INTERNATIONAL JOURNAL OF SUSTAINABLE CONSTRUCTION ENGINEERING AND TECHNOLOGY
VOL. 14 NO. 4 (2023) 154-170

IJSCET

http://publisher.uthm.edu.my/ojs/index.php/ijscet

ISSN : 2180-3242 e-ISSN : 2600-7959

International Journal of Sustainable Construction Engineering and Technology

Developing Adaptive Multi Dimension Road Construction Management Using EDAS Technique

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DOI: https://doi.org/10.30880/ijscet.2023.14.04.013
Received 16 January 2023; Accepted 16 October 2023; Available online 26 November 2023

Abstract: Adaptive road construction project Management is considered a major challenge in economic development issues. This research looks into the many variables that can have an impact on building projects. Unfortunately, infrastructure projects in Iraq have slowed the country's progress, so effective methods of project management using actual databases are urgently needed. This research established a centralized data bank with a collection of specialized maps depicting the status of infrastructure projects in Iraq, and it also produced an advanced administrative system via effective success and failure elements that allow administration of projects. Implementing adaptive features during road construction projects is the primary problem of this study. There were two stages to the study methodology; the first was the Delphi technique, which was used to determine the first set of influential elements. The EDAS method was employed in the second approach, and it provided the most useful information regarding the aspects that could affect road construction projects positively or negatively. According to the findings, there were a number of effective factors that could lead to the failure of road construction projects. These included insufficient site security, poor site management and supervision, ineffective field management, inexperienced equipment operators, and insufficient consultant experience. The findings may be helpful for the policy makers and the practitioners in future.

Keywords: Construction management, EDAS, success factors, failure factors, infrastructure development

1. Introduction

An infrastructure with high-quality roads enables markets to trade goods and services in a secure and timely manner. Indeed, road infrastructure projects provide better condition. Hence, for developing countries to improve their living standards, national road infrastructure programs and projects are critical. Building, highway, public, roadway, water-related constructions, road tunnel, railway, hydropower, power plant, and power projects are all interested application areas for project cost assessment. However, unfamiliar approaches, a lack of prior knowledge, more testing and inspection in road building, a lack of manufacturer and supplier assistance, and a lack of performance information are all linked to more efficient cost management in road construction. Additional goals may be set in relation to particular needs or issues discovered during the planning stage (Radzi et al., 2022). Effective management prediction is a critical procedure for any firm since it serves as a precursor to budget prices and resource allocation during the project life cycle. Actually, obtaining input data for an efficient management estimating process is difficult, especially when the extent of work is unknown, which can lead to inaccurate and rash estimations. The more the project scope is known, the more likely it is to provide more accurate estimates since more project requirements are established. Because of its characteristics and the vast quantities of cash required to launch and sustain a project, the railway construction sector is one of the project kinds that requires greater attention because of its high-effective management (Elewe et al., 2017). Future budget vs. actual cost variations will result from either overestimating or underestimating the cost of these

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initiatives. As a result, interest in the methodologies utilized in this field, their correctness, and even their shortcomings is rising (Rahman et al., 2020). Effective management is a systematic technique for determining the likelihood of any event occurring and detecting factors on that event using a substitution scheme to keep the project on track. Effective management may be described as a process for identifying, analyzing, and responding to project effective managements in order to boost chances and decrease dangers to the project's objectives. Effective management is one of the most critical aspects of the project decision-making process. A project's performance, productivity, budget, and quality may all be influenced by effective management (Celikag and Naimi, 2011). A slight activity that is presumed to include effort, resources, and a goal. Construction of physical infrastructure, such as a roadway, a bridge, a building, or other types of infrastructure, as well as significant and minor maintenance tasks relating to such physical infrastructure, could be considered such an activity (Talib et al., 2019). It is crucial that the entire activity be undertaken in a professional manner and that it be done within the allotted time and budget in order to achieve the intended outcome. Additionally, it is crucial that the entire process and the final product have little to no social and ecological impact and that the investors who will be influenced by it are consulted (Sergeeva, 2018). This entire action can roughly be classified as a plan. According to one definition, a project is a mix of organizational resources brought together to create something that did not previously exist and that will provide a presentation capability in the project and implementation of structural plans. Project management refers to the proper management of a project from its inception to completion (Naimi and Celikag, 2010). Deliverables are a part of every project. Often taking the shape of a strategy, report, rule procedure, product, or service, deliverables is something of value produced by a scheme management team as planned, to be accessible to an authorizing group, a reviewing group, client constituent, or other concerned gathering (Vinogradova et al., 2021). Since the bulk of earths have been moved by mechanical forces of nature, it is plausible to say that these forces are the main method by which they were naturally brought to or placed in their current locations (Pariyar, 2021). The kind of residual soil that was created was mostly governed by climate conditions, including temperature and rainfall. While chemical endurance predominated in tropical areas with year-round high fevers and heavy rains, mechanical weathering, or disintegration, predominated in northern cold temperatures and desert regions. Because they have been transported by other glacier soils or are buried beneath them, remaining soils are rarely discovered in glaciated areas (Talib et al., 2020). On the contrary hand, hot, humid regions are thought to have the least amount of in-situ lateritic soils (Silva et al., 2013). Soils are composed of stone debris, talus, or talus that has broken off from the buildings below and has been lowered by gravity down slopes. The upper and lower surfaces of the deposits are rarely flat, and these resources usually consist of course, badly sorted angular particles (Athanasopoulou et al.). Construction projects involving investments are notoriously difficult to carry out, both in general and in Iraq in particular (Lapidus and Abramov, 2020). This is because they are subject to a wide range of variables, including economic, technical, and political factors, as well as the vagaries of nature, such as weather and seasonality. Thus, there are numerous potential threats to such projects, which may delay delivery of the finished product, increase the budget, and lower the quality of the facilities being built. In any construction management, risk management which encompasses risk identification, analysis etc. play vital role. Therefore, this study focused on the identification and analysis of key success and failure factors of road construction project. This study employed the Delphi technique and EDAS method to identify the success and failure factors of construction management.

