69	10	46.77	10
Shortage of materials	47.37	6	45.6	14	53.91	3	46.28	11
Ineffective planning & scheduling of project by contractor.	39.1	19	40	19	43.47	17	46.1	12
Unsafe practice at site	37.16	20	47.2	13	42.6	19	45.90	13
Lack of financial management and planning	44.75	11	41.6	18	52.17	6	45.17	14
Mistakes or discrepancies in documents or specification issued by consultant.	41.60	14	52	4	47.69	10	45.10	15
High quality of work required	50.4	3	43.2	16	44.34	16	45.10	15
Difficulties on importing equipment's and materials	44.75	11	39.8	20	45.21	15	44.90	17
High cost of machinery	42.42	13	44.8	15	46.95	12	44.28	18
Mistakes during construction	41.60	14	51.2	6	45.27	14	43.31	19
Wastage on site	47.37	6	52	4	42.5	20	43.26	20

In the index of importance ranging from 57.55 percent to 50.28 percent, the top five variables for cost overrun are considered to be the most important. Inflation and escalation in material prices, owner changes to the project, high transportation costs, frequent breakdowns of the construction plant and equipment, and rework due to construction errors are all major contributors, according to the data presented above.

For cost overrun protection, the first step is to identify the variables that influence project costs. Qualitative and quantitative variables make up the majority of the extant components. It is difficult to accurately estimate the cost of completing building projects because of the many variables that must be taken into account. When a project goes over budget, it's not unusual for the final bill to be much higher. Budgets and estimates are two different ways of looking at project costs. Because a more precise estimate entails a more accurate budget and, consequently, a higher profit than anticipated by those involved in the project, [7].

1.1 COST CONTROL

Many aspects contribute to keeping costs in check, including finding the right person for the project, getting the proper tools and equipment for the job, and getting the right supplies in the right amount from the right source at the right price and delivered on time. To ensure the project is completed on time and on budget, managers are required to have the necessary skills and resources. Men, materials, machinery, and money are all examples of resource inputs that are relevant to a project's cost. Controlling the expenses of various input resources is critical to a project's success [8]. While there are many issues that a project manager must deal with, material wastage on most construction sites is one of the most common. Because of this, a manager must be on the alert for any losses at all times. Waste of materials can occur throughout the acquisition process, storage, and usage. One or more of the following factors can contribute to procurement waste: incorrect specifications, overbuying to account for unknown and unrealistic circumstances, untimely purchasing of short-lived commodities, poor and needless handling of materials, and transportation waste.. Improperly stored items can lose their value due to a variety of factors, including damage from handling, improper handling and maintenance, inadequate shelf life, and exposure to harsh weather conditions. The supervisor's carelessness and negligence are also to blame, as are a lack of pre-work preparation and coordination, improper accounting, and poor storage practices. Other contributing factors include long-term storage at the worksite and excessive

issuances from central stores with no follow-up from the stores to return unused surplus materials. An further cost issue is the difficulty in increasing productivity and efficiency in the workplace. Time may be squandered in a variety of ways, including inactive waiting, needless travel, tardiness, early departure, unannounced breaks, toll delays, and delays in receiving materials and job instructions, to name just a few [9].

1.2 PROBLEM STATEMENTS

A successful project is one that is completed on schedule and within the original budget. Project delays and expense overruns have plagued this industry for decades. Project cost overruns are a problem that continues to plague the construction industry. Consequently, a study of the various factors that lead to cost overruns over the building life cycle is proposed in this proposal. Iraqi construction projects are plagued by the problem of cost overruns, which has a negative impact on the projects. From the beginning to the end, there have been a lot of challenges that have slowed building. According to certain studies, material price changes, contractor cash flow and financial issues, and insufficient site management and monitoring are the leading reasons of cost overruns. The building industry has been linked to cost overruns in other studies. Iraq's cost overrun problem may be solved by identifying effective factors related to building needs, as is now being done.

1.3 OBJECTIVE OF STUDY

Purpose of the thesis is to investigate the factors that cause cost overruns of construction projects in Iraq. In order to obtain this aim, the following objectives will be achieved:

a. Identifying cost overrun factors throughout the project life cycle.
b. evaluate the factors effect on project cost overrun.

1.4 THESIS ORGANIZATION

This thesis has five chapters. Chapter one includes an introduction to cost overrun project management.

Chapter residential construction projects in different studies collected from vary researches. The application program, including the studied parameters and factors, the work methodology, and testing of overrun factors, are presented in Chapter three.

Chapter four discusses the result and the calculation of the work. Chapter five is the conclusion.

2. LITERATURE REVIEW

Project delays are nearly always the result of miscommunication among property owners, subcontractors, contractors , or other factors. Building projects are frequently delayed as a result of erroneous estimates of time or building company cost that were previously presented to clients or building company owners. Cost and time overruns are the most common factors that cause building delay in both developed and emerging nations. Numerous effective variables contribute to cost overruns in the building sector of the industry. These effectives include design modifications, poor planning, unpredictability of weather, and price fluctuations in building supplies. It is critical to comprehend which one of the outstanding issues in the construction sector [1].

Construction projects are being implemented at a faster pace. Building company management is becoming increasingly sophisticated over the last few years. For the causes of the building industry's forces, the creative complexity of constructions, the increase in government laws and instructions, and the large inflation. The problem of financing with all of these pressures helped contribute to a rise in the cost of building projects in the traditional way, which led to the search for up-to-date methods and procedures to ensure a faster and larger quantity cost effective finalization in which of only those phases of building the development. In order to overcome these issues, many cutting-edge methods in the industrial and construction sectors must be developed. In each method or approach, building company time is pressed just at expense of quality and cost, as well as the principle of accelerating execution in which of building projects rests in balancing the factors. It becomes useful within a determined and suitable period of time with really no prejudice as well as prepayment, and this is warranted by project's meeting objectives and delivery, which provides financial liquidity to a business proprietor upon finalization [2].

Designing is one of the fundamental stages in which plans for the initial and end project, as well as the technical requirements for its establishment, are developed. At this stage, the interaction is between the designers above, which comprises designers of various punctualities depending on what type or volume of the project, and the controlling that owns the project, one only one hand, and the controlling that owns the project on another. During this phase, the company owner identifies his requirements and aspirations in the project to

also be designed. As quality standards, it differ from one building project to the next in terms of the desired as well as expected constancy as any change in the representatives or function of a project in later phases in the future will be quite costly [3].

On the other hand, the developing is the main accepted role in cost. High percentage points of the magnitude of unit commitment in the design stage, this same application of amplitude designing for construction project layout future development will achieve goal magnitude of expense as it improves product development and eliminates unnecessary magnitude of expense using data gathered about the emanates and that the value of engineering concept [4].

Delays in building projects have been a major focus for a number of academics, as construction is considered an active sector. Both users and owners of a project face significant effectives if the project is delayed, which can lead to increased costs and delays. This can lead to project failure because of the occurrence of cost overrun. Although some writers feel that a single parameter is to blame for a project's failure, others claim that there are a variety of factors that have a role. But it was suggested that there are three distinct approaches to judge whether or not a project is a success; During operations, the project should carry out functional, programmatic, or stakeholder actions. To ensure a successful project completion and delivery, it is critical to accurately estimate the project's time and cost performance, as well as its overall quality. It is necessary to do a budget analysis of the project's development in order to determine the total estimated costs and profits. All construction expenses, as well as professional and contingency fees, are included in the cost estimate. To put it another way, a developer's return on investment and other external charges like project insurance and inspections are all included in the development cost.

The goal of a cost plan is to allocate funds to the project's most important parts in order to provide the groundwork for cost control. Sometimes, the terms "budget" and "cost plan" are used synonymously. However, the budget is a specific spending limit for the project, but the cost plan lays out what the money will be spent on or when it will be spent.

It is also important to include the most up-to-date and accurate cash flow forecast for the project in the cost plan. The cost estimate should include all phases of a project and act as the primary source of information for controlling project costs. To some extent, budgeting depends on the project's stage, however as more details are clarified, the more confident you

should be in your estimations. Because of this, only if there is a shift in project viability should a budget adjustment be made. It's the job of cost management to deliver the best possible structure within the budget's parameters.

The cost plan, which distributes costs and revenues for each quarter of the client's fiscal year, serves as the foundation for the cash flow plan. There should be a reporting requirement for expenditures at the base date level and at junction levels depending on the stated inflation estimate. In order to stay within the specified budget for the project, cost control measures must be used. The best potential estimate of the project cost will always be found through regular cost reporting. The expected cost of the project at the end of the project. Speculation about the future's cash flow.

2.1 COST OVERRUNS IN BUILDING PROJECT

Cost overruns in the construction industry are a global occurrence, however the situation differs by country. The variation is influenced by various elements such as the economics, geographic region, and the construction environment of nations. Architectural complexity, the presence of diverse interest groups such as contractors advisors, end users, owners, , financiers, materials ,building project funding, , equipment, climatic environment ,economic, political environment, and so on are examples of such aspects [6].

As previously stated, the magnitude of cost projections is consistently inaccurate, but the wide standard deviations suggest that the margin by which costs are incorrect varies among buildings. As a result, the project's rating suffers, and decision-makers are more likely to implement subpar projects. In addition, a larger budget is required, and the structures become more expensive than originally predicted. They also stated that it is typical to see construction projects fail to meet their goals within the projected magnitude of cost and time. In such cases, a good price act project is required. One of the most significant jobs for the effective completion of a construction is good construction cost control. Nevertheless, most of the time, achieving magintude of cost control is difficult, and the project will frequently have a noteworthy level in magintude of overrun [7].

Because the exact magnitude of cost projections is uncertain, high-quality magnitude of cost management is a crucial way of managing cost increase. This concern was accompanied by the construction of a realistic magnitude of cost model with adequate effective awareness, a

commitment to addressing difficulties as they arose, and regular cost monitoring inside the project. Cost overruns have obvious consequences for the construction sector and other stakeholders [8].

Cost overruns may result in project abandonment and a decline in construction activity in the industry. These are capable of earning a negative reputation and being unable to acquire construction project financing or securing this at a greater cost, resulting in additional complications. As communicated to the client, the size of cost overruns signal greater quantity cost well beyond the originally agreed upon for the start, resulting in lower investment returns.

If the contractor is to blame for the non-completion and defamation, then he or she stands to lose future business as a result of the loss of profit. As a result of these higher expenditures, customers bear more of the burden. In the eyes of experts, this indicates a lack of value for money, which might damage their reputation and cause their clients to lose faith in them. As proven by several investigators [9], it shows the impact of the scale of cost overruns in building projects.

2.2 EXPLAINING THE CAUSES OF COST OVERRUN IN CONSTRUCTION PROJECTS

To understand how to address the magnitude and cost overruns in construction projects, it is critical to first understand the source of the problem. Overruns frequently indicate deeper difficulties in construction project management, such as inadequately defined timetables and corresponding budgets from the project's early start. Although harsh weather or factors beyond human control might have an impact on budgets, in most states, project overruns are the result of insufficient assessing or planning before construction begins. Techniques, when combined with better planning, can help to decrease the common difficulties or aspects that cause economic overruns, allowing contractor to optimize productivity and profitability [10].

2.2.1 Inaccurate Estimates of Costs

Even if many people involved in the project are anxious to begin building, if the contractor has faulty schedules and budgets from the outset, the project is bound to surpass its original

budget. Because of the highly competitive nature of the process, the accuracy of the estimates will be compromised. One-size-fits-all building estimations are common, and this might lead to an exorbitant start-up cost [11].

In order to ensure a project's success, it is imperative that the element is completed during the RFP process and that it is exact and capable of properly projecting both the budget and the expenses of the building project. Contractors and consultants can express their concerns about the project's progress and timelines at this time. An urgent red flag should be raised when one or more parties appear to be unreasonable in terms of time or scope [12].

