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SUSTAINABLE NATURAL RESOURCES EFFECT ON CONSTRUCTION PROJECTS PERFORMANCE

Zakaria ALJANABI

Master's Thesis

Supervisor

Assoc.Prof. Dr. Sepanta NAİMİ

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The thesis titled SUSTAINABLE NATURAL RESOURCES EFFECT ON CONSTRUCTION PROJECTS PERFORMANCE prepared by ZAKARIA ALJANABI and submitted on 14/04/2023 has been **accepted unanimously** for the degree of Master of Science in Civil Engineering

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ABSTRACT

SUSTAINABLE NATURAL RESOURCES EFFECT ON CONSTRUCTION PROJECTS PERFORMANCE

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Economic growth of construction projects considered one of the many challenges that management representation. The lack of a unified understanding of the various types of building materials and their characteristics presents the biggest challenge to the Iraqi housing industry. Containing a set of defining characteristics. To that end, our research revealed the many factors, including cost and sustainability, that influence the final price tag of building projects. The primary obstacle confronted by this investigation is an automatic selection method's application to sustainable natural resources principles in residential building projects. The research methodology relies on three steps; the first is interviewing area experts to gather background information. The attributes of materials are ranked using the second technique. Third, there's WASPAS, which is the method of cost calculation. The research concluded that using the CPI representation for project predictions yields a considerable improvement in project shift costs. Performance data and test results showed that the existing method maintained a steady equilibrium in the evaluation of project processes. The expert thinks these are really important findings.

Keywords: WASPAS, Sustainable Materials, CPI, BIM, Resources Effect.

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ABBREVIATIONS

BIM	:	Building Information Modeling
CAD	:	Computer Aided Design
AI	:	Artificial Intelligence
MCDM	:	Multi-Criteria Decision-Making
WASPAS	:	The Weighted Aggregated Sum Product Assessment
NDM	:	Normalized Decision Matrix
WPM	:	Weights of The Criteria of The Decision-Maker
Qi	:	Performance Index
σ	:	Standard deviation

1. INTRODUCTION

1.1 OVERVIEW

Conserving resources means getting more done with less resources. To maximize benefits to present generations while preserving the ability to satisfy their requirements in the future, human use of natural resources must be managed. The idea has grown to be a crucial topic in discussions about sustainable development. Many academics have noted that certain resources are becoming very scarce, and that using the supplies that are still available requires caution. The author demanded that rare materials be replaced with less rare or renewable ones [1].

The underlying assumption is that greater productivity is necessary to lessen the effect on the capacity of natural systems to absorb waste and energy. Since the construction sector uses so many natural resources, increasing resource efficiency is a major focus of many of the initiatives designed to produce ecologically friendly structures. Resources are used more efficiently when waste is minimized during building construction and when opportunities for recycling and reusing building materials are created. Demands for greater resource efficiency have been sparked by worries about the depletion of nonrenewable natural resources. Conserving nonrenewable resources is essential for a sustainable future since energy, water, materials, and land are nonrenewable resources that are essential to construction projects. Figure 1.1 [2] illustrates how some design principles and approaches result from resource conservation. Sustainability generally refers to the use of natural resources in a manner that ensures their development and transmission to future generations without causing them to deteriorate, run out, or become unrenewable. From this vantage point, sustainability seems to be a concept that has been used in our time in every field, from energy usage to industrial planning to architectural design. By preserving the built and natural environments and maintaining the continuity of human and natural resource use, sustainability aims to ensure that future generations will be able to exist. In addition, sustainability is a multifaceted system that aims to enhance everyone's quality of life by enhancing the conditions of the underprivileged, creating meaningful connections between individuals by highlighting cooperation and social benefit, and reshaping the economy based on these natural resources [3].

