Principle of resource allocation in engineering projects Principle of Resource Allocation in Engineering Projects and Project Scope Management.

By

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Abstract

Engineering projects require careful planning and resource allocation for successful completion. However, resource allocation can be a complex and challenging task, as it involves balancing project needs and constraints with available resources. This study aims to identify the main challenges that project managers face in allocating resources in engineering projects, as well as suggesting potential solutions to these challenges. By reviewing the literature and analyzing case studies, this paper provides a comprehensive overview of key issues and potential strategies for effective resource allocation in engineering projects. The results of this study can be used by project managers to improve the efficiency and effectiveness of resource allocation in their own projects, by reviewing previous studies on project management and resource allocation in engineering projects, the researcher recommends identifying the main factors affecting resource allocation in engineering projects, such as project scope, budget schedule and team size. Consider how these factors interact and how they might be prioritized in different situations.

Keywords : resource allocation, engineering projects, project scope management.

Introduction:

Engineering project management is an important aspect of the engineering profession, as it involves planning, coordinating and controlling the various technical and non-technical activities of a project to achieve its objectives. However , engineering projects also face a variety of challenges that can affect their success. These challenges can range from technical complexities and resource constraints to stakeholder expectations and regulatory requirements.

In this research, we aim to identify and analyze the various challenges that engineering project managers face in executing their projects. We will review existing literature on this topic and draw on case studies and best practices from the engineering industry to provide a comprehensive overview of the challenges faced by engineering project managers. By understanding these challenges, we hope to provide insights and recommendations to improve the effectiveness of engineering project management.

Engineering project management involves planning, coordinating and executing projects in the field of engineering. These projects can range from creating infrastructure to designing and developing new technologies. However, the engineering project management process is not without challenges.

One of the main challenges in managing engineering projects is managing technical risks. These risks can include design uncertainties , unexpected technical problems , and problems with the performance of equipment or materials. To mitigate these risks, it is important for project managers to have a thorough understanding of the technical aspects of the project and to constantly monitor and evaluate potential risks.

Another challenge is stakeholder management. Engineering projects often have a large number of stakeholders, including clients, contractors, and regulatory agencies. Managing the expectations and concerns of these stakeholders can be a huge challenge for project managers. To meet this challenge, effective communication and collaboration is crucial.

The third challenge is managing resources, including people, materials and equipment. Ensuring that the necessary resources are available and allocated efficiently is critical to the successful completion of an engineering project .This can be particularly difficult when working on large scale projects with tight deadlines.

Finally ,engineering project management can also be challenged by the need to meet regulatory and compliance requirements. These requirements can vary depending on the location and nature of the project, and failure to meet them can lead to significant delays or even termination of the project.

To meet these challenges, it is important for engineering project managers to have strong leadership, communication and problem-solving skills, as well as a thorough understanding of the technical aspects of a project. In addition, the use of project management tools, such as project scheduling software and risk management software, can help mitigate some of these challenges.

the study Problem:

One of the main challenges engineering project managers face is the successful implementation of projects within budget and on schedule, while meeting technical and quality requirements. However , engineering projects also face a variety of other challenges that can affect their success ,such as:

- Complex technical requirements and uncertainties
- Resource constraints and competing priorities
- Stakeholder expectations and conflicts
- Regulatory and compliance issues
- Managing risks and unexpected events

Despite the importance of these challenges, there is limited research on their impact on engineering project management and how to address them effectively. The current literature is fragmentary and often focuses on specific challenges or industries, rather than providing a comprehensive

overview of the challenges faced by engineering project managers in general.

To address this gap in the literature, our research aims to identify and analyze the different challenges faced by engineering project managers in executing their projects. We will review existing literature on this topic and draw on case studies and best practices from the engineering industry to provide a comprehensive overview of the challenges faced by engineering project managers. Our research will contribute to understanding these challenges and provide insights and recommendations to improve the effectiveness of engineering project management.

the importance of studying:

Managing engineering projects can be challenging due to a variety of factors, including the need to balance technical considerations with financial, logistical, and stakeholder constraints. Detailed scholarly research on this topic can provide valuable insights and recommendations for improving project management in the field of engineering.