2.2.2 Errors in Project Design

Enough time and resources to budgeting and estimating in the preconstruction planning stage, that doomed to a slew of cost overruns in constructing projects. A deficit is a poorly planned, late, or unfinished a Deficiencies are prevalent and a source of hardship for owners and others alike, with a survey by Engineers Daily estimating that design flaws account for 36% of project delays. In this, during the same length of time, unfinished or nearly completed blueprints result in assent activity from contractors finishing the job, which can lead to and fights down the road.

Luckily, in many cases, these types of arguments are completely avoidable. Construction is may assist the effective in which of mistakes or is designs by to everyone is well above the same as in the design in times of itself, plus Project management is much easier the with technology in can incorporate of times changes toward consideration [13].

2.2.3 Changing of Rules

In addition to derivation mistakes, change rules are a typical source of budget overruns in building projects. An order for changes is given when a possessor or contractor discovers that a component isn't operating as expected or seeks to incorporate new specifications, corrections or requirements after the initial models or budgets have been completed. The initial project budget will be rendered worthless in the future if new needs lead to higher expenditures. Cost overruns can occur if a new initiative requires more time, personnel, and materials to complete, but just a single aspect of the project is affected. This means that disagreements are better resolved at the beginning of a contract, when a Provision for

Modification Orders may be added to describe the processes and money needed in the event of change.. Contractors may raise the overall cost of a contract in anticipation of modifications if the issue is not handled in advance, or problems may arise along the way if the issue of overrun is not properly planned for in the first place [14].

2.2.4 Errors in Administration

No matter how well-defined the project's specifications are, if project managers aren't kept up to speed on its development, the project may end up costing more than expected. The consequences of even the tiniest administrative blunder can be catastrophic. As a result, other project managers may not even be aware of difficulties that arise on one area of a building project if communication between administrators is restricted. at a far later date In the minds of many owners and contractors, the best remedy for inadequate administration is simply to expand the administrator's staff size. Administrators hope that by increasing the number of locals employed, they will be better equipped to make decisions specific to their area of the project. There is a chance that adding more administrators may lead to collaboration failures and, as a result, a significant cost overrun. This may not be the greatest long-term outcome. Instead of increasing the number of administrative staff, equip them with the appropriate equipment. A project management system can benefit more than simply the project's manager. It is not possible for a small team to keep up with several conceivable procedures using traditional administration, but software allows a small team to observe a building project from many different angles at once. Digitally updated concepts can be compared to previous phases of construction. Additionally, associated software can assist in preventing cost overruns by reducing the likelihood of human mistake in areas such as billing, accounting, and delivery tracking [15].

When a software solution is in place that assures the correctness of all project papers and offers delivery notifications, administrative mistakes may be eliminated easily. Digital support for operations and logistics in the future will allow administrators to see how flexible a project may be, as well [16].

2.2.5 Unsuccessful Site Management

A project's design integrity, equipment condition, and quality control are just a few of the many aspects that need to be monitored during the building process. As a result, many construction projects end up costing far more than originally projected. As frequently as the subject matter of a project shifts, personalities clash. In the early phases of a project, a trust gap between the owner and the contractor may arise because of an inherent conflict of interest that exists between the two parties. Some projects are just too huge to keep up with every new development in the area, and information may spread more slowly between departments.[17]

Site management issues can be alleviated by enhancing on-site communications and using design tools. There are several situations that may be evaluated side-by-side to see which will yield the best results in the future while using software for calculations and designs that can be accessed digitally. It is possible to make quick decisions based on solid knowledge without respect to office politics since in-digital-state computations are guaranteed to be correct (based on priceless inputs, of course) and software produces may be trusted to accurately replicate on-site descriptions [18]. The correct software also expands the possibilities for collaboration. Online access to ideas and situations enables more communication from remote places. Decisions can be made when project executives are on-site and face-to-face with an issue. Faster response also translates to improved judgments, since real-time insight allows for the resolution of a problem before it gains momentum into a larger problem that threatens the budget [19].

2.2.6 Scope Issues

There are a lot of things that need to be done in order to finish a project, and if they aren't included in the work scope (SOW), they might have a negative influence on the project's ultimate cost. During the early stages of the project, scope creep/expansion should be priced out and represented in the cost estimate [20].

2.2.7 Estimating Methods and Approach

Estimates based on incorrect quantities, per-unit cost estimates for bulk materials and bulk materials' in-directs, and worker productivity assumptions may have a considerable

influence on the final cost estimate if they are erroneous or incomplete. There is a effective of an unpredictable timeline and an increase in the likelihood of an expected overrun as a result of this issue. A professional cost estimator should prepare, or at the very least examine and verify, the estimated cost magnitude (SOW). It is vital that an experienced estimator be included in the estimating process since not everyone is educated in estimating labor, materials, indirect, future escalation, and a number of other factors that must be included in the final cost estimate. Checking the final estimate to make sure the estimated magnitude of cost values match the (SOW) standards are frequently overlooked. A comparison of the present estimate to past estimates would help determine the ultimate cost. To get the lowest possible price, several cost estimates are created, however this can often have an adverse effect on the ultimate estimated cost [21].

2.2.8 Currency Exchange Rate

In many cases, the projection is based on the most optimistic escalation rates. When a large project has been on-site for more than two, three, or four years, it is particularly sensitive to the rising costs of labor, bulk & engineered materials, and other indirect expenditures. Numerous early and front-end estimations of costs are unduly optimistic, which may result in underfunding [22].

2.2.9 Strategy Deficiency

Transfer execution strategies and plans that are not well defined can lead to large cost overruns. Building projects are often complicated by issues such as whether they will be stick-built or modular, or by issues such as whether they will use union or non-union labor. A high proportion of modularization reduces the site's indirect costs. Predicted expenses need to be in line with the strategy [23].

2.2.10 Over Schedules

The EPC implementation manual's cost estimate is unrealistic and excessively optimistic. To avoid delays due to rework and major orders, an EPC project handbook neglects to link the completion date of construction to the setup delivery. Another potential issue is whether; whether it is snow, cold rain or even heat, these conditions will have an impact on the project's field and cause delays [24].

2.2.11 Poor Communications

a lack of clear and open communication between the EPC team members and those on the building site, especially with regard to how the project is now progressing, the timeline it is on, milestones it has to fulfill, and developments it will have an influence on in the future. Communication must be clear and unambiguous or mistakes will be made, resulting in cost overruns [25].

2.2.12 Complex Specifications

Criteria that are much too complex When the team does not completely comprehend or appropriately utilize reporting systems, such as matrix type tools and the like, man-hour and budget overruns can occur; many of these systems provide little value to the project and can indirectly result in cost time overrun [26].

2.2.13 Poor Construction Contracts

Claims and cost overruns can result from combative contracting tactics and ill-defined contractors that lack a detailed list / schedule of percentages for change requests, late payments to subcontractors, and other concerns [27].

2.2.14 Weather

Unanticipated situations is the most prominent reasons of expense overruns. done a good job with effective design, and contractor had accounted for the typical weather. However, contractor cannot plan for a hurricane, tornado, or wildfire; instead, contractor must have the necessary safety precautions, insurance, and a contingency plan in place. Unforeseen conditions involve things like digging on top of an old fuel tank that will need to be remediated inside the future or realizing that the utilities are not exactly where the maps depict. can address these circumstances with a reserve fund, either the own or the owner's, depending on what the contract allows [28].

2.3 RESOLVING COST OVERRUNS IN CONSTRUCTION PROJECTS

2.3.1 Planning

If cost overruns aren't currently a priority in construction budget planning, they should be. Taking the time to figure out what's causing your own cost overruns and working together to find solutions will help you better manage the implementation of complex projects. Because contractors receive a larger cut of the creative pie, there is no incentive to offer upfront payment. As long as the contractor has a solid strategy in place, he or she may significantly lower project costs while also increasing income. A new normal of cost overruns in the building projects cannot be accepted; make sure the contractor has the appropriate planning solutions or tools to enable the contractor complete the next project on time and on budget. Keeping project expenditures in check requires careful planning [29].

2.3.1.1 Effective management plan

Every project, no matter how large or little, necessitates an effective management strategy. Although the strategy does not have to be complicated, it should be as inclusive as feasible. Developing an effective management strategy necessitates creativity. Contractor must consider what could possibly go wrong at each level of the project. If that really want to be thorough, look at each item on the WBS and picture the dangers. Contractor will soon learn and over one in the future [30].

2.3.1.2 Planning considerations

There are dangers for which contractor can plan, and effectives for which contractor just cannot prepare. When contractor have a list of effectives that contractor can plan for, contractor should list the options for avoiding or mitigating them and select what course of action to take. Unpredictable hazards necessitate a reassessment of the insurance and contract terms. that could either insure against the effective or transfer it to another person. If contractor opt to delay the effective, please remember that shifting effective to individuals who have no control over this is unlikely to cover it at all. Furthermore, the move with in future will make a part in new foes [31].

2.3.2 Control Design Errors

Design errors occur as a result of unknowns that are not taken into account. They can also occur as a result of scope modifications. Despite the fact that people have learned to accept derivation errors as a normal part of life, there is a change on the horizon. As building database schema and grouped project delivery become widely used in the not-too-distant future, such irritants will be reduced to a more tolerable scale. In the meantime, starting early is the best way to control issues. Regardless of delivery mechanism, stakeholders have the opportunity to inform design as early as possible in the processes as bidding amount of time [32].

Before reviewing the plans, make notes on problematic areas and recommend alternatives while submitting the proposal. When that won the project, start pouring over the paperwork. Take note of all the sites wherein things could go wrong as a result of poor or missing design. Variation orders don't just happen; they're usually spelled out in the plans. If contractor carefully examine the blueprints, contractor will be able to identify the locations where they are most likely to occur.

Another issue is the change rules that arise as a result of changes made by the possessor as the project progresses. The best protection in this situation is to keep the channels of communication open. Inquire with the design team and the possessor, stay current on specs, and request advance warning for scope or redesigns that are in the process [33].

2.3.3 Control Material Delays to Improve Deliverables

Consider employing on-site involvement to keep drugs close to the work area. To transfer materials more quickly and safely, use mechanical element handlers. Set up notifications with vendors to remind them about deliveries, then streamline the delivery methods such that designers understand where to dump the loads [34].

2.3.4 Control Information Delays in Conjunction with Effective Communication

Contractor should employ cutting-edge technology to gain a handle on above-informatiabove delays. Make goals mobile-device deliverable, and teach employees how to utilize photographs and videos to support change requests, substitutes, punch lists, and RFIs.

Are using a digital project planning technique, such as Procore's, to expedite efficient communication all areas of the project from a single location [35].

2.3.5 Control Quality to Reduce Rework

When the fail to deliver on quality, rework—a major contributor to overruns—is sure to follow. Contractor're not only on the hook again for redo, but that also spending money on rectifying what went wrong, restocking materials, lining up the necessary equipment, or managing labor. The entire process takes more time and costs more money. Get on the fast road to quality control by ensuring that everyone is following the most recent plans. Check sure personnel are aware of the plans and are capable of carrying them out. Next, have trustworthy individuals check the job as it goes to ensure that it adheres to the plans and the desired quality. A budget overrun does not have to be in the plans. Begin early, make use of technology, and maintain open lines of communication [36].

2.3.6 Manage Delays Caused by Clients

Owner-caused delays can occasionally result in a large number of cost overruns. On an unstable path activity, a possessor may issue a cease work rank. Alternatively, the owner's tenants may interfere with the work in some way. An owner may be required by deal to keep access to the website open. Their actions or inactivity on their elements may limit access and increase includes the following expenses. Once again, staying ahead of potential problems is the best defense. Maintain open lines of communication so that contractor are aware of any important owner decisions that may affect the job in the future. Don't let bad owner behaviors mount up by failing to address them. Work swiftly to resolve intercepts. Finally, review the contracts for the "no penalty for delay" clause then try to alter it before signing. When the clause is there, contractor may be able to prevail in court for damages, but this is unlikely [37].

2.4 TYPE OF COSTS

2.4.1 Direct Costs

Consider the direct costs for costs that flow directly to the project in order to produce deliverables. The cost of the materials required to build anything is a good example of an inline cost. That cost of such materials is applied to the creation of an end product.