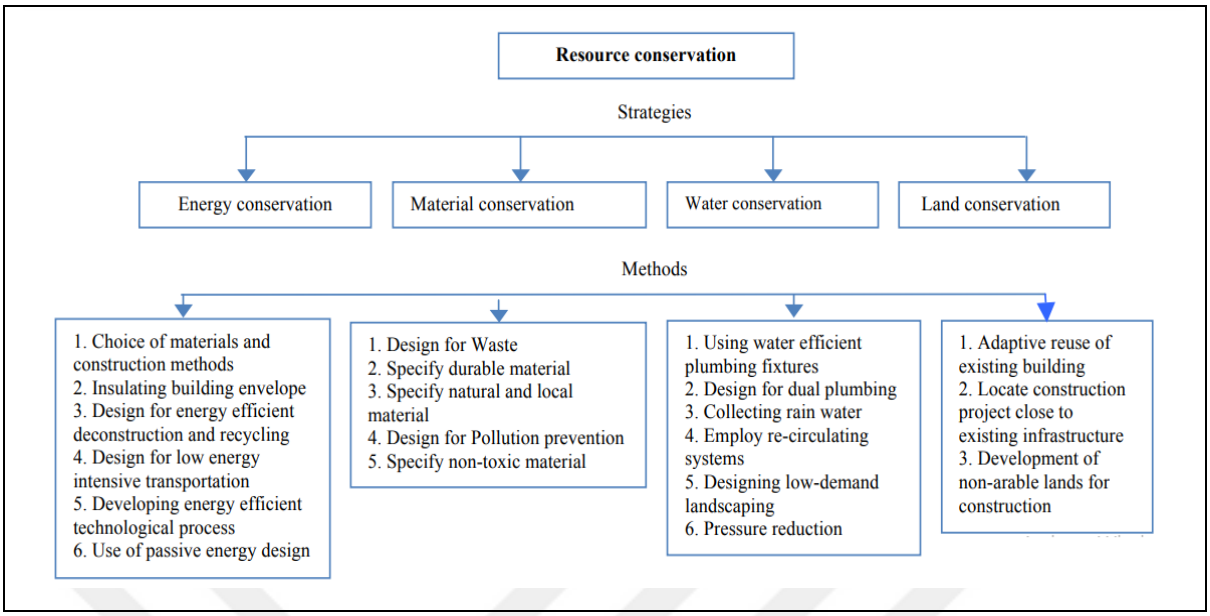

Figure 1.1: Strategies and Methods To Achieve Resource Conservation [2].

Fundamentally, the idea seeks to establish a balance between people, time, and place, or, to put it another way, an equal division of world resources among all nations, all forms of life, and future generations. Sustainability is maintaining our present standard of life while making continuous improvement based only on our consumption habits. This development's long-term survival is also dependent on universal solidarity, democratic distribution, and equity. The sustainable development model, which aims for environmental management, social responsibility, and economic solutions by rejecting the consumer society [4], so proposes a comprehensive perspective of development. According to this viewpoint, the three main aspects or dimensions of sustainability are environmental, economic, and social sustainability. A balanced and ongoing mix of environmental, economic, and social elements may lead to sustainable development. Social sustainability is seen as a need for economic sustainability since ecological and social sustainability cannot exist without economic sustainability. These three elements should be seen as inseparable parts of a whole due to their total interconnection [5].

1.2 BUILDING INFORMATION MODELING

BIM, on the other hand, takes the opposite approach. It centralizes all data in a single database and correlates all data with certain objects (building and building components). As a result, the BIM model is a centralized database model with intelligent data association. Furthermore, the centralized architecture makes cooperation between various disciplines possible (BIM interoperability). Building Information Modeling Structure Information Modeling, or BIM, is a digital model of a building that includes digital copies of the real building sections and components used during construction. Engineers can complete a virtual simulation of the full structure before construction begins by using architectural elements, systems, parts, and components that have the same qualities as the real building. BIM also covers the whole life cycle of a structure, including design, construction, operation, and maintenance [6]. Traditional tools (such as CAD) on the other hand, as indicated in figure 1.2 [7], require more traditional modes of communication between the various parties.