Some potential benefits of this research study may include:

- Identify common challenges faced by engineering project managers , and develop strategies to address these challenges.
- Improving the efficiency and effectiveness of engineering project management processes, leading to cost savings and increased project success rates.
- engineering projects , which can be disseminated to practitioners in this field.
- Provide a basis for further research and development in the field of engineering project management.

There have been many previous studies on the challenges of managing engineering projects. Here are some examples of these studies:

- A study of the challenges faced by project managers in engineering organizations VK Arora and RP Singh)International Journal of Project Management, 2002.(
- "Challenges of Project Management in Engineering and Construction ",a study by Slater and R.G. Shenhar)Journal of Management in Engineering, 2002.(
- "Engineering Project Management: A Review" in the study of Al-Sultan and JE Meredith)International Journal of Project Management, 1991.(
- "Challenges and Solutions for Project Management in Engineering and Construction" by Lui and Wong)Journal of Management in Engineering, 2008.(

Theoretical framework:

The study of engineering project management involves understanding the various processes, tools, and techniques used to plan, implement, and deliver engineering projects within budget, scope, and schedule constraints .Many factors can affect the success of engineering projects, including the complexity of the project, the level of uncertainty, the level of stakeholder involvement, and the level of resource constraints.

To understand the different engineering solutions that can be applied to engineering project management, it is helpful to review previous research in this field. Some of the basic theories and concepts studied in the field of engineering project management include:

- **Project life cycle :**This refers to the series of stages a project goes through from concept to completion. Understanding the project life cycle can help project managers plan and implement projects more effectively.
- **Project management methodologies :**There are many different project management methodologies that can be applied to

engineering projects, including agile ,agile, and waterfall. Each methodology has its own set of principles ,processes, and tools that can be used to plan and implement projects.

- **Risk Management :**Engineering projects often involve a high level of uncertainty and risk. Effective risk management involves identifying ,analyzing and mitigating potential project risks.
- **Stakeholder management :**Engineering projects often involve many stakeholders with different interests and goals. Effective stakeholder management involves engaging with stakeholders, understanding their needs and concerns, and managing their expectations throughout the project.
- **Resource Management :**Managing resources effectively is critical to the success of engineering projects. This includes managing human resources ,financial resources, and physical resources such as equipment and materials.

Engineering project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements (PMI .2017), However , engineering projects often face many challenges that can affect their successful completion. These challenges can be grouped into three categories: organizational, technical, and external (Kerzner , .(2013

Organizational challenges refer to issues within the organization that can affect a project, such as poor communication ,insufficient resources, and lack of clear roles and responsibilities (Gido & Clements .2014).

Technical challenges refer to the complexity and uncertainty of the project itself, such as changes in technology, requirements ,or regulations (Kerzner, 2013).

External challenges refer to external factors that can affect the project, such as changes in market conditions, competition, and regulatory environment (Gido & Clements, 2014).

Previous studies:

Numerous studies have identified and analyzed the challenges of managing engineering projects. For example ,Gido and Clements (2014) conducted a study on the challenges faced by engineering and construction firms and found that the top challenges included project scope changes, budget and schedule overruns, and quality issues.

Kerzner (2013) conducted a study on the most common challenges faced by engineering project managers and found that the top challenges included meeting project deadlines , managing project costs, and dealing with changes in project requirements.

In a study of the challenges faced by engineering and construction firms in the Middle East ,Al- Hejji and Dawood (2015)found that the main challenges included project scope changes , schedule delays, and cost overruns.

Abdi and Hayasat (2016) Study entitled" Can Lean Construction Improve Project Performance in Jordan"

The construction sector in Jordan faces many challenges in terms of production losses and low productivity. Lean Construction Technologies is an innovative approach to managing construction operations. It has proven its effectiveness in various construction projects in many countries. The aim of this research is to verify the level of awareness and appreciation of the construction techniques with limited losses in construction projects in Jordan and to discover the ability of the tools and techniques of this system to improve the level of project performance. In order to achieve the objectives of the research, 348 questionnaires were collected and 35 interviews were conducted with experts in the construction sector. The study was applied to first- and second-class contracting companies and consulting engineering offices. The study revealed that only approximately 37% of those who applied the research have knowledge in these technologies, but most of those surveyed have a high desire to implement them in the near future .Moreover, the research has shown some of the tools and techniques of this system most used in Jordan such as: value management and analysis, employee engagement, total quality management, visual management and

process redesign .In addition, after analyzing the data, it was found that the construction techniques with limited losses can improve the performance of construction projects in many dimensions, and the dimension most affected by this system is the results of improving performance and feedback. The results of this research can be used as a starting point in understanding and implementing lean construction techniques on a larger scale in the construction sector and as an encouragement for more research on the use of new project management techniques aimed at improving the performance of construction projects.