Indirect expenses: Indirect costs, on the other hand, go toward funding "behind the scenes" expenses incurred over the course of a project. They are referred to as overhead costs. For instance, the leasing a connected office space is indeed a frequent fixed overhead price. This expense must be paid in order for the construction to be completed, but it also goes toward supporting other projects [38].

2.4.2 Fixed Costs

Fixed costs are expenses with fixed prices that are not subject to any type of modification. These are consistent charges that will not vary and potentially throw off a budget in the future. Both indirect costs can have fixed magnitudes of costs A fixed expenses, for instance, could be the flat rate that a contractor charges for their service [39].

2.4.3 Variable Costs

Variable costs, on the other side, are unpredictability. For example, the cost of renting equipment may vary based on the vendor, the demand, or the length of time the equipment is required [39].

2.5 COST VARIANCE

Budgeted project costs fluctuate from actual project costs, and this discrepancy is known as the cost variance. The artistic definition is the difference between the budgeted cost of the work and the actual cost of the work performed (ACWP). Using this approach, you may see exactly how much money a certain expenditure line item, project, or budget is taking in. Several related industries use cost variance in a variety of ways, from reporting to estimates, depending on their goals. The CV, or state cost variance, refers to the actual measurement of price act on a single project. [40].

2.6 IMPACT OF PROJECT COST OVERRUN

Cost overruns have a number of immediate consequences:

a. Manpower and labor shortages contribute to low output and delays.
b. Admin and management: Those in charge of projects, particularly those who report to a board, encounter challenges when it comes to preparing monthly profit and loss statements.
c. Reduced materials budget: Obviously, costs that surpass the original authorized project budget tend to eat into any contingency set aside, thus profits can quickly disintegrate if any additional inconsistencies or problems occur.
d. Projects often have numerous phases, each of which is dependent on the performance of the previous phase. Timelines vanish if financial constraints cause phase delays.

2.7 CONTROL COST OVERRUN IN CONSTRUCTION PROJECT

A conservative approach to planning is essential, and there are various things that can aid with this, which we'll go over below:

a. Forecasting Construction Projects
b. Seeking Financial Assistance
c. Putting Together the Right Team
d. Using Productivity and Collaboration Tools

2.8 HIRING THE RIGHT TEAM

Construction projects are becoming more complex, therefore it's more crucial than ever to employ the proper kind of expertise or reinvest in your current stable of talent. This ensures that new employees receive the appropriate training.

It is critical, for example, to have the necessary employees who are familiar with the new technology required to carry out these complex projects. After all, the construction industry is notorious for being one of the least digitized, with as many as 38.2 percent of construction firms claiming "lack of employees to support technology" as the key limiting issue for new technology adoption.

This entails assembling the correct team to use technologies such as BIM, which can increase the quality of increasingly complicated tasks. Given that 30.9 percent of contractors would not even bid on BIM-enabled projects, it has never been more critical to have a team of construction technicians and quality assurance professionals at the forefront of efforts like these to prevent errors from being returned to the customer.

2.9 CURRENT WORK

The study aimed to analysis the factors that lead to cause the problem of cost overrun in construction project in Iraq. The study explained the problem of cost overrun in construction sector and showed the issue in which of project cost overruns and explained the main element of researches that contribute to the situation of cost overruns throughout the life cycle of building. The study examined the cost overrun problem as a common occurrence in Iraqi building contractions, and it include a detrimental impact on the constructions. The study covered the factors that lead to the problem including the material price fluctuations, cash flow and financial challenges experienced by contractors, and inadequate site controlling and monitoring. The study arranged the necessary data to go forward scientific routine from the cause of the problem to the procedures of reducing that unrequired matter.

2.10 LITERATURE SURVEY

(U. Vaardini, et al., 2016) Cost overruns were examined as an ongoing concern in the construction sector in the research. Projects are considered successful when they are finished on schedule, according to the survey. According to the research, there are a number of different causes that might lead to overruns in a project's budget. This research focuses on the most important factors that may be analyzed using the appropriate data analysis method to determine the amount of cost overruns. These issues were found to be present in the study's routine: unfavorable weather circumstances; wrong scheduling; unstable element percentages; inadequate site measurement and management; and a lack of proper resource management in building projects. The findings of the study suggest that additional research might be undertaken on a wide range of projects, including infrastructure, water supply, industrial, and specialized ones. Several studies may be carried out using this data to assess the real cost [41].

(A. Chandragiri, et al., 2021) Starting with the success of construction projects and demonstrating how it is mostly based on fulfilling the scope or goals of the job within time and cost restrictions, the study concluded: Project management has a major influence on the success of a project, according to the conclusions of the study. According to the findings, the biggest flaws in the construction sector are the inability to complete projects on time and on budget. The study revealed the significance of these two aspects in terms of the building's overall success. As the most major structural building project, the Kanaka Durga flyover's cost overruns are being studied. Cost overruns and the reasons for them were explained in the probe. Focus on the major areas where the cost overruns are most visible since overall cost characteristics cannot be obtained. Delays have also been blamed on unanticipated water overflows at the barrage, insufficient machinery and its upkeep, insufficient trained hiring force, and a considerable expansion in building business scopes, according to a study. As a consequence, future cost overruns and schedule delays may be prevented with careful planning and monitoring [6].

(E. Plebankiewicz, 2018) An early proposal for developing a model to estimate the cost of a construction was presented in the research. Building elements were picked in this study, which led to a large rise in expenses. In light of the building project scenarios and characteristics that impact costs, it is probable to lead to an increase in volume of individual member costs to be estimated using any fuzzy logic. There was an investigation into whether or not there was a chance of a rise in cost in the walls where a superstructure is located, and it was found to be highly probable. According to the findings of the study, the studied item is likely to raise prices by 55% in comparison to the expenses discovered in the field of cost estimating. A schematic illustration of the model used to estimate cost overruns for each building project was recommended by the research. The offered case study contrasted the summary model's estimated cost overrun with the actual cost overrun that occurred. The study's findings show that the model's ability to accurately estimate construction project cost increases is backed up by a high degree of agreement among the participants [3].

(A Goyal, 2017) It was determined that cost overruns and inefficiencies could be traced back to a variety of established sources. A comparison of construction metrics across continents and areas was part of the research. More than 350 documents were accessed using a variety of resources. There is an increase in the demand for building, but cost overruns on these

projects are not decreasing at a rate nearly as fast as they should be worldwide. Finally, it was decided that the best way to reduce construction cost overruns is to employ the best performance data procurement system. Overshoot in the construction sector has been reported in several different nations, and the technique has been shown to be effective in reducing it [42].

(M. Enrica, et al., 2021) All construction projects worldwide have a final cost overrun after they are completed, according to the report. This can lead to overruns in costs when a building project needs to face a wide range of hazards because of insufficient preparation planned to limit these effectives. For both owners and contractors, the study revealed that altering a construction project's budget was a huge problem and a major task, thus the study recommended that it be handled to limit or avoid undesirable things. There are several aspects that contribute to cost overruns, such as building elements, cost estimation, project participation, environmental conditions, and financial affairs, that need to be taken into account while analyzing prior research. In a survey of more than 50 magazines on directing effectives to cost overruns, researchers concluded that project participants (25, 61%), accompanied by inadequate planning, and building elements (23.67%) with frequent modifications were the two most common causes of cost overruns, respectively [43].

(K Ullah, et al., 2017) Researchers in Malaysia found that completing a project on time, within budget, and with the required level of quality is the primary goal of a construction practitioner. Time and expense overruns in construction projects occur often and across the world, therefore building projects in Malaysia are not immune to these issues. There are several aspects that may be given serious attention in order to deal with concerns like time and value of cost overrun in order to successfully complete any construction project beyond the defined time and within the budgeted cost. It was the goal of the research to provide a framework for any of the reasons of schedule and expense overruns in Malaysian building projects. A comprehensive analysis of the causes of building cost and schedule overruns in Malaysia was conducted, resulting in the development of theoretical frameworks to explain the phenomenon. Frameworks have been designed to enable foundational literature and construction practitioners plan effective strategies to accomplish successful project completion, according to the findings of this study [44].

(S. Ahady, 2017) Research on Afghanistan's building construction projects was the focus of the investigation. Analyzing a variety of factors, including literature reviews and a representative sample of actual building projects in Afghanistan, the researchers came up with the following conclusions: The greater the 0.7, the more reliable the variables are. There was a high correlation between the assessments, according to Kendall Concordance Coefficient. The 10 most critical variables in terms of cost overruns have been found from any set of rankings. Results demonstrated that market inflation was not a significant factor in cost overruns, and this was supported by the research. The study found that Afghanistan's two decades of conflict have resulted in a third scarcity in the availability of building materials necessary, which demonstrates that the building supplies needed to complete construction work are scarce in Afghanistan [45].

(S. Simushi1 and J. Wium, 2020) Despite the evident development in the project management profession, the study found that trends of growing time and expense remain in major projects. Research on major South African buildings led the way to discover the core reason of this phenomena, according to the findings of the study. An empirical study employing case studies was conducted to examine the theoretical foundations for the reasons of periods of and cost overruns. External factors, including weather and other natural disasters, were shown to be the primary cause of long construction delays and cost overruns. It was discovered that the root cause was a lack of project-specific skills on the part of the construction project team, previous external and organizational decisions, community resistance and pressure on the part of the construction project team, and a driver of scope change on the part of stakeholders. Researchers found that managing projects in the context of the environment, as well as the organization and the external environment, may be an efficient technique for cutting back on time and extra costs. In the idea of redundant causation and in the management of huge projects, the study contributes new information [46].

(J. Khabisi, et al., 2016) Cost overruns are not unusual in construction, civil engineering, and infrastructure projects, according to the findings of the research. Some of the most major projects in South Africa were shown to have large cost overruns in research. As a result, the factors that contribute to project cost overruns in Gauteng County may be found in general portion building projects. Construction managers, architects, project managers, and quantity

surveyors were all surveyed using standardized questionnaires that were given to the study's participants rather than to those who worked on general component building projects. Secondary data came from a survey of relevant literature. One hundred and ninety-nine percent of the surveys were returned. Descriptive statistical approaches were used to analyze the data gathered from the questionnaires in the research. Change orders, scope changes, cash flow, and financial challenges were identified as the most significant elements in the research based on the questionnaire audit. Additional factors contributing to cost overruns were identified in the research, including insufficient planning and coordination, a tendency to accept inexpensive bids despite their high effective of mistakes and omissions in the design, and a lack of expertise among the project's contractors. In order to avoid cost overruns and boost the efficiency of construction projects, it's critical to figure out what causes them from the outset of the project. [47].

(E. Bentil, et al., 2017) Engineering projects in Ghana were examined as part of the research. The study found that this issue has grown to be a key worry for construction industry stakeholders over the years, accompanied by expenses and periods of excess in the business, and it gives alternatives to decrease or control them. This is a problem that needs to be addressed immediately. The results of this poll, which mainly depended on questionnaires, go well beyond the inception of Ghana's building construction sector and are indicative of factors other than just the business itself. It was the goal of the research to identify and establish the stage of existence in which cost and institutions in the Ghanaian construction industry have been experienced to elicit comments from quantity surveyors, architects and construction project managers in building circumstances in Ghana. Overruns in both cost and distribution timeframe were discovered, according to the research, at a rate of 89 percent. More than 40% of the organizations surveyed were found to have overruns in both time and money. It was found that the average cost and schedule overruns for Ghanaian public building projects were worrisome at 75%, while construction projects in Ghana exceeded 40% of the planned project cost and time, even when utilizing targeted sampling approaches. Cost caps and periods of cost exceeding 98 percent and 300 percent, respectively, are established at 34 percent and 77 percent, respectively. However, private building projects in Ghana had comparatively moderate average cost and time overruns of 146 percent, which were accompanied by maximum cost and time overruns of 376 percent

and 4 00 percent, respectively. As a result of this research, 34 and 38 valuable sources of cost and time overruns, respectively, were discovered in Ghana. [48].