2. Literature Review

2.1 Overview

The transportation industry is a vital part of the global economy and scientific community, and the choices taken in this field are often complex. Some examples of transportation-related decision-making problems that call for the consideration of multiple environmental, economic, and social factors in light of the concept of sustainable transport are the selection of an investment site, the selection of a route for road infrastructure, and the selection of a public transport development scenario (Broniewicz et al., 2020). Roads are an essential part of every nation's infrastructure, which is why governments the world over spend so much money on them. However, the efficiency of time, the affordability of the project, and the quality of the end result are the three most important restrictions of every given project. In addition, the identification and management of risks and uncertainties is one of the most influential variables that affects the accomplishment of project goals. The goal of risk analysis and management is to reduce the likelihood that any major surprises will arise throughout the course of a project (Lavanya and Malarvizhi, 2008). There are a range of risk factors that may influence the construction management. A research assessed the potential for slippery surfaces at the construction site (NAİMİ et al., 2019). It's a part of construction management. The research centers on a geotechnical analysis that verifies the presence of several phases and the danger of slippage in the real world. Research sought to mitigate the threat by examining the soil with the help of the Talren and Slop programs, and it proposed a method to permanently stabilize the location where the threat had been identified. Lack of contractor experience, poor working conditions, delays, insufficient planning, inaccurate scheduling, missing and poor-quality materials, inappropriate technology and tools, price fluctuations, and unskilled laborers are just some of the factors that were found in a study examining what hinders productivity in the road construction industry, particularly in Iraq (Ali and Parseiy, 2022). In addition, it is thought that assessing risk is not always simple since both the likelihood and impact of

an event are sometimes immeasurable. They must, therefore, be calculated using some method (Kerzner, 2017), whether statistical or another. In order to design processes, tools, and methods that aid project management in a manner that mitigates such risks throughout the lifespan of the project, it is necessary to identify and assess such hazards (Goh and Abdul-Rahman, 2013). Financial, environmental, socioeconomic, and construction-related hazards are only some of the many that might affect building projects (Zavadskas et al., 2010). There are variety of approach to identify critical success and risk factors. The MCDM methods EDAS and others like it. Multiple criteria (such as the nature of the risk and corporate capabilities) may be considered when using MCDM techniques to identify significant risk elements, allowing for a more thorough risk assessment. Many well-known MCDM approaches exist. The EDAS technique has the benefit of being easy to calculate in comparison to other MCDM methods (such as TOPSIS, TODIM, and VIKOR). The results it can get are comparable to those of other MCDM methods, as shown by Peng and Selvachandran (Peng and Selvachandran, 2019). As a result, the EDAS approach is a viable option for the users.

2.2 Effective Road Projects Criteria

A comprehensive list of factors to be used in marketing a set of road standards is included in design standards. These include goals for resource management, environmental restrictions, care, actual environmental problems (including terrain, climate, and soils), traffic supplies, and traffic facility levels. For each road, objectives must be determined (Radzi et al., 2022). Boundaries of property ownership, the health of the neighborhood economy, and public sentiment toward a particular project are some examples of the latter (Jamroz et al., 2019). Regular daily traffic should be forecast for various user collections, according to traffic supplies. For instance, a road may be used by record or cattle trucks, followed by local traffic. It is important to analyze an estimate of traffic supply in proportion to usage as well as changes over time (Bartuška et al., 2016). With the fewest infrastructures per unit area, the ideal road design is one that retains the lowest haulage coldness. When compared to the area of land removed from production, the density of infrastructures offers short-term cost savings and long-term savings on road maintenance costs (Pienaar and Regulation/Volume, 2014). Road placement and design should be compared to the overall forest resource, which includes patterns of short- and long-term harvesting, reforestation, fire prevention, fish and nature reproduction, rural agricultural development, and rangeland management (Omar et al., 2022, Kassem et al.). In addition, the following elements must be taken into consideration: the number of lanes, turnout spacing, path widths, the type of heavy surface, sight distances, project speed, clearance; horizontal then vertical alignment, curve flaring, and turn-around (Qian et al., 2012). Many additional factors can be concern such as car design which represents a vehicle that typically travels on public roads, such as dump trucks in the case of mining activities. The term "critical vehicle" refers to a vehicle that is necessary for the operation being considered but only sometimes utilizes the road (for example, a livestock truck when transporting range livestock) (Kukkapalli et al., 2021). Also, multiple user kinds will be using the same road, circulation safety is a crucial necessity (NAIMI and KARIMI, 2019). The chosen road standards can be determined by the other design standards in combination with safety considerations like as stopping distance, sight distance, and then permissible design speed (Grdinić-Rakonjac et al., 2021). The resource management impartiality across various planning prospects should be stated for each category. For instance, a road needs to be constructed first for a parcel of land's timber crop, then for the native population's access to gather firewood or graze, and finally for administration of watershed rehabilitation works. If the qualities of the road operator vary during the course of the road's existence, the planner should be in charge of that (Oad et al., 2020).

2.3. Related Studies

Abbas, et al., (2018) presented to fill a figurative need for a textbook on the classification of roads, different types of pavements, materials, construction tools and activities, drainage, necessary safety and upkeep, contracts, work procurement, revisions to the FIDIC conditions of contract, supervisions and organization, and issues with controlling road construction. - Interviews and a questionnaire were used in the study to analyze the issue (Abbas et al., 2018). Hemant, et al., in 2022 examined the mean score of risk management practice based on contractor perceptions demonstrates mediocre management awareness (Elewe et al., 2017).Yucai Wu, et al., in proposed application of green highway construction is done in the following four ways: "building traffic infrastructure regime integrated in to the non-artificial scenery," "promoting green construction technology in which of environmental regulation, energy conservation, and big efficiency," "generating tourism type Freeway pilot program," and "promoting green construction technology." (Wu et al., 2020). Mohane and H. Ambre, in 2019 study defined the management system necessary for planning and regulating the quality and quantity of equipment, prompt equipment installation, good price, and the appropriate quantity as needed (Mohane et al., 2019). Mohamed, in 2010 study roads to be considered important national assets. Roads need to be maintained on a regular basis just like any other asset to keep them functional (Mohamed, 2010). Seboru, in 2016, in the study, Nairobi County was used as a case study to determine the effect of material acquisition on performance in which road construction projects in Kenya. The hypotheses were tested using the Fisher (F) test to determining the quantity of materials needed had a statistically significant impact on the project to build the road (Seboru et al., 2016). Wichard, in 2018 study showed the new Environment and Planning Act that being created in the Netherlands. This matrix suggests participative process approaches that are appropriate for a project's

problem environment (Wichard, 2018). Rahman, et al., in 2020 study showed the highway construction projects as frequently involve substantial risk because of how crucial they are to the political, social, and economic progress of a country. This study adds to the existing body of knowledge by giving researchers and practitioners a set of alternative elements that are influencing the success of highway projects. The knowledge gained from this study will help the industry to support the success of highway projects in Malaysia (Rahman et al., 2020).