Darwish (2018) study entitled "Arbitration in Engineering Contract Disputes According to FIDIC Rules Fidic .

In practice, the construction and building sector ,whether in Egypt or the Kingdom of Saudi Arabia, is still witnessing a great recovery over the past years, whether in the volume of financial investments ,or in the emergence of giant companies, which led to the emergence of disputes in engineering contracts between different parties, as a result of conflicts of interest, which leads to halting of engineering projects; Therefore, most engineering contracts include clear clauses on how to resolve disputes between different parties amicably, and arbitration is one of the best options for resolving these disputes due to its many advantages based on the FIDIC contracts issued by the International Federation of Consulting Engineers as models acceptable to contractors and business owners. In view of the ease of the procedures followed in considering the subject matter of the dispute, the speed of adjudication by a judgment that ends the dispute, as well as the specialization, experience and competence of the arbitrator in engineering work, and finally the emergence of a new system, the Dispute Settlement Council, which showed high efficiency in settling many disputes at the lowest financial costs, In the shortest period of time and within the framework of complete neutrality.

Sadat (2018) study entitled" Legal Aspects of International Construction Contracts: An Analytical Study in the Specificity of Dispute Settlement Mechanisms in FIDIC Contracts"

Our research came as a complement to our research) Commitment to Ensure Food Safety and Quality" A Critical Study of Consumer Protection

in UAE Law ,("in which we dealt with a statement of the original obligations of the supplier in ensuring food safety, followed by subsidiary obligations, and then moved on to the problems of responsibility of the supplier with the obligation to ensure safety in the law Federal No. 24 of ,2006and Federal Law No. 7 of 2011 amending it, and in Cabinet Resolution No 12 .regarding the executive regulations of Law No. 24 of 2006 issued on March 2007 ,29 AD, and in Cabinet Resolution No. 1 issued on 13/1/2014 regarding The rules and conditions for reconciliation in violations committed in violation of Federal Law No. 24 of 2006, Ministerial Resolution No. 332 of 2009, and relevant federal laws, namely the Civil Transactions Law, the Penal Code, the Criminal Procedures Law, the Civil Procedures Law, and the rulings of the Federal Supreme Court, in two chapters The first included two demands, and the second included three demands. The researcher relied on his personal consideration and diligence in explaining the dimensions of consumer protection in the texts of consumer protection articles, adopting the method of analyzing the texts, opposing them to each other in order to reach a picture of their compatibility ,removing their contradictions, removing the ambiguity surrounding some of them ,and expressing an opinion on what he sees as a legislative deficiency or shortcoming in it. The goal is to protect, and the second research included thirteen problems that were diagnosed with proposed solutions according to the meaning we mentioned above, then we presented the results of the research, and the researcher made seven recommendations that he deems sufficient to develop Law 24 of 2006 regarding consumer protection, especially in the field of the supplier's commitment to ensuring safety Food and its quality.

The study of Baqer et al . (2020). titled The impact of risk management in managing engineering projects: the mediating role of organizational culture in the Public Authority for Roads and Land Transport in the State of Kuwait.