(R. Aziz, 2012) Using quantified relevance indices, the study determined the relative importance of 52 factors that affect the price of building wastewater treatment plants in Egypt. The identified factors were divided into four categories: those that began with the owner, those that originated with the designer, those that originated with the contractor, and finally, those that originated with the miscellaneous group. The results of the study were divided into groups depending on participants' and responders' professional experience in order to examine the impact on the findings. All participants in the research were assessed to see if they could handle all of the aspects that contribute to Egypt's wastewater projects costing more or less than expected. Because of its relevance in determining causes of cost variance for wastewater projects above other categories, the study indicated that the owner originated category was deemed to be most significant. Owner Originated Category's lowest Relative Importance Index (RII) bidding procurement technique was shown to be the most predictable and significant element in the findings of the study, which described the most important factor. The study found that the most significant cost difference might also be achieved with the cooperation of the owner, who would be responsible for forcing more work to take place [10].

(A. Shibani & K. Arumugam, 2015) The study's goal was to figure out what causes building projects in India to go over budget. Cost overruns were also analyzed, as were the crucial success criteria. A survey and interviews were conducted as part of the research. Project cost overruns in India's construction sector were examined as a result of a lack of key crucial success characteristics. Effective components for a project's success include proper planning in the early stages, continuous communication with the client and stakeholders, and early involvement from the contractor. Cost overruns may be minimized by employing effective planning, a well-run construction site, regular meetings during the project's progress, and competent subcontractors and service suppliers [15].

3. METHODOLOGY

This chapter includes the research methodology for the purpose of preparing and developing a method to find the most important factors that cause an increase in the cost of carrying out construction works. All the necessary steps to achieve the objectives and requirements of the research were based on the conclusions from the previous studies, as well as the influencing factors were prepared based on what is found in the previous studies. However, some modifications to the variables were made by the researcher based on questionnaires and field meetings with experts. The main field of this research is the management of construction projects in Iraq and to shed light on the causes of cost overruns. This chapter prepares a methodology for identifying and evaluating the main factors, where the researcher began by preparing interrogative questions based on the totals of factors from previous studies, preparing a questionnaire to clarify the reason for each factor, and then interviewing experts using the Delphi method, and finally applying the correlation coefficient between those factors and finally evaluating the effect of the factors in a HP manner. Professionals who have worked on construction projects conducted a survey to investigate the importance of cost overrun factors. The most important factors of cost overrun were determined by analyzing the occurrence and severity of factors.

3.1 GATHERING DATA

Interviews and questionnaires were used to gather the information. The researcher employed the abilities outlined above when conducting interviews with project managers in Iraqi projects, and meetings were planned with an exclusive set of related persons. Questions were crafted in line with Iraqi projects and the historical context related to questionnaire themes to guarantee that they were answered correctly. For the interview to succeed, both the interviewer and study participant must adhere to the interview's stated objectives.

Because the interviews are performed one-on-one, only a small number of people were able to participate in the study. . In this approach, the researcher attempts to elicit as much data as possible from the subject. However, the researcher cannot study the interviewee's preferences and goals since this type of research provides more precise and thorough information on the research issue than less personal questionnaires. More qualitative responses can be elicited from interviewees by in-depth discussion of their own opinions

and experiences. When conducting a research interview, a researcher must take down notes, including notes that are not based only on the interviewee's answers to the interview questions, but rather the researcher's own observations and conclusions. Natural and open-ended inquiries from the researcher allow the subject to freely express themselves. Research-related answers should not be tampered with in any manner. Follow-up questions should be asked by the researcher when he or she wants to learn more about a certain issue. Researchers must have skills in data collecting, analysis, and conclusion in order to conduct an interview that generates the essential data.

3.2 PREPARING THE QUESTIONNAIRE

Study and design the questions to be asked is the main task in this section, also, finding an appropriate design for the sequence of questions. For the objective of evaluating and discovering the best outcomes, surveys are a useful tool. It is also common for researchers to conduct field surveys using questionnaires, which might be abused in the process. Additionally, they may be used to compare the differences between the 'before' and 'after' states in order to discover and assess any changes that have taken place. Research objectives and individual questions are linked together by a key connection in the researcher's design and implementation. Through inquiries and a shared exploration of creative thinking, objectives and how to attain them may be determined. Various sorts of questions can be utilized, for example, open-ended questions vs closed-ended questions, and responses might be individual or many, or organized in a given way. Data may be analyzed, encoded, entered, and examined using open questions as opposed to closed questions. The data was analyzed and the prediction was measured using a MATLAB program. Each row in the spreadsheet represents a "case," which is short for "single responder," and data may be entered manually or using other tools like Excel. There is a column for each variable, which includes data for that variable in all of the cases that are being considered.

3.3 THE INDEPENDENT RESEARCH FACTORS

Assumptions about the relevance of project management are presented in this part based on independent research considerations, including the justifications for each element. Factors discussed in the second chapter. They discovered that the major probable sources of cost overrun may be categorized. Five of these organizations, according to the expert's judgment,

are capable of operating independently in Iraq's cost overruns. We'll go into the specifics in the next sections.

Table 3.1: Inaccurate Estimates of Cost Overrun Factors.

GROUP 1	Inaccurate Estimates of Cost	Strongly Agree	Agree	Neutral	Disagree	strongly Disagree
		5	4	3	2	1
F1-1	Construction Projects Complexity					
F1-2	Construction Material Costs					
F1-3	Labor Wage Rates					
F1-4	Construction Site Conditions					
F1-5	Quality of Plans & Specifications					
F1-6	Location of Construction					
F1-7	Size and Type of Construction Project					
F1-8	Inflation Factor					
F1-9	Project Schedule					
F1-10	Regulatory Requirements					

Table 3.2: Errors in Project Design Overrun Factors.

GROUP 2	Errors in Project Design	strongly agree	agree	neutral	Disagree	strongly Disagree
		5	4	3	2	1
F2-1	Skill level					
F2-2	Experience					
F2-3	Training level					
F2-4	Accountability					
F2-5	Poor resources					

Table 3.3: Errors in Administration Overrun Factors.

GROUP 3	Errors in Administration	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
		5	4	3	2	1
F3-1	Lack of resources and skills					
F3-2	Failure to communicate properly					
F**3-**3	Poor project initiation					
F**3-**4	Lack of clear objective					
F**3-**5	Wrong estimation of time and budget					
F**3-**6	Failure to manage project scope					
F**3-**7	Micromanaging projects					
F**3-**8	Not following a process					
F**3-**9	Assigning the wrong person to manage the project					
F**3-**10	Lack of resource planning					

Table 3.4: Poor Construction Contracts Overrun Factors.

GROUP 4	Poor Construction Contracts	Strongly agree	agree	Neutral	Disagree	strongly Disagree
		5	4	3	2	1
F4-1	Contract Price					
F4-2	change orders					
F4-3	time of performance of each step					
F4-4	payments progress					
F4-5	Warranty obligations					

Table 3.5: Complex Specifications Overrun Factors.

GROUP 5	Complex Specifications	strongly agree	agree	Neutral	Disagree	strongly Disagree
		5	4	3	2	1
F5-1	The specification provides clear instructions on project intent, performance and construction					
F5-2	Materials and manufacturers' products clearly defined					
F5-3	Installation, testing and handover requirements identified					
F5-4	the drawings, the specification forms are part of the contractual documents					
F5-5	The specification provides answers to many onsite construction questions					

3.4 HIERARCHY PROCESS FOR ANALYSIS

There are a variety of methods for determining how well a construction project is managed. Probability set models have two basic flaws, according to the researchers. In the early phases of development, many models require speculative quantitative data, which is often in short supply. As a result, this method's ability to conduct thorough analysis is severely hampered. Consequently, project evaluation must be subjective in order to be effective. The analytical hierarchy approach was invented by Saaty (1980). It is possible to include both objective and subjective variables in project factors analysis. The initial step of a hierarchical structure is used to formulate the reasoning issue. The choice problem's principal aim is displayed at the top of a typical hierarchical structure. Intermediate-level considerations have an influence on decision-making. The lowest level is represented by the choice option. In order to make an informed conclusion, the hierarchy's many components are analyzed one at a time and compared to the one above them. Decision-makers can utilize data on the components to generate comparisons, but they depend mostly on their opinions of the elements' relative importance and worth in drawing comparisons. In the AHP, evaluations may be made based on human judgements rather than only the underlying facts, and this is the concept. As eigenvectors associated with the greatest Eigenvalue are normalized, the weights of the components of each level in respect to an element in the neighboring upper level may be calculated after the comparison matrix has been constructed. For this, double the weights on each segment of an ascending path from the highest level of an alternate hierarchy to its lowest level.

3.4.1 Prioritizing and Synthesizing Hierarchy

Priorities are obtained from judgment and synthesized down the hierarchy by a weighing and assembly technique, which progresses from local priorities derived from multiplying the criterion's importance to overall priorities derived by assembling the global priorities of the same element. The consistency of the paired judgments is represented by this consistency ratio.

3.4.2 Priority Vector Calculation

Step 1: We begin by preparing a typical matrix. For each comparison matrix, the technique of preparing a standard matrix is to add up the columns and divide each column value by column summation[50].

$$f(\lambda) = |A - \lambda I| = \begin{vmatrix} a_{11} - \lambda & a12 & \dots & a_{1n} \\ a_{21} & a_{22} - \lambda & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n1} & a_{n1} & a_{nn} - \lambda \end{vmatrix} \quad (3.1)$$

Step 2: Next, we computed the average of each row, which is referred to as the priority vector. Each column and non-zero vector Xi are the eigenvectors of matrix A [from Equation (2)], for which the following equality holds :

$$(A - \lambda_i)X_i = 0 \quad (3.2)$$

$$Aw = \lambda_{\max} w = 0 \quad (3.3)$$

Step 3: Multiply the priority vector by the standard matrix, then add all of the column's values together and take the average.

The maximum eigenvector λmax is calculated from equation (4). Here, n is the number of factors, w is the weight matrix.

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(Aw)_i}{W_i} \quad (3.4)$$

3.5 SOFTWARE MATLAB R2018A

Programming language and multi-paradigm numerical computing environment MATLAB were used. Matrix manipulation, data visualization, algorithmic implementation, user interface creation and interfacing with programs written in other languages are all possible with this language. including C, C++, Java, FORTRAN, and Python. Control engineering was the first field to utilize MATLAB, but it quickly spread to a number of other fields. It is now widely used in education, especially in the teaching of linear algebra and numerical analysis, as well as among image processing professionals. In MATLAB, structure data types are provided. Because all variables in MATLAB are arrays, the term "structural array"

is a better fit, as each element of the array has the same field names. MATLAB also contains a number of tools for documenting and sharing user work, as well as dynamic fields. MATLAB methods and applications can be distributed, and MATLAB code can be combined with other languages and applications. To determine the things that have an impact.

The MATLAB code for this step shown below:

```
M(M==0)=NaN;
M(M<0)=-1./(M(M<0));

if isempty(B) == false
    if isequal(normalization,'linear')
    elseif isequal(normalization,'relativelinear')
        B = B./max(B,[],1);
    elseif isequal(normalization,'minmax')
        B = (B-min(B,[],1))./(max(B,[],1)-min(B,[],1));
    elseif isequal(normalization,'vector')
        B = B./sqrt(sum(B.^2,1));
    elseif isequal(normalization,'enhanced')
        B = 1 - (max(B,[],1)-B)./sum((max(B,[],1)-B),1);
    elseif isequal(normalization,'logarithmic')
        B = log(B)./log(prod(B,1));
    end
    B = B./sum(B,1);
end % isempty(B) == false

if isempty(NB) == false
    if isequal(normalization,'linear')
        NB = 1./NB;
    elseif isequal(normalization,'relativelinear')
        NB = min(NB,[],1)./NB;
    elseif isequal(normalization,'minmax')
        NB = (max(NB,[],1)-NB)./(max(NB,[],1)-min(NB,[],1));
    elseif isequal(normalization,'vector')
        if isequal(normalization,'linear')
            NB = 1./NB;
        elseif isequal(normalization,'relativelinear')
            NB = min(NB,[],1)./NB;
        elseif isequal(normalization,'minmax')
            NB = (max(NB,[],1)-NB)./(max(NB,[],1)-min(NB,[],1)
        elseif isequal(normalization,'vector')
            NB = 1 - NB./sqrt(sum(NB.^2,1));
        elseif isequal(normalization,'enhanced')
            NB = 1 - (NB-min(NB,[],1))./sum((NB-min(NB,[],1)),
        elseif isequal(normalization,'logarithmic')
            NB = 1-(1-log(NB)./log(prod(NB,1)))./(size(NB,1)-1
        end
        NB = NB./sum(NB,1);
    end % isempty(NB) == false

    if isempty(C)
        Cmean = [];
        Mmean = geomean(M,2);
    else
        C(C==0)=NaN;
        C(C<0)=-1./(C(C<0));
        Cmean = geomean(C,2);
        Mmean = [];
        for j = 1:size(C,2):size(M,2)
            Mmean = [Mmean,geomean(M(:,j:j+size(C,2)-1),2)];
        end % 1:size(C,2):size(M,2)
```

Figure 3.1: AHP MATLAB Code.