3. Methodology

In order to better evaluate the potential dangers of road building projects, this research introduced a novel hybrid framework. In the first step, interviews and brain storming were used to compile expert opinions on the project hazards. A survey was performed on different road construction project. Both male and female employee were participated on the survey who involved with road construction project. Experts choose the most significant risks to evaluate and rank using the EDAS approach. Lack of experience, the necessity for additional testing and inspection during road building, and the absence of manufacturer and supplier support and performance data all contribute to cost overruns in the road construction business. The earliest phase of a project's life cycle is the preparation of a cost estimate, which is a crucial element of any organization's budgeting and resource allocation procedures. Due to the lack of clarity surrounding the task's scope, it may be difficult to obtain the essential input data for the factor's estimation process, leading to estimates that are ambiguous and incorrect. Since more project requirements have been identified, estimates may be more accurate if the project's scope is outlined in greater detail. The inherent factors and vast amounts of money required to initiate and maintain a railroad project requires careful planning. Budgets might deviate from real costs if cost estimates are too low or too high. As a result, there has been an increase in interest in the approaches employed in this field, as well as their correctness and, yes, even their flaws. The major purpose of project management is to ensure the effective completion of the project within the stated time and budgetary limits, while taking quality concerns into account. There is discussion of uncertainty as a risk factor for budget and schedule overruns. There is a possibility that the project may fail to reach its objectives due to poor management and performance control. Project management is a systematic strategy that evaluates the probability of each occurrence and identifies the elements that influence it in order to prevent the project from deviating from its intended objectives. Managers can improve opportunities and eliminate threats to the project's objectives by identifying, evaluating, and responding to project-related factors. Competent management is one of the most critical components in making the best decisions for a project. Unique aspects of each project can have a substantial effect on the project's overall timeliness, efficiency, cost, and quality.

3.1 5DPM Adaptive Method

Since the five-dimensional project management (5DPM) methodology presented in this dissertation is meant to complement rather than replace established PM practices, it has the potential to enrich the framework and methods used in road construction projects. Flexible and inherently management-dependent, this approach allows for the adoption of a wide variety of approaches, tools, and tactics. The priorities for Iraq's infrastructure have switched from building brand-new facilities to repairing, modernizing, and enlarging existing ones. Road infrastructure renewal construction requires a different set of project management issues than road infrastructure building from scratch. Incorporating novel project management ideas into standard practice is essential for accelerating completion times, decreasing costs, and lessening the likelihood of conflicts across all project sizes and types. The complexity of renewal projects has increased over the years due to underfunded maintenance and replacement initiatives. Numerous renewal projects have grown more challenging as a result of the need to avoid significant traffic interruptions and, in some cases, infrastructure breakdowns. Factors such as project kind, engineering complexity, scale, modality, jurisdictional control, finance strategies, contract type, and delivery mode all contribute to a project's overall level of difficulty. Different approaches to project management will be needed for various tasks. Managing complex projects with the help of the five dimensions of 5DPM is not a new idea. But it has been carefully considered, described, and organized for inclusion in this thesis. The five dimensions are as follows:

(1) cost,
(2) schedule,
(3) technical,
(4) context,
(5) finance.

The 5DPM methodology relies on five techniques that are tailored to each individual project:
• Specify the important project success elements for each metric, if needed.
• Identify the most important reasons a project could fail and categorize them accordingly.
• Put together a team of specialists to work on the project.
• Pick factors to be included in project arrangements.

It is important to anticipate costs and account for them in an early financial plan. One of your tasks should be to create project action plans. The most pressing next steps are applying the material to real-world complex projects and integrating the philosophy and tools into the existing project programs and project management policies and procedures, although several additional research ideas have been identified during the course of the project. To better distribute resources and identify where more are needed, your project team can benefit from creating a complexity map. Complexity maps can also be used as a basis for using the five complex-project planning approaches and making decisions about complex-project management tools.

3.2 The 5DPM Adaptive Factors

Rather than focusing on individual geotechnical issues, this study took a holistic approach and adopted the factors found in the work by Douglas et al. (Gransberg et al., 2018)and Kerim Koc et al. (Koç et al., 2020) and Sissakian et al, (AL-HADİTHE and BİNGÖL). The effective factors have been characterized, and their efficacy has been verified, by professionals. Professional assistance will be sought in the next step of this investigation, which will focus on identifying potential risks associated with transportation projects. A questionnaire was developed to collect responses from specialists managing different infrastructure projects in Iraq after a comprehensive list of relevant indicators was established based on a literature search. The type of soil around the structure's foundation is significant. The soil underneath the researcher's home may not have been adequate for the foundation. There is also a relationship with the moisture content of the soil. Along the foundation's perimeter, the soil is more compacted and drier. However, water-saturated soil becomes more flexible and delicate. The water leak will erode the soil surrounding the foundation's footing, causing the footing to droop. When the earth is either too dry or too moist, hydrostatic pressure can arise. The chemical composition of the soil is the primary cause of this stress (Hong et al., 2010, AL-HADİTHE and BİNGÖL). Vegetation growing within a relatively limited radius of the project could promote settlement. Specifically, a tree's roots can absorb rainwater from the soil. This occurs frequently during dry spells and droughts. Dry circumstances cause the planet to compress. The most common reason is tree roots seeking water close to and beneath the foundation. Surrounding foundations with shallow depths and proximity to the ground's surface, there is a higher incidence of soil drying up. Because they stretch so deeply underground, basement foundations are particularly susceptible to shifting soil (Oyediran et al., 2011).

3.3 Ranking the Factors

The primary objective of this study is to determine which risk variables are the most relevant and crucial for infrastructure projects. A trained and experienced crew is required to complete the rating. For the researcher, the Delphi approach offers a tool that is versatile and open to adaptation for the purposes of data collection and interpretation. The following are some of the justifications for using the Delphi method (de la Cruz López et al., 2021, AL-HADİTHE and BİNGÖL). The Delphi method is one of the ways to forecasting that is used the most frequently in the technical sector and across the industry as a whole. It is responsible for more than 90 percent of technological forecasts and research. Before commencing the investigation, the Delphi method was conceived of, developed, and put into practice with subject selection and time periods as the primary focuses of attention.

A low response rate, inadvertent influence on responses, and questioning panelists about their lack of experience on the topic rather than demanding their expert judgments are some of the additional safeguards that should be taken (AL-HADİTHE and BİNGÖL).

The fundamental purpose of this research is to identify the factor effect factors that are the most important and significant for the development of infrastructure projects. To successfully fulfill the rating, you will need a crew that is both trained and experienced. For the objectives of data gathering and analysis, the Delphi method provides the researcher with a tool that is flexible and open to change in order to meet the requirements of the project. The use of the Delphi approach can be justified in a number of different ways.