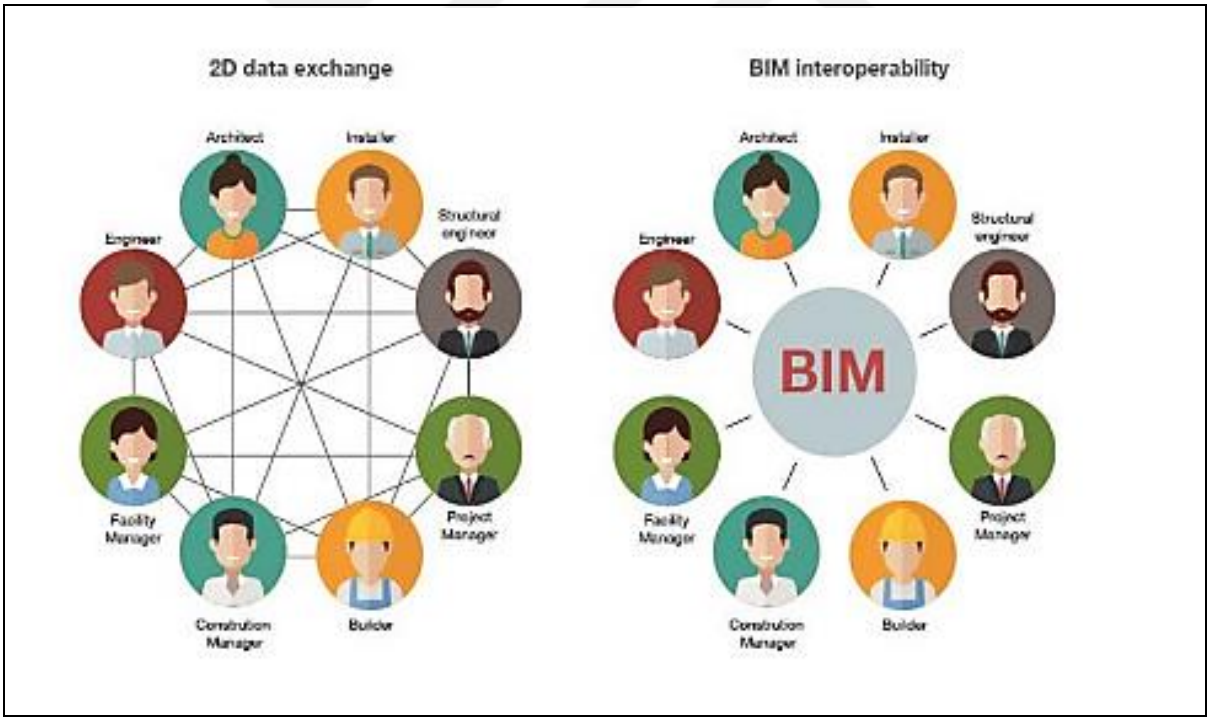

Figure 1.2: 2D Data Exchange in Comparison With BIM Interoperability.

Various BIM applications are used during the creation and lifespan of a building. These applications deal with different aspects of BIM technology and how it is deployed. The following are just a few of the BIM applications that may be linked to each stage of the development process, including design, planning, and construction [8].

1.3 PROBLEM STATEMENT

Tall constructions are becoming a major concern in all nations throughout the world as urbanization and population grow. Natural and different structures are plainly visible, in addition to technical aesthetic and functional changes over time. The study's main purpose was to spot trends and future generations, and it was influenced by the Chicago Style, which is often considered to be the first architectural style [9]. In terms of aesthetics and structure, as well as performance-oriented long-term building, several styles have evolved. By studying school and architectural styles throughout the development process, architects, engineers, and planners may employ architectural design to raise these types of facilities. If the incidents are not adequately handled, they will have a negative impact on the organization, such as a loss of goodwill, income, or additional expenditures for construction, operation, or maintenance delays. An adequate safety margin must be established to assure the building project's safety [10]. All considerations must be considered in order to provide the highest possible safety margin for construction projects. The design and execution of site investigations are influenced by all aspects in construction project considerations. The most challenging aspect of this study is determining the optimal method for managing construction projects and identifying project impediments.

1.4 OBJECTIVE OF STUDY

The goal of this study is to look into the impact of sustainable natural resources on management and to use an independent state-of-the-art approach to enhance the quality of all activities while reducing project costs and time.

1.5 THESIS ORGANIZATION

There are five chapters in this thesis. In the first chapter, you'll learn about building projects. In addition to the problem statements and objectives, it discusses the background of this field and the main concept of building projects.