4. RESULTS AND DISCUSSION

Recent increases in interest rates, inflation, and development plan goals, among other things, have caused an upsurge in worry over the length of time it takes to complete building projects in Iraq. As a result, it's more crucial than ever to figure out what causes construction project delays and cost overruns. The achievement of a project's budgetary goals is critical to its success. A company's productivity and profitability may be measured by its cost performance. Estimated construction costs and actual construction costs are used to determine a project's total cost overrun. Iraq's construction sector is notoriously unreliable when it comes to completing projects on time and on budget. Project cost overruns have been the subject of a number of investigations. The purpose of this thesis is to identify the elements that lead construction projects to surpass their budgets. After deleting variables that are basically duplicates and integrating components with a similar meaning together, the total number of factors found in prior studies is reduced to 35. They've been broken down into five categories based on the causes. Based on group categorization and the AHP approach inside MATLAB software, the researcher computed the primary effective overrun factors for each group. Overrun effects may be found and evaluated using the third step's linear regression, which evaluates the obtained data to identify and rate each overrun. .

4.1 QUESTIONNAIRE RESULTS

Due to their speed and cost-efficiency, questionnaires have become one of the most commonly used research methodologies in recent years. Measurement of the elements that contribute to construction overrun costs may be done effectively using these techniques as a result, the identification of the overrun causes must be carried out in a systematic manner. Tables 4.1 to 4.5 display the outcomes of the substantial overruns.

Table 4.1: Inaccurate Estimates of Cost Management Overrun Factors.

GROUP 1	Inaccurate Estimates of Cost	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
F1-1	Construction Projects Complexity	5	5	3	4	3
F1-2	Construction Material Costs	7	5	3	3	2
F1-3	Labor Wage Rates	6	7	3	2	2
F1-4	Construction Site Conditions	6	4	4	3	3
F1-5	Quality of Plans & Specifications	1	2	4	6	7
F1-6	Location of Construction	6	5	3	4	2
F1-7	Size and Type of Construction Project	7	3	3	6	1
F1-8	Inflation Factor	8	5	3	2	2
F1-9	Project Schedule	7	3	4	3	3
F1-10	Regulatory Requirements	8	4	4	3	1

Table 4.2: Errors in Project Design Overrun Factors.

GROUP 2	Errors in Project Design	strongly agree	agree	neutral	Disagree	strongly Disagree
F2-1	Skill level	5	4	5	4	2
F2-2	Experience	5	5	5	3	2
F2-3	Training level	7	7	3	2	1
F2-4	Accountability	5	7	4	3	1
F2-5	Poor resources	6	5	4	3	2

Table 4.3: Errors in Administration Overrun Factors.

GROUP 3	Errors in Administration	strongly agree	agree	neutral	Disagree	strongly Disagree
F3-1	Lack of resources and skills	4	4	7	3	2
F3-2	Failure to communicate properly	5	3	5	4	3
F3-3	Poor project initiation	3	1	7	5	4
F3-4	Lack of clear objective	5	3	7	3	2
F3-5	Wrong estimation of time and budget	4	2	6	4	4
F3-6	Failure to manage project scope	5	5	2	5	3
F3-7	Micromanaging projects	4	4	5	5	2
F3-8	Not following a process	2	5	6	5	2
F3-9	Assigning the wrong person to manage the project	6	2	4	5	3
F3-10	Lack of resource planning	4	5	5	3	3

Table 4.4: Poor Construction Contracts Overrun Factors.

GROUP 4	Poor Construction Contracts	strongly agree	Agree	neutral	Disagree	strongly Disagree
F4-1	Contract Price	7	6	1	3	3
F4-2	change orders	4	4	7	3	2
F4-3	time of performance of each step	7	6	5	1	1
F4-4	payments progress	4	4	8	3	1
F4-5	Warranty obligations	4	8	6	1	1

Table 4.5: Complex Specifications Overrun Factors.

GROUP 5	Complex Specifications	strongly agree	agree	neutral	Disagree	strongly Disagree
F5-1	The specification provides clear instructions on project intent, performance and construction	4	4	5	5	2
F5-2	Materials and manufacturers' products clearly defined	2	5	6	5	2
F5-3	Installation, testing and handover requirements identified	5	3	5	4	3
F5-4	the drawings, the specification forms is part of the contractual documents	5	3	7	3	2
F5-5	The specification provides answers to many onsite construction questions	4	2	6	4	4

The first part of the questionnaire investigated the agreement of experts on the construction cost overrun factors effects. the evaluation will be presented at the end of this chapter. the next step is to find the more effective factors by using AHP method in order to evaluate and compare the results.

4.2 AHP RESULTS

The AHP analysis allows for the identification of the majority of relevant criteria based on responses from participants, and it is also a useful technique for prioritizing indicators. The results of the AHP analysis are shown in the tables in the following sections for each group of factors. The threats were identified as having high importance levels in the overrun assessment of building projects based on effects as a result of these ranking results. The

selected 35 overrun factors were highlighted as having high important levels in the cost overrun of projects based on building construction survey results.

Table 4.6: The AHP Results of Inaccurate Estimates for Cost Overrun Factors.

	EFFECTIVE FACTOR	AHP RANK
Construction Projects Complexity	F1-1	0.4979
Construction Material Costs	F1-2	0.4053
Labor Wage Rates	F1-3	0.4122
Construction Site Conditions	F1-4	0.4592
Quality of Plans & Specifications	F1-5	0.7784
Location of Construction	F1-6	0.4735
Size and Type of Construction Project	F1-7	0.8524
Inflation Factor	F1-8	0.3892
Project Schedule	F1-9	0.4496
Regulatory Requirements	F1-10	0.3722

The F1-7 rank was (0.85), indicating that this factor is the highest in Inaccurate Estimates of Cost the higher rank. The F1-7 which represent the Size and Type of Construction Project, there can be high demand for workforce. For such a requirement, local workmen may not be sufficient and workmen from different regions need be called. These may incur extra costs such projects and also for the type of construction project where specialized workforce is required.

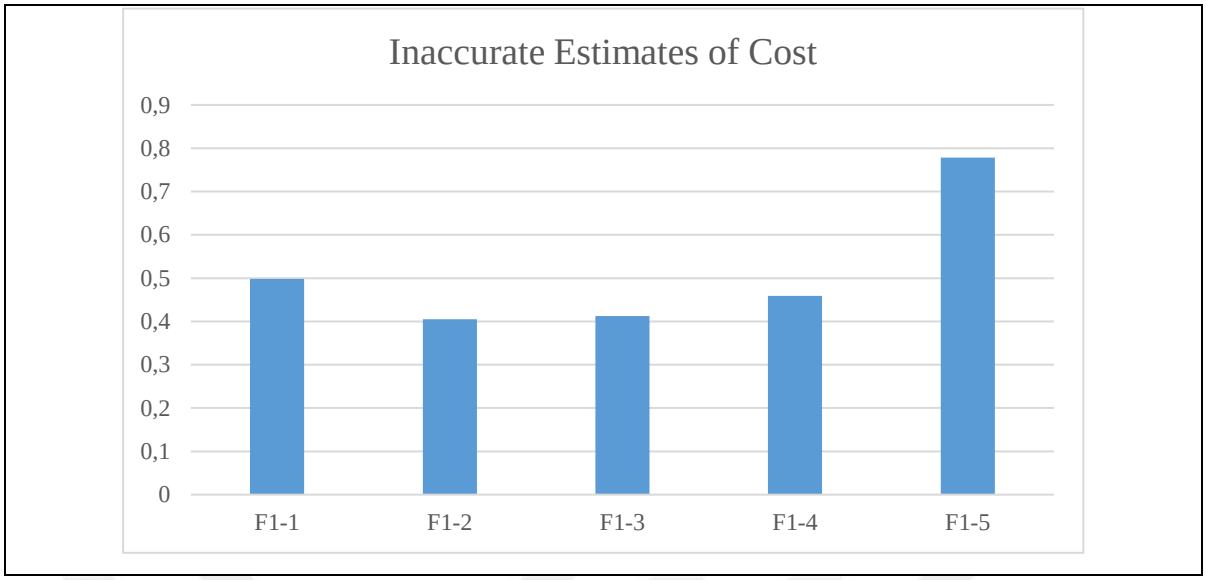

Figure 4.1: Inaccurate Estimates of Cost Overrun Factors for Group 1.

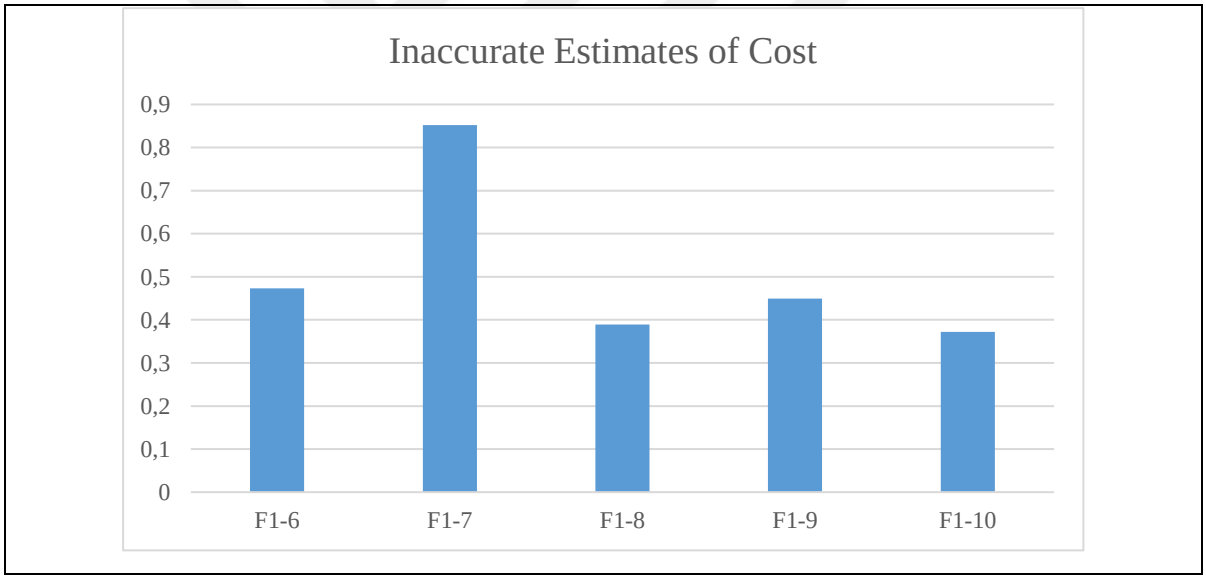

Figure 4.2: Inaccurate Estimates of Cost overrun factors for Group 2.

If you want to know how strong of a link exists between two variables, you may use the correlation coefficient to do so. It is employed to determine the degree to which overrun variables are linked to one another. Between -1 and 1, where;1 represents strong positive association, -1 indicates strong negative relationship, and zero implies no link at all Using this technique, we may determine how well two overrun factors can fit into a linear connection via the data by comparing each data point's distance from the factor mean. It is depicted in the stories in Tales 4.7 and 4.8.