3.4 Evaluation Based on Distance from Average Solution EDAS

Keshavarz Ghorabaee, Zavadskas, Olfat, and Turskis developed the Evaluation based on Distance from Average Solution (EDAS) method to handle MCIC issues. It is also applicable to MADM and MAGIC issues, which involve weighing several factors. The EDAS method outperforms other decision-making and classification strategies primarily because it is more efficient and uses less computing power. Here, we need to find the nadir or idle solution, which is found by taking the maximum value of the positive distance from the average solution and the minimum value of the negative solution and summing them up. Not all DMs have the same level of knowledge, background, or experience, so this must be taken into account while evaluating them individually in GDM with uncertainty. A researcher's strengths, interests, and personality style might all be quite different from one another. EDAS is unique since its conclusion is based on the median answer, which removes the bias that may exist across experts. With the data already normalized thanks to the use of an average solution, the probability of deviating from the ideal answer is dramatically reduced. Therefore, in comparison to TOPSIS and VIKOR, it provides a more accurate and efficient solution to the actual

problems. The procedure of this approach is of the study in the reference article(Siraj, 2015). It begins with defining the problem and the criteria that will be used to evaluate the solutions.
The second step is to build the decision-defining matrix A by arranging the possible options and evaluation criteria in the fashion shown. To rate x option using y standards is denoted by the notation AXY.

$$A = [A_{XY}]_{pxr} = \begin{bmatrix} A_{11} & A_{12} & .... & A_{1r} \\ A_{21} & A_{22} & .... & A_{2r} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ A_{p1} & A_{p2} & .... & A_{pr} \end{bmatrix}$$

Third, we average the solution values for each alternative we've identified thus far. Often abbreviated as "AVG," the term "average" describes the middle value.

$$AVERAGE = [AVG_Y]_{1Xr}$$

Where r= {1, 2, 3 …}, where AVG is the new matrix of size 1Xr.

$$AVG = \frac{\sum_{X=1}^{p} A_{XY}}{p}$$

The fourth step involves deriving the positive distance (PD) and negative distance (ND) from the average solution matrices, respectively, depending on whether the criteria are positive or negative. To the extent that a matrix is different from the mean in a positive way. Fifth, for each candidate, we compute a sum of positive distances (SSoP) and a sum of negative distances (SSoN), as shown. In which w represents the importance placed on a subset of the aforementioned r criteria.

$$SoP_X = \sum_{j=1}^{r} w_r PD_{XY}$$

$$SoN_X = \sum_{j=1}^{r} w_r ND_{XY}$$

Sixth, as shown in the figure, standardize the SoP (SSoP) and SoN (SSoN) values for all the preferred options.

$$SSoP_X = \frac{SoP_X}{\max_X SoP_X}$$

$$SSoN_X = 1 - \frac{SoN_X}{\max_X SoN_X}$$

The APS is then calculated for each of the finalized options in Step 7.

$$APS_X = \frac{1}{2}(SSoP_X + SSoN_X)$$

Where the values of APS_X will be $0 \le APS_X \le 1$.

Step 8: Rank the possibilities by arranging the appraisal score values from highest to lowest. Among all of the possible solutions, the one with the highest appraisal score is the one you should pick.

4. Results and Discussions

According to projections, road construction projects will be completed on time and under budget. In the transportation business, budgets and schedules are frequently modified at the eleventh hour. Possible effects of initiatives to improve public infrastructure include claims, cost overruns, and missed deadlines. Transportation projects frequently incur cost increases as a result of change orders. Disputes and confrontations can emerge over even the tiniest alterations to a construction project. This research's primary objective is to examine the reasons of claims, rework, and cost overruns. Several books and articles examine cost overruns and claims in civil construction projects, such as buildings, roads, tunnels, and hydropower or water infrastructure. In Iraq, study has been conducted on cost overruns, modification orders, and claims. Moreover, each location has specific hydrogeological and hydrochemical characteristics. The objective of the survey was to determine not only how frequently the hazards identified in this study occurred during the construction of various types of infrastructure, but also the consequences of their occurrence. The objective of the survey's questionnaire was to collect information that would enhance our comprehension of the factors and effects that practitioners encounter on a daily basis. The most pertinent comments were made by experts who are currently participating in Iraqi initiatives. This study aims to investigate the factors that contribute to the success of road pavement construction projects. The EDAS method was utilized to evaluate the smartphones accessible on the Indian market in order to identify the most effective smartphones from a variety of smartphones. The objective of this study is to determine which of the previously selected smartphones is the best. An impartial public survey was utilized to choose the study's variables. In which they ranked the aforementioned features as most important when acquiring a smartphone. The characteristics, which were then evaluated by specialists to decide the outcome.

4.1 Delphi Results

The Delphi method has been shown to be an effective and commonly used method in the field of information systems research for the purpose of determining and ranking the challenges associated with management decision-making. On the other hand, the vast majority of the previous Delphi investigations did not follow a method that was systematically designed. The Delphi procedure is frequently used by researchers when they are unable to employ alternative methods that produce higher levels of evidence because the information, they have access to is either insufficient or susceptible to some degree of doubt. The purpose of this activity is to uncover areas of consensus by compiling the knowledgeable opinions of a diverse group of participants and analyzing the results. The Delphi method has been used successfully for many years to find answers to research questions. This can be accomplished by selecting a point of view that is supported by an extremely strong majority of specialists in the relevant field. It offers the opportunity for reflection among the participants, who are able to modify and evaluate their perspective in light of the unnamed perspectives of others that were expressed throughout the session. This gives the participants the chance to reflect on what they have learned from the session. In order to correctly foresee the implications of potential future scenarios, calculate the probability of an event occurring, or arrive at a conclusion on a particular topic, the Delphi method requires the participation of specialists who have knowledge in construction costs. As a result, it will be possible for the specialists to take part in the survey. When determining how much money should be spent on the construction of a building, the application of the percentage scoring technique discussed earlier in this thesis was employed to calculate how much should be spent. The process of identification calls for the development of a comprehensive plan that is able to single out all of the aspects that are essential to the successful functioning of the building project.

4.1.1 First Round Delphi Method

The first round of Delphi method is to specify the successes group including evaluation of the successes effect in 10 deferent road construction projects. A professional evaluation is conducted by someone who has received training in accessibility techniques and is conversant with existing standards. Some of the principles will likely be used implicitly by the reviewer(s) in an expert evaluation; however, the reviewers will not explicitly assign problems to certain heuristics. Instead, they will rely on their expertise in UX design (and with interfaces that are similar) to help them spot issues. One legitimate argument against heuristic evaluations is that they place too much faith in the heuristics themselves and the reviewer's understanding of them. A heuristic evaluation's validity can be assured without requiring the reviewer to have any specific expertise. According to findings, Suitable location for the project is ranked as top of group 1 for success factor. Effective project planning & control and professional designer and contractors involvement are the immediate most significant success factors (Figure 1).

Fig. 1 - Success factors, group 1 of First Round Delphi Method

Figure 2 represents the 2nd group of success factor. In this group, controlling waste of resources in project implementation was identified as highest contributor to the success factor. Immediate important success factor was availability of required materials.