The second chapter gives a broad overview of the effects of building projects, based on studies gathered from various studies.

In Chapter three, the solution technique program is presented, which includes the studied parameters, work methodology, and risk element effectiveness testing.

The work's result and calculation are discussed in Chapter 4. The fifth chapter is the final chapter

2. LITERATURE REVIEW

2.1 INTRODUCTION

Reuse is an exercise that's also gaining popularity due to its positive impacts on the natural surroundings while also improving the economy. Similarly, as the Life Cycle Assessment approach emphasizes, recycling is not new in the construction industry. As a result, (Building after which Demolition) end up wasting retrieval has reached significant taxes at the moment, at at least in Europe; however, greatest recovered funds are used for lower housing effort, such as satiating excavations as well as roads, and thus it is necessary to improve the quality, not just the amount, of composting. Waste from construction and demolition. This scenario is influenced by a number of factors. Between many them, the following are currently of involvement: the initial resources which compose Building then Destruction waste, this same original construction methods, the expense of left-over treatments, insufficient research then implementation of therapeutic approaches in the building suburb, an absence of preparation of a entertainers associated with the building process, and the obscurity of laws [1].

It is also important to remember that the exact sustainability principles in resource upkeep that advocate for recycling also advocate for the composting of existing structures for as as long as possible, throughout order to promote land preservation and reduce waste generation. This entails repeatedly assuming responsibility for construction work on existing buildings over time, each time producing a certain amount of construction then destruction waste, while destruction is advantageously postponed for centuries. It follows that a more collaborative effort is required to improve recovery and recycling, both on- and off-site. As lengthy as composting in construction also isn't supported by a strong after which thorough eyesight that reflects the entire project value chain, it remains weak and constantly under the impact of construction companies of building supplies who promote their goods as sustainable because they contain a portion of recycled waste. This really is promising throughout sequence, but it isn't sufficient nor constantly viable [2].

Regarding the original components that constitute waste, another of the most significant issues for high-value recycling is associated to an original structure method: if it requires wet processes, such as huge walls of bricks and mortar, selective demolition unraveling the basic materials increases costs and takes time. As a result, the benefit of waste collected after nonselective demolition is plummeting and even zooming for the manufacture of second raw materials unless it is exposed to adequate based intervention with related prices, favoring its terminus as low value physiological (usually cost - sharing) for building works. Even though dry construction techniques seem to be originally rummage-sale, basic materials and components can be gathered more easily and effectively and redirected to repurpose. Even so, for just a variety of reasons, they are frequently directed towards rudimentary reuse treatment methods, such as steel, wood, glass, and PVC, instead of experiencing maintenance and adjustment processes that can make them useable in similar or other construction places as secondary materials and components, including such struts, window frames, and ceramic tile [3].

Treatment systems are too crucial for recovering recyclable materials, both financially and in terms of innovations that can generate second raw building materials. Numerous residual recycling activity processes, such as pliable or tires, are studied and put in place outside the building sector; occasionally, they help produce construction materials, such as recycled polymer elements for constructing skulk rooms or reprocessed neoprene agglomerates for composites. In the meantime, legislation has begun to establish the obligation to adhere to a certain fraction of reclaimed materials used for construction products, as a minimum least for national expenditure. This is rising producers' devotion to the implementation of novel operations and maintenance technologies for left-over treatment procedures in the construction subdivision, which is also helping to reduce the expense of products that would otherwise be higher than the cost of raw materials. Even so, research and implementation of action processes in the construction sector feel unsatisfied, as they are absorbed primarily by legislative supplies and producer interests rather than, or in addition to, what is most effectively desired on construction sites. This is demonstrated by research and production labors that, despite being important in terms of environmental, remain quite contained and the under [4].

Types of usual resource [5]:

a. The Earth (wind, attractive, kinetic, gravitational, as well as electrical forces)

b. Solar irradiance (for sustaining life, growing crops, astral and thermal power)

c. The weather (for agriculture, sustaining lifetime)

d. Water (seas, river systems, lakes, scenic, glaciers, and other bodies of water) for survival

e. Air (then its constituent gases) for life support f) Geothermal energy (basis of heat)

f. Wildlife

g. Metals and mineral deposits (iron, copper, diamond, petroleum) (marine- and earthly - based life)

h. Forests and other vegetation (enjoyment, source of food, timber)

i. Beautiful natural areas (mountains, heaths , Savannah, tundra and other types of land).

j. Individuals (labour then populations).