The current study aimed to identify the impact of risk management in its dimensions: technical risk management, logistical risk management, financial risk management , human resources risk management, social and political risk management and environmental risk management on

engineering project management in its dimensions: cost, quality, time and scope, through The mediating role of organizational culture in the Public Authority for Roads and Land Transport in the State of Kuwait. To achieve the objectives of the study, the analytical descriptive approach was relied upon, by designing a questionnaire and distributing it to the study sample. They are the engineers and technicians working in the Public Authority for Roads and Land Transport in the State of Kuwait through the use of simple random sampling technique. The number of questionnaires distributed electronically was (220), while the number of questionnaires retrieved and valid for analysis was (160), representing %72.72 of the total distributed questionnaires. In order to analyze the data of the study, descriptive statistics represented by frequencies, percentages, and arithmetic averages were used. Simple and multiple linear regression analysis was also used, in addition to using the Partial Least Squares Structural Equation Modeling) PLS-SEM (program to analyze and test hypotheses. The current study reached a number of results, the most important of which are: the existence of a statistically significant effect of risk management in its combined dimensions on the management of engineering projects in its combined dimensions in the Public Authority for Roads and Land Transportation in the State of Kuwait, and the existence of a statistically significant effect of risk management in its combined dimensions in organizational culture . And the existence of a statistically significant effect of the organizational culture in the management of engineering projects with their combined dimensions in the Public Authority for Roads and Land Transport in the State of Kuwait. It was also found that there is a partial statistically significant effect of risk management in terms of its combined dimensions. Engineering projects management in terms of its combined dimensions across organizational culture as a mediating variable in the Public Authority for Roads and Land Transport in the State of Kuwait. In light of the results of the current study, the researcher recommends a number of recommendations, the most important of which are: Establishing electronic systems for monitoring and evaluating the equipment and tools used in the project and linking them with the quality control department to ensure

permanent compliance with the standards and standards followed. Reducing risks related to the supply chain by recognizing, evaluating, mitigating and controlling unexpected events and conditions, and preparing for their negative impact on any part of the supply chain during project performance, by developing programs to track risks and linking them with electronic project management programs such as Primaver program Linking the KIMS payments program used In the Public Authority for Roads and Land Transport in the Audit and Financial Management Bureau to avoid the occurrence of any inaccurate operations and to increase the level of internal and external control. Building an information base that includes most of the risks facing engineering projects at all stages of the project life, and the most important requirements for implementing risk management of engineering projects in the Public Authority for Roads and Land Transportation in the State of Kuwait, and how to address and avoid risks.

Amer (2022) study entitled" Carbon Concrete - Creative Building Material: Its Characteristics and Performance Indicators in Reinforcing Structures Elements"

Since the beginning of this century, construction and restoration processes have developed rapidly. This development coincided with the tendency of researchers to develop and discover new building materials that meet the aspirations and needs of those interested in all engineering fields . One of the most important building materials that has been discovered and is currently being developed is carbon concrete ,in which carbon is used as reinforcement instead of steel that has been used so far as reinforcement. Due to the many advantages of carbon concrete when used in the implementation of new facilities or in the repair, strengthening and strengthening of existing buildings, this innovative material will replace traditional reinforced concrete in the near future. This research aims to shed light on carbon concrete and present the latest findings of scientific research on this material and its production and use techniques, whether in modern buildings under construction or in existing buildings for the purpose of repair and rehabilitation. It also aims in the experimental part to study the effects of reinforcement using carbon concrete on the behavior of the

implemented concrete elements (such as column elements) by changing many parameters. This research paper presents the properties and components of carbon concrete, its manufacturing methods and fields of use, in addition to the advantages and disadvantages of the new carbon concrete through a brief overview in order to introduce this innovative building material in the Arab sector and encourage its use as an alternative to reinforced concrete. However, there is still a great need for scientific research into the details of carbon concrete. Only then can unified overall concepts be introduced for their practical use and ,above all, the code to follow when using them.

Recommendations:

By reviewing previous studies on project management and resource allocation in engineering projects, the study recommends the following:

- Identify key factors affecting resource allocation in engineering projects, such as project scope, budget, schedule ,and team size. Consider how these factors interact and how they might be prioritized in different situations.
- Carry out a systematic development of studies, such as a case study or a practitioner survey. This will help you collect data and analyze the resource allocation process in a systematic way.
- Consider using tools and techniques to allocate resources, such as Gantt charts, critical path analysis, or earned value management. This can help you visualize and optimize resource allocation across different tasks and phases of a project.
- Take into account the potential ethical implications of resource allocation in engineering projects. For example, how might resource allocation decisions affect the safety and well-being of project team members or project stakeholders?

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