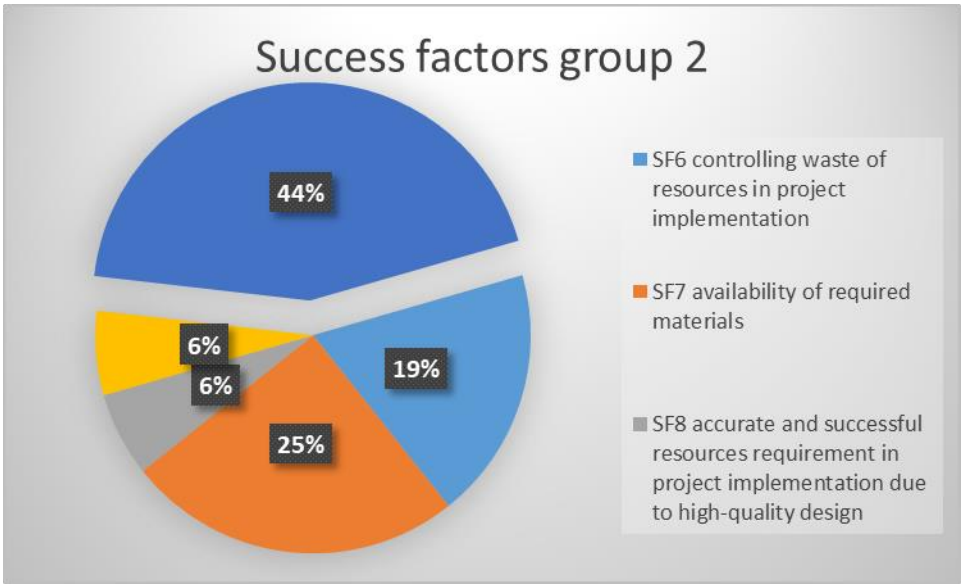

Fig. 2 - Success factors, group 2 of First Round Delphi Method

Figure 3 demonstrates the third group of success factor. In this group efficient site management and supervision was identified as highest contributor to the success factor. Immediate important success factor was efficient owners' financial situation and accurate materials delivery from supplier respectively.

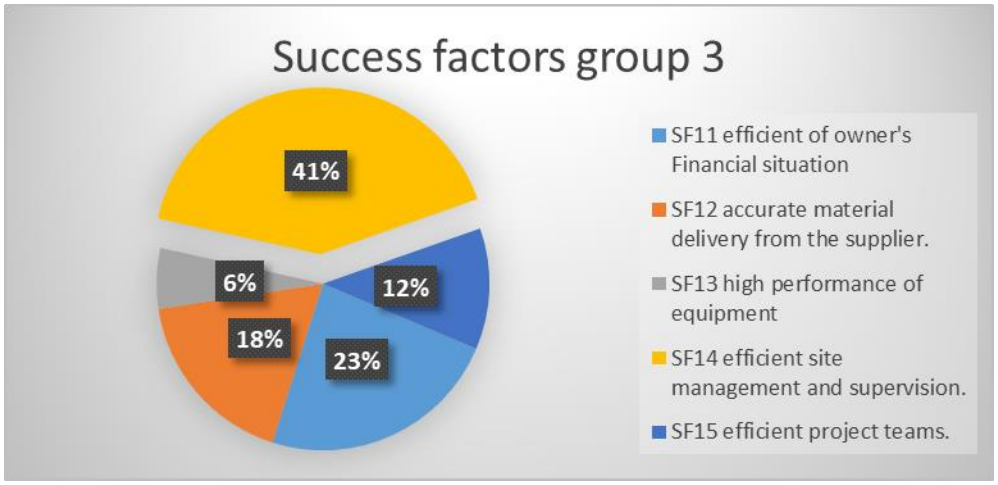

Fig. 3 - Success factors, group 3 of First Round Delphi Method

4.1.2 Second Round Delphi Method

The second round of Delphi method is to specify the groups of factors that can cause a fail in the road projects. these factors were 40 factors classify into six groups. The expert's evaluation of the frailer factors depends on 12 deferent road construction projects. Evaluators give detailed explanations of the ratings they assigned to each category of criteria. Each set of considerations is screened in advance by expert evaluators to identify any potential monetary concerns. All surveys and questionnaires for this review have to be completed online. There is no need for a separate signing session for this examination because it may be done over the phone. In theory, fifteen specialists are tasked with assessing each factor first. Experts who reviewed the ideas in question meet in a consensus group to compare notes on their separate assessments and settle on a final score and commentary. Following the group discussion, everyone agrees on a final score and the reasons behind those scores, as well as any dissenting opinions. It is the researcher's duty to ensure that the final conclusion is an accurate reflection of the group's consensus. In most cases, the debate happens in Iraq and involves professionals who were involved in the particular assessment. The results shown in the figures. According to results shown in figure 4 for failure factor in group 1, delay in approval of significant change in the scope of work was identified as most important factor that was around 60%. Immediate impactful factor was insufficient data collection and survey before design.

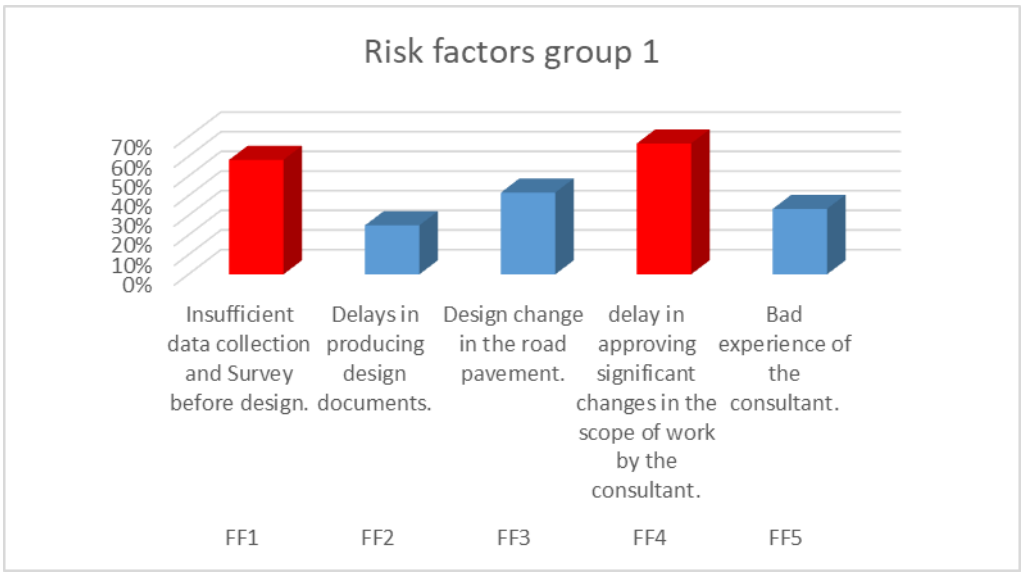

Fig. 4 - Failure factors, group 1 of second Round Delphi Method

Figure 5 shows the 2nd group of risk factor. In this group, most significant factor was hard coordination of geotechnical and soil/ground with a value of 60% impact. The immediate important factors were project scope creep with massive amount of change and lack of adequate information of the site respectively.