2.2 ELEMENTS OF CONSTRUCTION PROJECT RESOURCES

This project considers the next resources primarily for the total of the countries in footings of geographical attention [6]:

a. Substances in use in construction, such as metals, minerals, real as well as wood (wooden);

b. Energy (embodied) and associated emissions - this is energy used in the harvesting of components, production of construction products, this same construction stage on its own, construction and demolition, but just not power rummage-sale straight throughout the utilization.

c. Liquid - this is related to the packed cycle, but mainly to the use of water in structures. However, after a thorough examination of existing data, quantifications of embodied water were ruled out.

d. Land - by land, we mean the direct use of land.

2.3 RESOURCE CONSERVATION

Trying to move to much more sustainable building design has been understood as a comprehensive concept aimed at reducing resource use and limiting ecological impact after building structures throughout their lifespan - from material removal to be used in the construction phase, finished resource use throughout tenancy and upkeep, to resource recovery at demolition [7].

Construction resource use is initially unspoken as the density (typically verbalized in bodily units) of stockpile inputs Furthermore, it is too well understood to cover marginally outputs posing a weight on the natural basin functions emissions, quantity of waste generated. The environmental costs are excluded from this meaning [8].

2.4 ENVIRONMENTAL IMPACTS ACCORDING TO BUILDINGS STAGES

Its life - cycle of a building begins with the mining of raw materials, continues through the building projects and usage phases, and ends with demolition, sewage disposal, and/or reuse. Throughout the lifespan of a building, funds are used and environmental damage are molded. The environmental impacts of recycling are understood through the quantified or qualified impacts linked to the actual use of assets. The ecological cost of the use of substance capitals in building structures arises at various phases of the building's life-cycle, from physical harvesting to the processing and creation of construction materials, conveyance, building itself, usage of the constructing including remodeling, upkeep, and ultimate collapse and reuse or removal. Every one of the phases has an affect on the environment. Though influences should ideally be described based on, in practice, the best-available substitute may be the real pressure. the apply support -to- entrance figures covering the resource extraction to last product (steel, concrete, etc.), since the future organization of waste arising after materials used for structures in present times is rather uncertain and so difficult to cover [9].

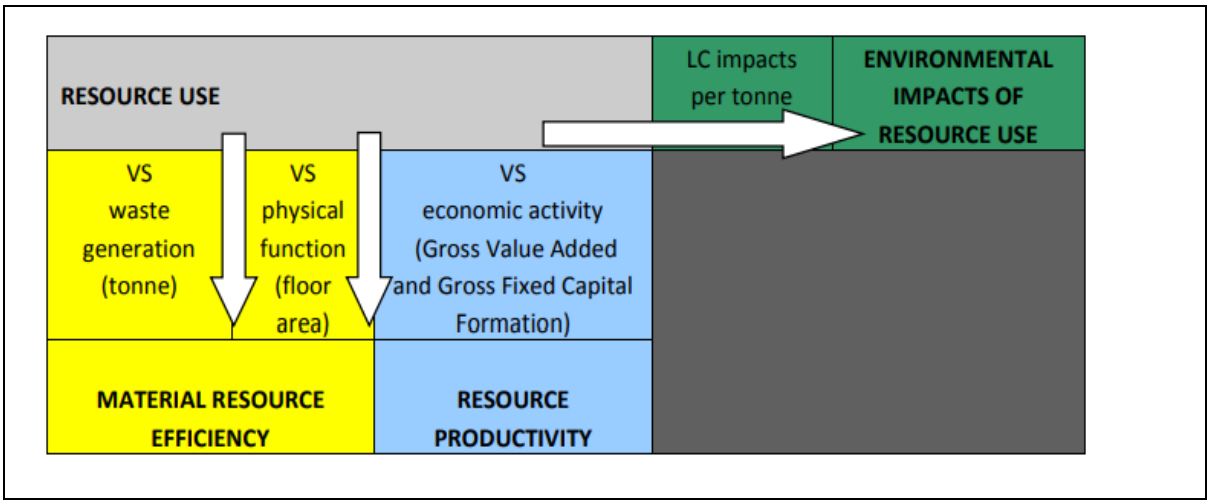

Figure 2.1: Impact of Resource Usage in Projects [10].