Tales 4.7: Correlation Coefficient for Inaccurate Estimates of Cost Overrun Management Group 1-1.

	F1-1	F1-2	F1-3	F1-4	F1-5
F1-1	1	0.875	0.852803	0.612372	-0.78446
F1-2	0.875	1	0.852803	0.918559	-0.93155
F1-3	0.852803	0.852803	1	0.696311	-0.91987
F1-4	0.612372	0.918559	0.696311	1	-0.8807
F1-5	-0.78446	-0.93155	-0.91987	-0.8807	1

Tales 4.8: Correlation Coefficient for Inaccurate Estimates of Cost Overrun Management Group 1-2.

	F1-6	F1-7	F1-8	F1-9	F1-10
F1-6	1	-0.7746	0.868243	0.63901	0.868243
F1-7	-0.7746	1	-0.8807	-0.76603	-0.92074
F1-8	0.868243	-0.8807	1	0.849208	0.923077
F1-9	0.63901	-0.76603	0.849208	1	0.905822
F1-10	0.868243	-0.92074	0.923077	0.905822	1

As seen in the tables, the maximum correlations in the first group were between F1-2 and F1-4 in the first matrix. It represents the correlation between the construction material costs and construction site conditions. That means the sit conditions can increase the material cost for instance due to the difficulty of guarding materials due to the distance of the place from the city and the lack of a stable security situation or the storage of materials well due to the lack of a suitable place or the difficulty of building regular warehouses. In the second matrix, F1-8 and F1-10 which represent the inflation factor and regulatory requirements.

The errors in project design group of factors were identified as having high importance levels in the overrun assessment of building projects. The selected five sub factors of this

group of overrun factors were highlighted as having high effect on the cost overrun of projects based on building construction survey results as shown in table 4.9.

Table 4.9: Overrun Factors of the Errors in Project Design.

	EFFECTIVE FACTOR	AHP RANK
Skill level	F2-1	0.8941
Experience	F2-2	0.8827
Training level	F2-3	0.6397
accountability	F2-4	0.786
Poor resources	F2-5	0.8139

The F2-1 rank was (0.89), indicating that this factor is effective factor in this group. The F2-1 which represent the skill level of workers and employers in construction project. The failure of a project can be attributed to a lack of resources. Similarly, even if your team is fully staffed, if none of them have the necessary expertise to carry out a certain task, the project will fail. It will also have a negative impact if the resources aren't properly matched. Before beginning any endeavor, be sure you have everything you need.

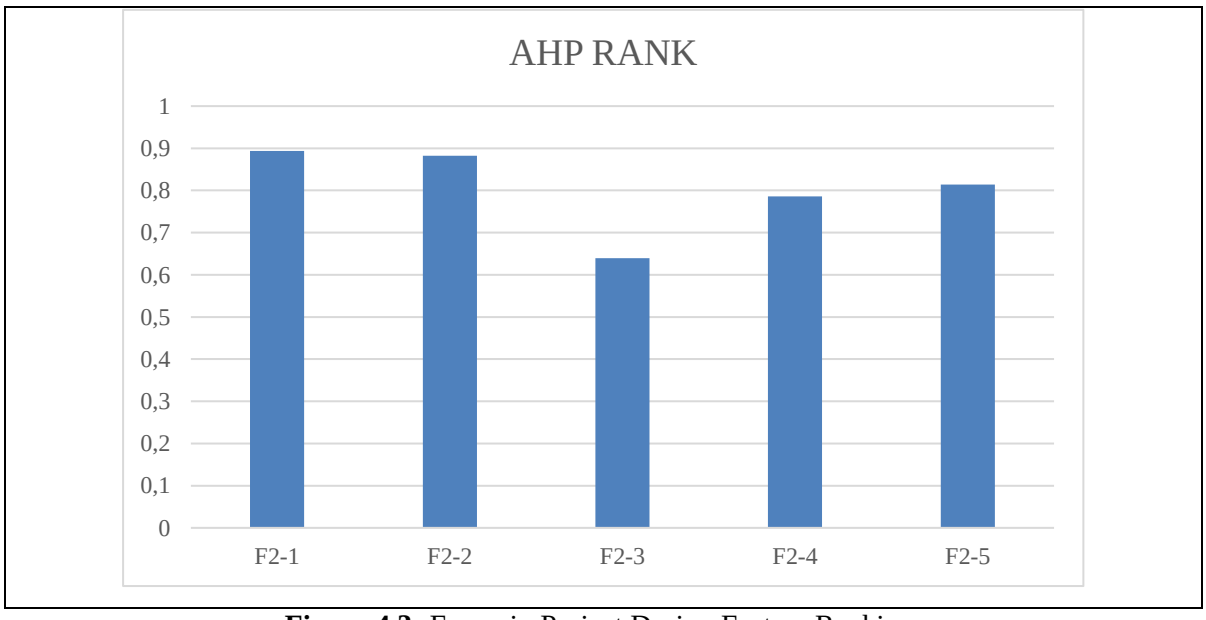

Figure 4.3: Errors in Project Design Factors Ranking.

Table 4.10: Correlation Coefficient Values of Errors in Project Design Group 2-1.

	F2-1	F2-2	F2-3	F2-4	F2-5
F2-1	1	0.866025	0.57735	0.63901	0.774597
F2-2	0.866025	1	0.8125	0.869626	0.894427
F2-3	0.57735	0.8125	1	0.909155	0.950329
F2-4	0.63901	0.869626	0.909155	1	0.848528
F2-5	0.774597	0.894427	0.950329	0.848528	1

As seen in the tables, the maximum correlations between F2-3and F2-5 in table 4.10. It represents the correlation between the Training level and Poor resources. That means the Poor resources can increase the cost for instance due to the need to train the workers and the poor productivity of them.

The errors in administration overrun factors were identified as one of the essential groups in the overrun causes in building projects due to effects of administration processes. The selected 10 overrun factors were presented in table 4.11:

Table 4.11: The Errors in Administration Overrun Factors.

	EFFECTIVE FACTOR	AHP RANK
Lack of resources and skills	F3-1	0.7421
Failure to communicate properly	F3-2	0.7195
Poor project initiation	F3-3	0.7579
Lack of clear objective	F3-4	0.67
Wrong estimation of time and budget	F3-5	0.7621
Failure to manage project scope	F3-6	0.6683
Micromanaging projects	F3-7	0.7402
Monitoring the time schedule	F3-8	0.9221
Assigning the wrong person to manage the project	F3-9	0.6163
Lack of resource planning	F3-10	0.7579

The F3-8 rank was (0.92) which represent monitoring the time schedule of building construction, indicating that this factor is the highest in the errors in administration overrun factors. This group is also separated into two sub groups. In the first, the F3-5 which represent the wrong estimation of time and budget, identified as the highest rank in overrun factors.

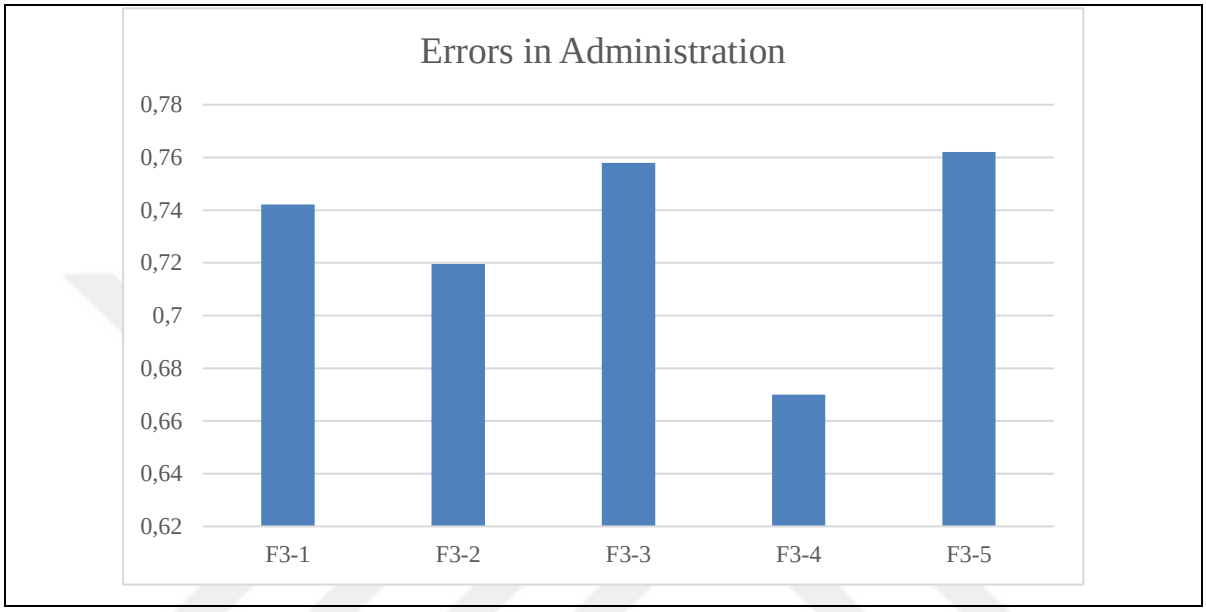

Figure 4.4: Errors in Administration Factors Ranking Group 3-1.

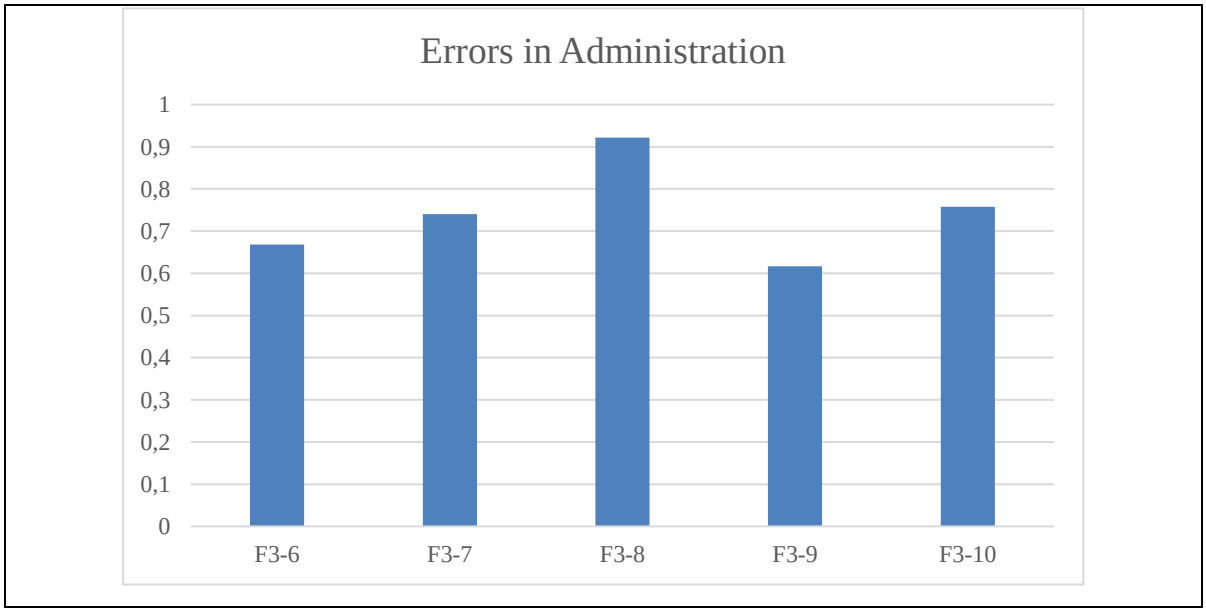

Figure 4.5: Errors in Administration Regression Group 3-2.

As presented in the previous sections, the maximum correlations in the first group were between F3-3 and F3-5in the first matrix and F3-7 and F3-8 in the second matrix as shown below:

Table 4.12: Correlation Coefficients of Errors in Administration Group 3 First Matrix.