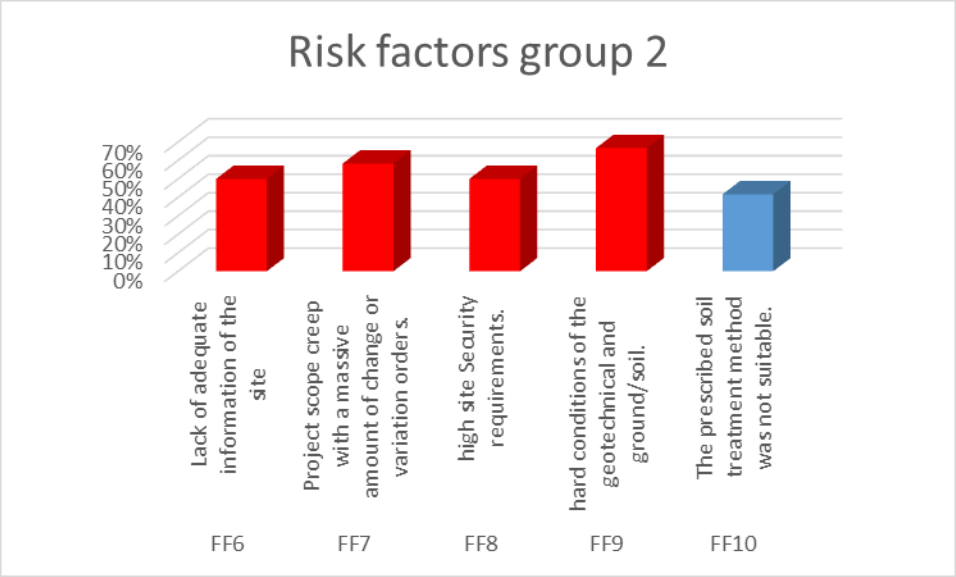

Fig. 5 - Failure factors, group 2 of second Round Delphi Method

Figure 6 shows the 3rd group of risk factor. In this group, most significant factor was poor site management and supervision with a value of 70% impact. The immediate important factor was incompetence of the project team.

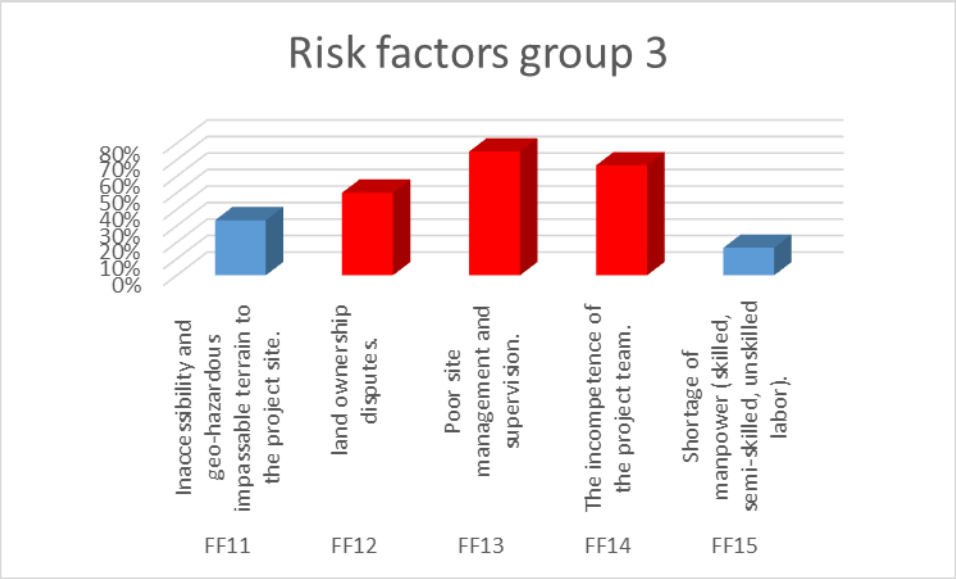

Fig. 6 - Failure factors, group 3 of second Round Delphi Method

Figure 7 demonstrate that low labor productivity and workplace accident were identified as most important factors. Immediate impactful factor was slow mobilization of resources.

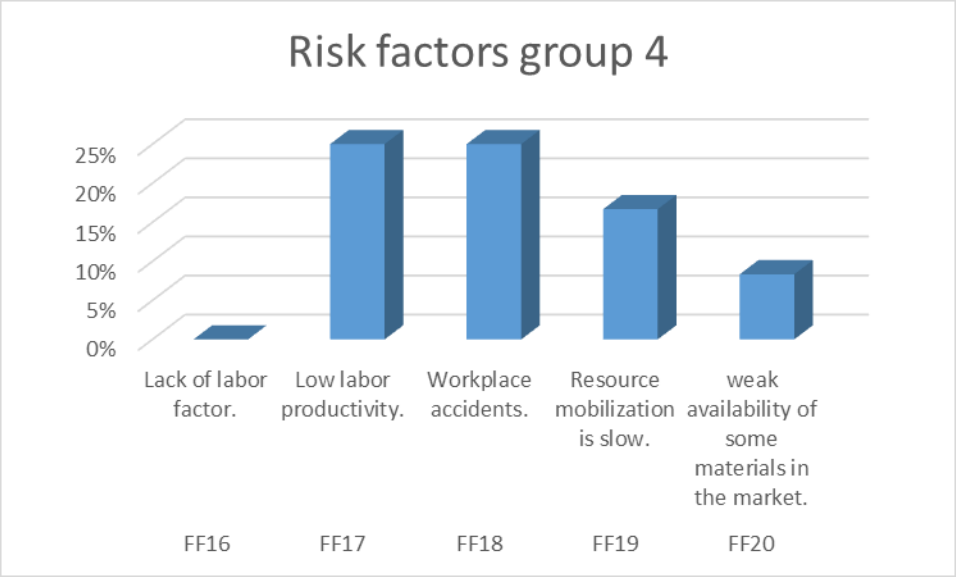

Fig. 7 - Failure factors, group 4 of second Round Delphi Method

Figure 8 represents the 5th group of failure factor. In this group, lack of optimal supervision was identified as highest contributor to the failure factor. Immediate important failure factor was contractors experience.