2.5 BIM AND NEUTRAL RESOURCES

The capacity to use BIM contributes significantly to the ensuring sustainable development of the building design. that requests provide tools for examining and maximizing BIM models throughout terms of energy efficiency during the design phase. Designers can quickly and easily decide on the placing, orientation, and procedure of building structures in order to maximize energy requirements early part with the conceptual stage. Just as planning new evolves, that models contain the necessary data about various sustainability factors such as the ecological emissions and energy requirements of the designed building. When there are no specialized sources of stress, the comfort of BIM tools allows developers to reflect on the project's sustainable development without significant challenges. Neither energy saving measure is as effective as ensuring that out during the design process. This same building's proper trying to position just on site, its orientation in relation to the sun, its procedure, material properties, and the potentials for natural convection by way of well by way of the helpful positioning of the accommodation are values that can't be easily replicated by sophisticated thermos-technical strategies for heating, temperature control, and airflow.

Bim software is a true game changer in project management, with significant benefits for clients and the general public. Considering that an increasing number of countries (primarily on the European landmass) are imposing legal limits on the environmental impact of new structures, BIM apps are becoming vital instruments for carbon foot print command during the design process [11].

Using BIM projects and BIM building applications, construction firms can precisely plan the construction process during the construction process. 3D BIM models as well as the information they contain allow for the rapid and efficient making plans of a constructing in which refuse is minimized, pollution is reduced, public transport is utilized, less vigor is necessary for construction, and so on. Technology is bringing back prefabrication. BIM designs precisely list, describe, and maximize building materials, enabling businesses to use production plant parts that are manufactured in a controlled environment with the fewest amount of ecological impact. Blueprinting, along with the use of artificial intelligence and robotics (AI), is becoming increasingly popular in the building economy. Such technologies could perhaps make the construction business as efficient as the automobile and aviation industries [12].

Even so, substantial financial money saved are observed during the construction process and upkeep as a result of atmospheric carbon reductions (when compared to buildings designed and constructed without BIM technology). Unconscious regulatory oversight systems that use sensors and data are not new; however, whenever these systems use Bim and their data, the possibility of management and switching grows. Building foundations would benefit from even more advanced intelligence thanks to the Digital Twin skill in construction projects that use BIM models [13].

2.6 MANAGING NATURAL RESOURCES

Examine the chemical and physical qualities of fresh and salty liquid. Create a chart or diagram depicting the vital uses of water, distinguishing the water that is available for human usages from that which is not. Utilizing administration news stories and news television, investigate the major issues with water quantity and quality affecting global water supply. Separate opinion pollution from non-point source pollution. Discuss the benefits and costs of various management plans that have been used to solve water quality and quantity issues by developing a rubric that can be used to evaluate each technique and citing particular evidence from the text [14].

2.6.1 Resource Optimization

To effectively complete a construction project, various resources are required. It consists of materials, labor, and machinery. Second guess the project leader can complete the task with the fewest resources; it is regarded as an important stage toward sustainability. For example, if we don't need six transportation mixers for tangible torrential operations, the scheme manager can skip two of them and still deliver the same scope on time. It not only lowers rental rates, but it also saves a significant amount of fuel. Likewise, using effective laborers to regulate concrete waste at the site aids in the conservation of building materials such as cement and steel. During project execution, approximately 3percentage points to 5percentage points of assets are typically wasted [15].

2.6.2 Reducing Reworks

Several more businesses are aware of mistakes in the construction process. It entails revisions, which have high associated costs. The most significant impediment to productivity is revision. A foundation, for example, is built in a location where he was required due to a surveyor's error. Such errors are avoided by implementing some well quality control system. Sustainability is possible by avoiding these reworks, which waste both physical and energy resources. A start-up company recently introduced new technology in construction that uses a robot to image project sites and then compares it to BIM models. The mistakes are identified before moving onto the next stage, saving massive costs [16].