	F3-1	F3-2	F3-3	F3-4	F3-5
F3-1	1	0.668153	0.478091	0.935414	0.566947
F3-2	0.668153	1	0.559017	0.875	0.707107
F3-3	0.478091	0.559017	1	0.559017	0.948683
F3-4	0.935414	0.875	0.559017	1	0.707107
F3-5	0.566947	0.707107	0.948683	0.707107	1

Table 4.13: Correlation Coefficients of Errors in Administration Group 3 Second Matrix.

	F3-6	F3-7	F3-8	F3-9	F3-10
F3-6	1	0.144338	-0.18898	0.223607	-0.17678
F3-7	0.144338	1	0.763763	0.387298	0.408248
F3-8	-0.18898	0.763763	1	-0.25355	0.534522
F3-9	0.223607	0.387298	-0.25355	1	-0.31623
F3-10	-0.17678	0.408248	0.534522	-0.31623	1

It represents the correlation between the Poor project initiation and Wrong estimation of time and budget. That means the lack in experience and skills to manage the project will confuse the project regulation and increase the costs. In the second matrix, F3-7 and F3-8 considered the administration experience in which how to apply micromanaging projects with respect to monitoring the time schedule.

Another collection of issues that have been overestimated is the Poor Construction Contracts. A construction contract is a legal document that captures the intentions of the parties and outlines how they want to allocate effective. "Construction contracts" are in fact a number of separate documents that collectively outline the agreement between the

contractor and the owner of the project. Standard contracts include an agreement, drawings, specifications, general conditions and addenda as well as contract revisions made over the course of the work to be done under the contract. Complex and hard construction processes make it a "high effective" enterprise. You must understand and adhere to a wide range of rules, norms, and regulations to do your job effectively Construction project hazards can be identified in the contract's basic terms and conditions. Throughout the process, significant resources such as time, labor, equipment, and material must be accumulated. The owner, the design professionals, the contractors, subcontractors, and suppliers may (possibly) have competing interests in a project's communication and cooperation with other stakeholders. Having a unified goal of completing a construction project on schedule and under budget should be the goal of all parties involved. The AHP evaluation of this collection of variables is shown in Table 4.14.

Table 4.14: Poor Construction Contracts Selected Overrun Factors.

	EFFECTIVE FACTOR	AHP RANK
Contract Price	F4-1	0.5569
change orders	F4-2	0.7816
time of performance of each step	F4-3	0.4951
payments progress	F4-4	0.6988
Warranty obligations	F4-5	0.6084

The F4-2rank was (0.78), indicating that change of orders is the highest cause of cost overrun. According to some estimates, an average of 35% of projects experience at least one major change throughout the life of the project.

When a modification order is issued, it refers to work that is either added to or subtracted from a contract that was previously signed between a customer and contractor. Someone (either the contractor or the owner) makes an adjustment as the work progresses in order to accommodate unexpected events. Change orders can be made without amending the contract if they are requested or decided on by the parties themselves. Owner and prime contractor, prime contractor and subcontractor or two or more subcontractors must mutually agree to amend the contract in order for it to be valid. Work, price, timeline, or any other contract

term can be changed by mutual agreement through a Change Order, which indicates the agreement of both parties.

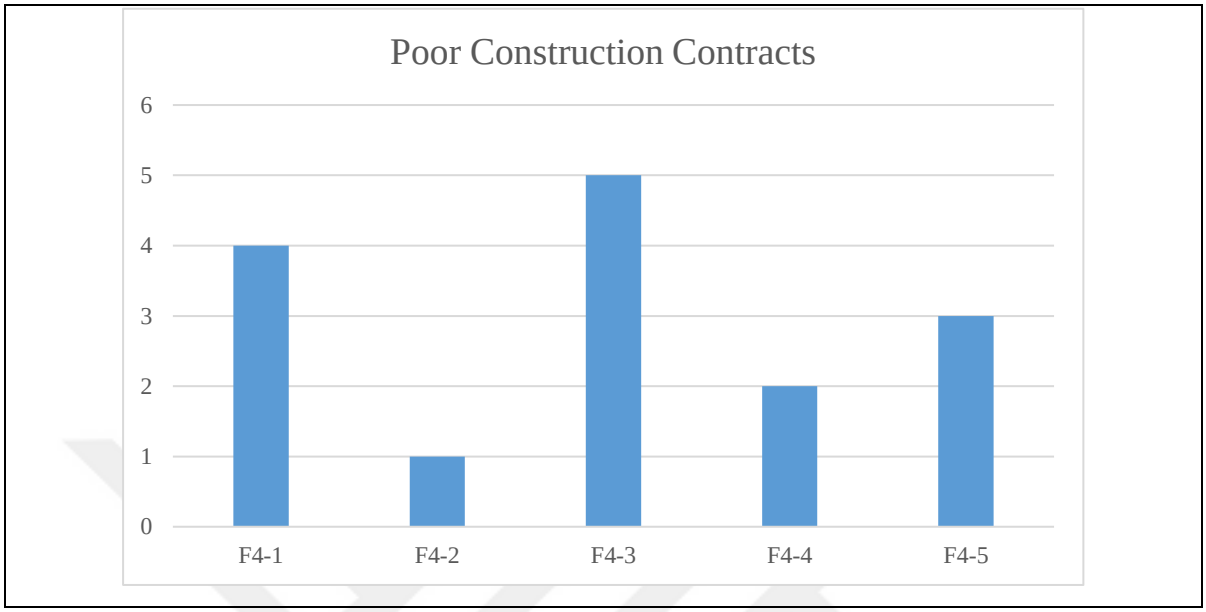

Figure 4.6: Poor Construction Contracts Factors Ranking.

Table 4.15: Poor Construction Contracts Correlation Coefficients.

	F4-1	F4-2	F4-3	F4-4	F4-5
F4-1	1	-0.32733	0.57735	-0.32026	0.264906
F4-2	-0.32733	1	0.566947	0.995871	0.650332
F4-3	0.57735	0.566947	1	0.5547	0.802955
F4-4	-0.32026	0.995871	0.5547	1	0.636285
F4-5	0.264906	0.650332	0.802955	0.636285	1

As seen in the tables, the maximum correlations between F4-2 and F4-4. It reflects the correlation between the change orders and the payments progress. Additional requests may delay the payment.

In Complex Specifications of project needs, the final set of elements were established. With hundreds of individuals possibly participating in the project, specifications must be established to communicate with all of them so that both the designers' goal and the criteria for appropriate installation may be met. The process of creating specifications may be just

as time consuming as putting out building plans. In contrast to construction plans, specifications specify the qualitative needs of the items, materials, and equipment that make up a project. The design process can be made easier to manage if requirements are well-developed. In this dissertation, a large number of interrelated variables have been identified and analyzed.

Table 4.16: Complex Specifications Ranking Factors.

	EFFECTIVE FACTOR	AHP RANK
The specification provides clear instructions on project intent, performance and construction	F5-1	0.6776
Materials and manufacturers' products clearly defined	F5-2	**0.8441**
Installation, testing and handover requirements identified	F5-3	0.6345
The drawings, the specification forms is part of the contractual documents	F5-4	0.5908
The specification provides answers to many onsite construction questions	F5-5	0.6721

The F5-2 rank was (0.844), which represent the highest in Complex Specifications group of overrun factors. The F1-7 which represent the Materials and manufacturers' products clearly defined in construction project.

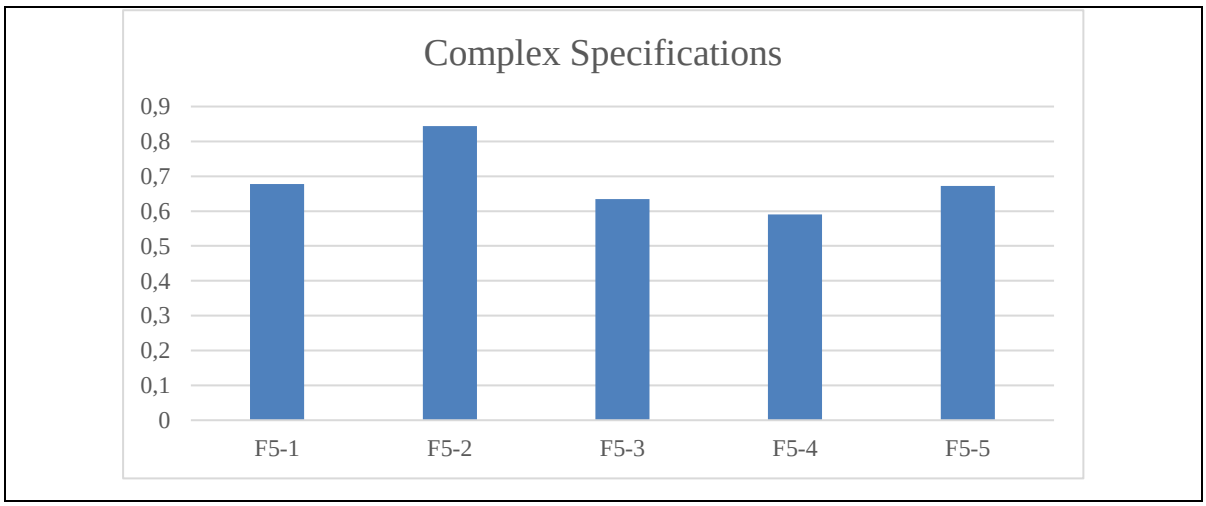

Figure 4.7: Complex Specifications Factors Ranking.

Table 4.17: The Complex Specifications Overrun Factors.

	F5-1	F5-2	F5-3	F5-4	F5-5
F5-1	1	0.763763	0.612372	0.612372	0.288675
F5-2	0.763763	1	0.133631	0.400892	0.188982
F5-3	0.612372	0.133631	1	0.875	0.707107
F5-4	0.612372	0.400892	0.875	1	0.707107
F5-5	0.288675	0.188982	0.707107	0.707107	1

The correlation results present a maximum value between F5-3 and F5-4 as shown in the matrix. It represents the correlation between the Installation, testing and handover requirements and the drawings, the specification forms in part of the contractual documents.

4.3 COST EVALUATION OF THE PRESENT SYSTEM

The purpose of this study is to determine the factors affecting cost overrun and to assess which factors have the most impact on the work environment in Iraq. After conducting statistics and questionnaires for different age groups of project managers and employees, the following was found; The effective factors affecting the rise in costs in Iraqi projects can be listed in Table 4.18.

Table 4.18: The Effective Overrun Factors Based on Questionnaire.

Factor	Details
F1-2	Construction Material Costs
F1-3	Labor Wage Rates
F1-8	Inflation Factor
F1-10	Regulatory Requirements
F2-3	Training level
F2-4	Accountability
F4-1	Contract Price
F4-3	Time of performance of each step
F4-5	Warranty obligations

It can be noted from the results obtained from the questionnaires that the most influential factor on the rise in prices is F2-3 which represents the training level of the project staff.