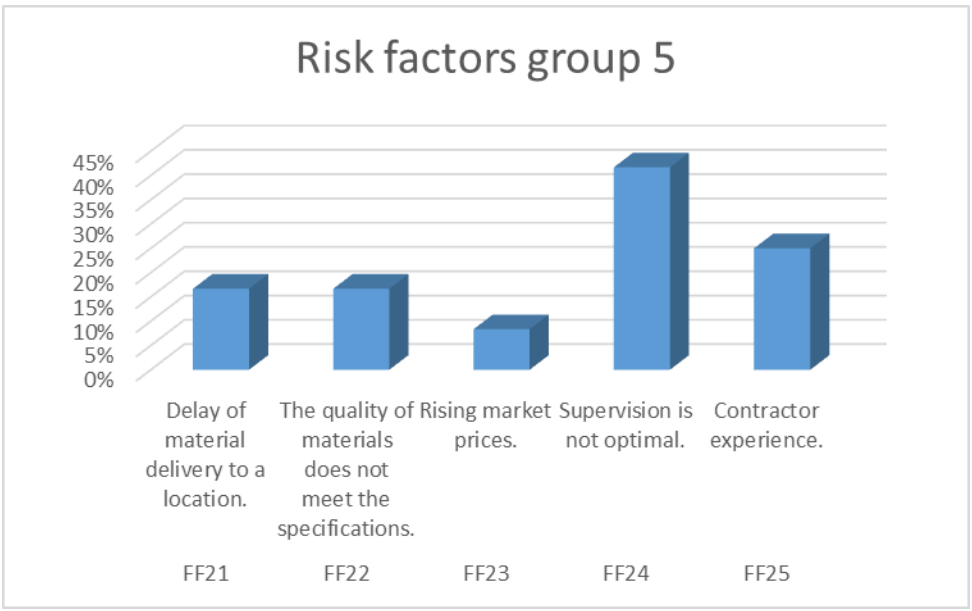

Fig. 8 - Failure factors, group 5 of second Round Delphi Method

Figure 9 shows the 6th group of risk factor. In this group, most significant factor was poor management in the field. The immediate important factors were slow decision making and lack of supervision subcontractor and suppliers.

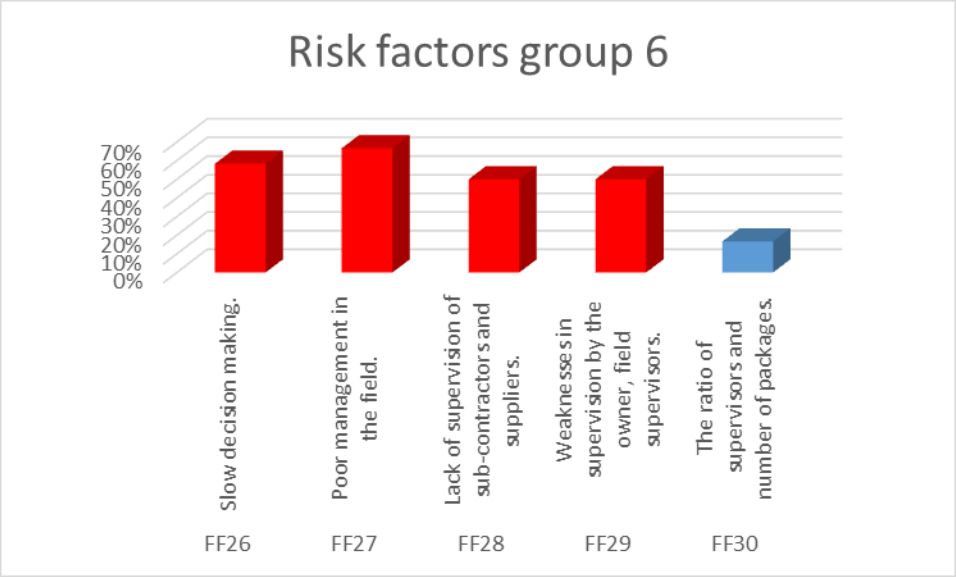

Fig. 9 - Failure factors, group 6 of second Round Delphi Method

Figure 10 represents the 7th group of failure factor. In this group, frequent equipment breakdown was identified as highest contributor to the failure factor. Immediate important failure factor was productivity of equipment.

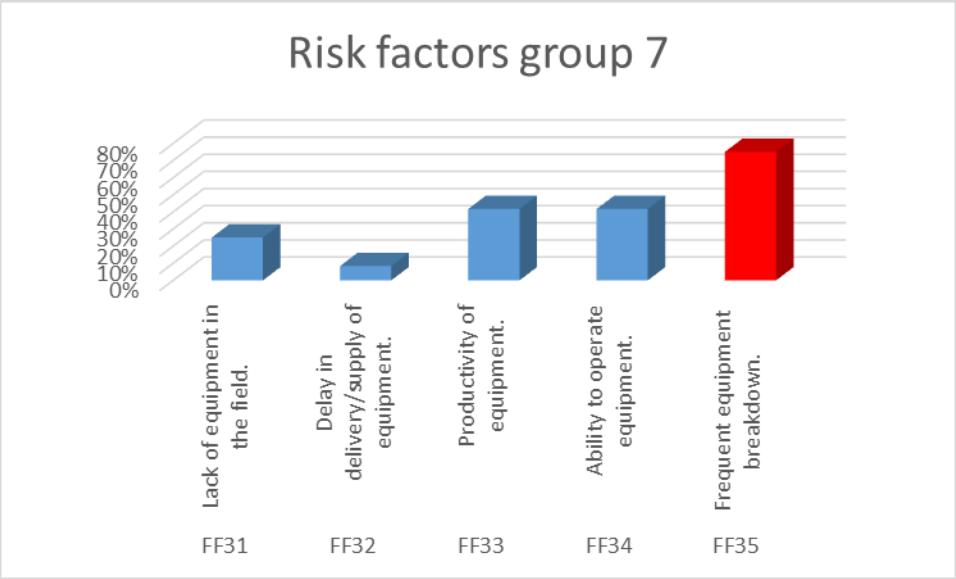

Fig. 10 - Failure factors, group 7 of second Round Delphi Method

Figure 11 presents the 8th group of risk factor. In this group, most significant factor was financial difficulties of the contractor with over 60%. The immediate important factors were political issues, late payment of work and mode of financing and payment for completed work.

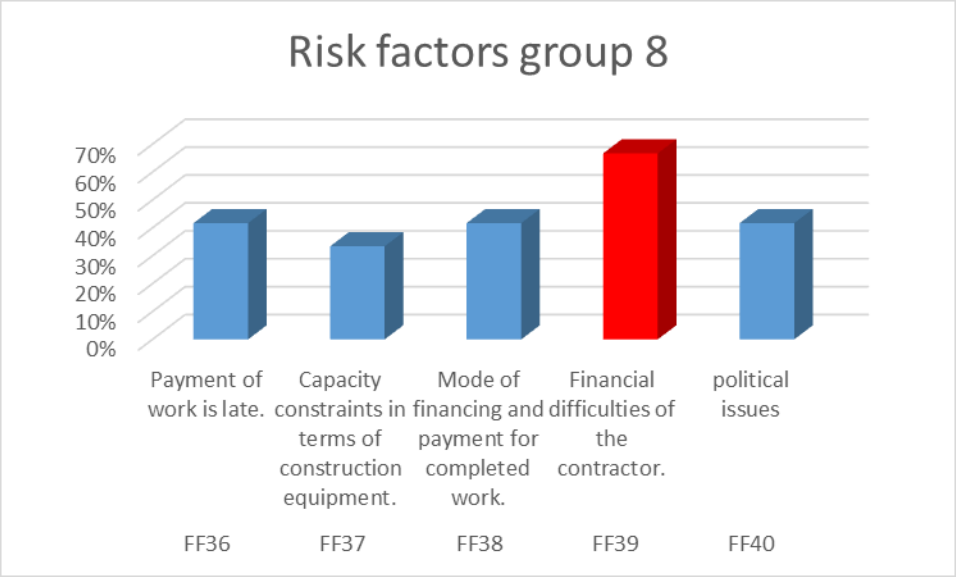

Fig. 11 - Failure factors, group 8 of second Round Delphi Method

The results show that the main effective failure factors in road construction were as in below.

According to findings, the highest possibilities of failure occurrence was poor site management and frequent equipment breakdown with 75%. The lowest impactful factors were lack of information from the consultant, high site security requirements, weakness in supervision by the owners and some others.

Table 1 - The results of probability of failure factors

Code of factor	Description	Probability of occurrence
FF1	Insufficient data collection and Survey before design.	58%
FF4	delay in approving significant changes in the scope of work by the consultant.	67%
FF6	Lack of adequate information from the consultant.	50%
FF7	Project scope creep with a massive amount of change or variation orders.	58%
FF8	high site Security requirements.	50%
FF9	hard conditions of the geotechnical and ground/soil.	67%
FF12	land ownership disputes.	50%
FF13	Poor site management and supervision.	75%
FF14	The incompetence of the project team.	67%
FF26	Slow decision making.	58%
FF27	Poor management in the field.	67%
FF28	Lack of supervision of sub-contractors and suppliers.	50%
FF29	Weaknesses in supervision by the owner, field supervisors.	50%
FF35	Frequent equipment breakdown.	75%

FF39	Financial difficulties of the contractor.	67%

4.2 EDAS Results

A number of road construction projects in Iraq were analyzed using the EDAS method to discover what contributed to their success or failure. In this section, we'll focus on what works. Independent public polling was used to select the variables for this study. This is what they considered to be the most important considerations. Using a suitable amount of time as the schedule's foundation, two hypotheses can be formulated to account for the unknown result of the project: likelihood and potential. Examining the causes of the delay is essential to resolving the problem. The most important conclusion to be drawn from this study is that numerous analytical approaches can be used to describe the aspect of road building and associated projects, hence facilitating the finding of the most effective application processes. It is impossible to exaggerate the significance of this, given the fundamental purpose of the study is to enhance and identify the most efficient methods currently applied for model construction and analysis. The degree of uncertainty in these variables influences whether or not the current methodologies for building roads with as few variables as feasible are effective.

4.2.1 Success Factors Group

The EDAS success factors group is the first step to detect the main success reason in road construction. According to finding it was observed that efficient site management and supervision was ranked number 1 as success factor. the most immediate factors were identified as professional designers and contractors and effective project planning and control respectively.

Table 2 - Success factors EDAS results

	EDAS Results	**Rank**
SF1	0.526	3
SF4	0.513	4
SF5	0.697	2
SF10	0.000	5
SF14	0.896	1

4.2.2 The EDAS Failure Factors

The EDAS failure factors group was the second step to detect the main success reason in road construction Table 3. According to the analysis findings were summarized as follows:

- The EDAS result of the first group is Bad experience of the consultant.
- The EDAS result of the 2nd group is high site Security requirements.
- The EDAS result of the 3rd group is Poor site management and supervision.
- The EDAS result of the 4th group is Poor management in the field.
- The EDAS result of the 5th group is Ability to operate equipment.
- The EDAS result of the 6th group is Capacity constraints in terms of construction equipment.

Table 3 - The failure factors EDAS results

Code Factor	**EDAS Results**	**Rank**	**Code Factor**	**EDAS Results**	**Rank**
FF1	0.653602	2	FF26	0.83153	2
FF2	0.407852	3	FF27	0.888937	1

FF3	0.344164	4	FF28	0.275653	3
FF4	0.169284	5	FF29	0.023219	5
FF5	0.997527	1	FF30	0.054744	4
FF6	0.925846	2	FF31	0.82679	2
FF7	0.10096	5	FF32	0.441571	3
FF8	0.939348	1	FF33	0.169607	5
FF9	0.444613	3	FF34	1	1
FF10	0.378932	4	FF35	0.263997	4
FF11	0.436695	4	FF36	0.322674	3
FF12	0.244884	5	FF37	0.847088	1
FF13	0.5	1	FF38	0.418622	2
FF14	0.477683	2	FF39	0.320071	4
FF15	0.459733	3	FF40	0.295619	5

In summary, the bad experience of the consultant, high site security requirements, poor site management and supervision, poor management in the field, ability to operate equipment, and bad experience of the consultant considered the main effective factors that can cause the fail in the road construction projects.

4. Conclusions

Studies and analyses of what makes road construction projects successful are essential. The length of time spent waiting can be cut down by taking advantage of some of the available options. This article takes a close look at delays from the viewpoint of road construction management, and it provides a thorough framework for delay management. Adaptive features, key criteria, information to lessen delays, and overall project procedures can all be found and prioritized with the help of this framework. A system for identifying and ranking road construction project delays using the EDAS technique was developed. The EDAS technique is used in a system management framework to look into and lower the number of anomalies that are found. The Ishikawa chart and the EDAS technique have both been validated for their ability to identify and rate both qualitative and quantitative threats. Think about how a road-building project could benefit from an adaptive management framework and how its structure could guide its implementation. To get there, we used these strategies and procedures:

- First, we examined the findings of two surveys, the opinions of infrastructure project specialists, interviews with those specialists, and exploratory research from prior studies to identify the components of successful factors and their consequences.
- The creation of EDAS models begins with the selection of an appropriate software application. The EDAS methodology relies on Microsoft Excel for its usability and ability to draw conclusions.
- Thirdly, the concept was evaluated in a scenario based on the road construction environment in Iraq.

According to EDAS, four out of five clients had a poor opinion of the consultant. Incompetent site administration and supervision, incompetent field management, incompetent equipment operation, and poor consultant experience were identified as most significant factors.

Acknowledgement

The authors would like to thank and acknowledge Department of Civil Engineering, Altınbaş University, Istanbul, Turkey for all kinds of support given.

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