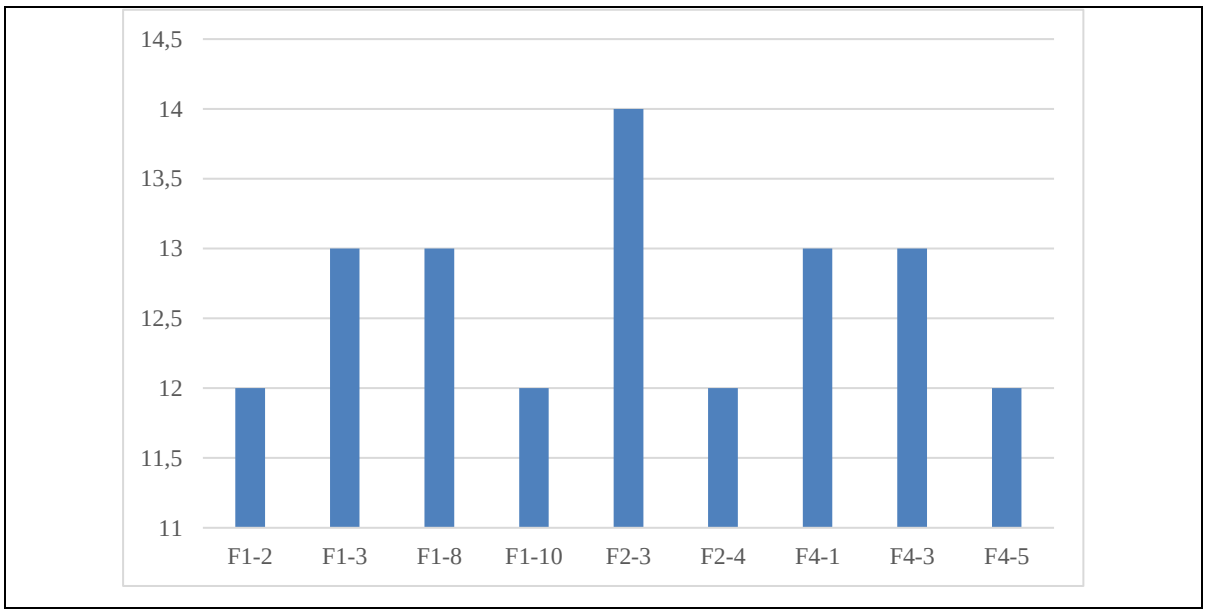

Figure 4.8: Effective Overrun Factors from Questionnaire Results.

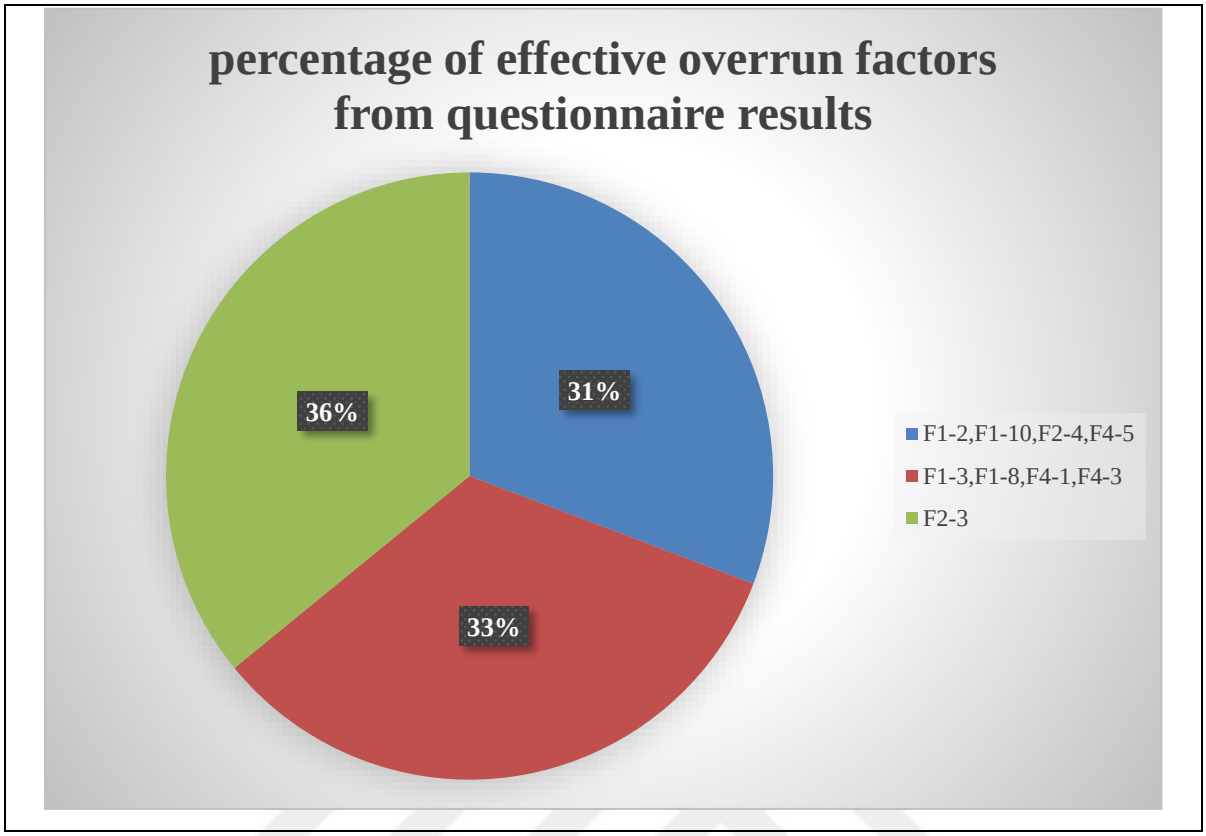

Figure 4.9: Percentage of Effective Overrun Factors from Questionnaire Results.

In this study, 36 percent of the effective variables were F2-3; this suggests project managers should pay attention to the training level of their employees. Materials and labor costs; wage rates; inflation; regulatory requirements; accountability; the contract price; the time of performance of each phase; and warranties. Project overruns are caused by a combination of current circumstances.

The AHP results offer a different perspective on the effective overrun variables. Project Size and Type, Project Type, Skill Level, Plan and Specification Quality Wrong time and budget estimation, time schedule monitoring, modification orders, and materials and products of manufacturers are all clearly specified in table 4.19. Table 4.19: Materials and products of manufacturers.

Table 4.19: AHP Effective Factors Results.

Group Of AHP Overrun Cost Project	Factor Code	The Effective Factor in Each Group Which Cause Overrun	Evaluation of factors
G1	F1-5	Quality of Plans & Specifications	13%
	F1-7	Size and Type of Construction Project	15%
G2	F2-1	Skill level	15%
G3	F3-5	Wrong estimation of time and budget	13%
	F3-8	monitoring the time schedule	16%
G4	F4-2	change orders	13%
G5	F5-2	Materials and manufacturers' products clearly defined	14%

It can be seen that the most effective factor in AHP results is monitoring the time schedule which can overrun 16% of project cost. According to the expert's opinion, it is significant results. The other factors presented in figure 4.10 and 4.11.

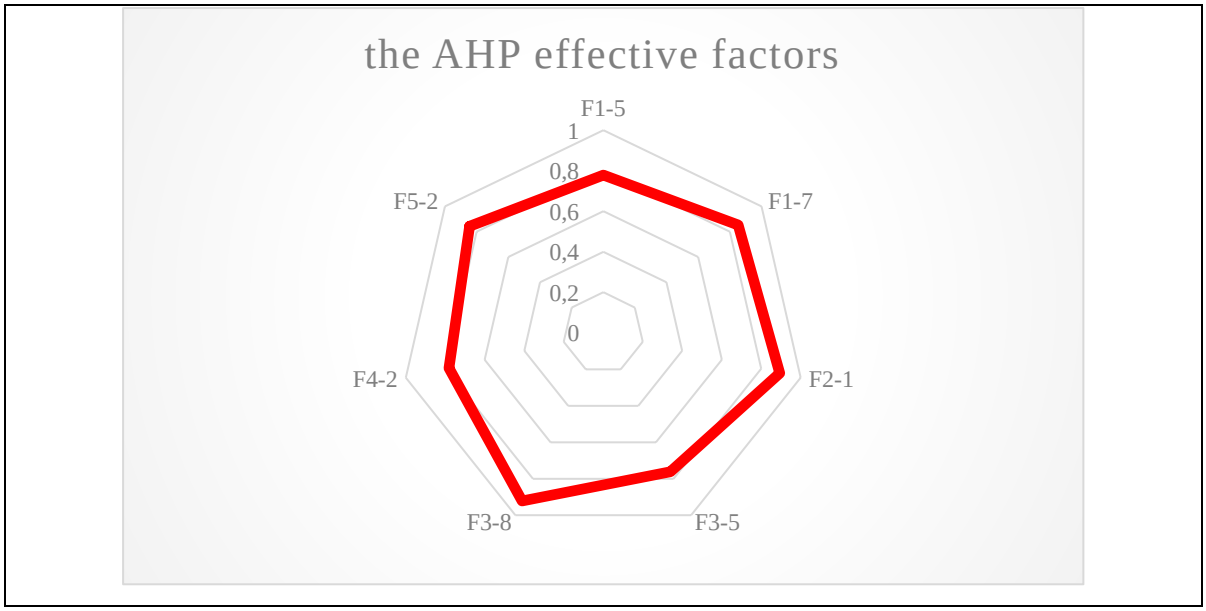

Figure 4.10: Diagram of the AHP Effective Factors.

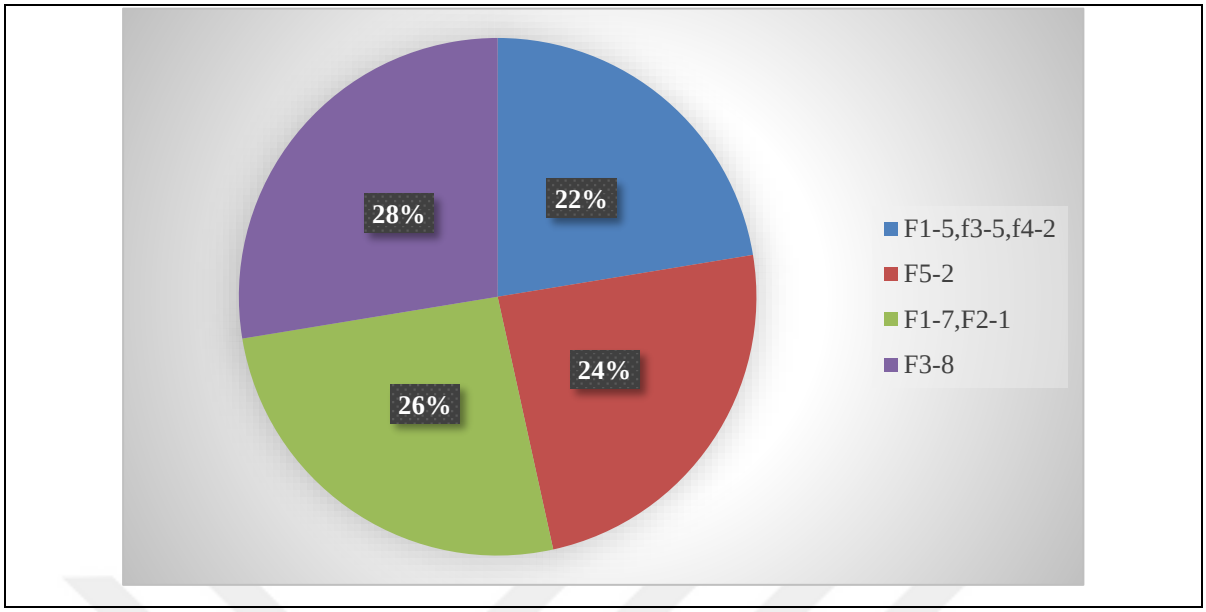

Figure 4.11: Percentage of Effective Overrun Factors from AHP.

5. CONCLUSION AND RECOMMENDATION

The aim of this research is to provide a new approach for estimating the project overruns arising from the Iraqi projects by creating a model that may help the parties involved in building projects in obtaining the obstacles and overruns in the early stages of the project. To achieve this goal, and according to the research results the following procedures and processes were followed:

a. Effective overrun elements factor from AHP results is monitoring the time schedule which can overrun 16% of the project cost.
b. The factors: Quality of Plans & Specifications, Wrong estimation of time and budget, and change orders can overrun 13% of the project cost.
c. The factors: Materials and manufacturers' products clearly defined can overrun 14% of the project cost.
d. The factors; Size and Type of Construction Project, Skill level, an overrun of 15% of the project cost.
e. The system was tested, and the results were excellent, and the overrun prognosis was excellent, according to experts' opinion.

5.1 RECOMMENDATIONS

The latest study showed promising results in identifying overruns, and this technology will continue to make significant progress, particularly in the field of building engineering. However, some recommendations should be made to decision makers in the project implementation sector, in addition to future studies, to support the results of this study:

a. The researchers should study project staff factors on the overruns and focuses on the use of these information effect on project overrun.
b. The researcher suggests to extend the studies on effective assessment and that standardized studies divided on the basis of the effective classification of overrun factors.

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