2.6.3 Alternative Construction Methods

The adoption of alternative building techniques restores sustainability and aids in waste reduction. Precast or outsourced construction is the most common method of waste reduction. The repetition of gathering the shares of a framework in a production plant and then shifting them to some other location is known as construction projects. So because building takes place in a factory, prefabrication is significantly more sustainable long term than conventional methods. It consumes less energy than traditional building methods. Construction management software can replace use of paper, illustrations, and specs in sustainable construction companies. It not only reduces paper waste, but it also eliminates the possibility of accidentally using an old revision at the location. Investment in modern

technology will enable these businesses to save time and money by eliminating the need for newspaper proposals and large records [17].

2.6.4 Physical Selection

The variety of materials is one of the most important factors contributing to sustainability. He mentions using green materials , low paints, water-saving fixtures, little coating metal halides filled glass, and current insulations. It makes the building more sustainable over time by lowering energy consumption [10].

2.7 CURRENT WORK

The study aimed to identify and evaluate the impact of using natural resource in construction projects execution in the way of examining the effect on the project performance and its life cycle as well as the impact on environment. The study outline was toward enhancing the sustainable construction management and to decrease the uncontrolled cost and the time that can variate the scope of the project. The study analyzed the related factors based on the independent state of the art approach to improve the project quality for better results.

2.8 LITERATURE SUREVEY

The financial, environmental, and social pillars are the three main pillars of sustainability. These tasks in relation must be stable in order to achieve sustainable building projects. When considering the project, materials, and skills used in building, social features rank equally. This same enhanced use of naturally derived materials derived from renewable sources using traditional techniques is common throughout sustainable structures and therefore can help balance some communitarian aspects. Whenever the structure meets modern scientific and manufacturing standards, building with traditional technologies such as compressed soil slabs, compressed earth, adobe, or definition of the word skills is a viable alternative to ordinary make a substantial. Elevated, long-lasting structures can be built with indigenous materials and labor. This paper presents research papers from distant Europe and Australia before demonstrating the social and environmental impacts of the technology used. Previous taking into account social aspects may result in an improvement in the tower's sustainable development [18].

The money of raw resources to reduce the usage of quasi resources, other than fossil fuels, as well as the quantity of waste that must be disposed of in landfills have received attention inside the construction industry, which is one of the primary users of the these resources. This interest highlights the significance of recycling. Predicated on the author's inter studies and research on sustainable construction, this quick paper will discuss a number of issues trying to influence the strengthening of composting. Since the emergence of the principles of sustainable development throughout building projects, we have been proceeding in stages instead of using a universal approach that has been widely publicized as effective in communicating the complexities of sustainable development [29]. This has been true for reducing the consumption of fossil fuels, and it is true for other issues of current attention, such as recycling. Though this approach to responsibility produces results, it is insufficient to overturn this same unsustainable use of traditional resources, contra this same natural environment, and combat climate change [30]. Remanufacturing is an important neutral in the construction industry that can and must be strengthened to help promote a general approach to the environmental sustainability of the built environment [19].

In the past three decades, sustainable development subject matters in construction manufacturing have produced many developments in project management, structure remodeling, and building advancement. It all related to vigor, such as vigor conservation and efficiency, as well as the use of renewable energy sources, has been extensively investigated and applied. Even though vigor is important, there are other equally important issues to consider, such as significantly reducing usage, conserving metal and inorganic stockpiles, treating and repurposing water using reprocessed resources, as well as recycling. Even so, they have been given less attention and, more importantly, are still not practical on a large scale. This Special Subject goes beyond the specific goals of energy redistribution and efficiency, as well as the use of renewable dynamisms, and focuses on the sustainable usage as well as use of natural resources in buildings and the built environment. Some, but not all, of the Special Patient's priority areas include decreasing soil consumption, minimizing the usage of raw materials in buildings, employing recycled materials and low-value materials, and delivering and reusing both rainfall and storm water. Publications that relate to the aforementioned subjects are welcome, especially if they take a holistic approach that engages with much more than a culturally determined in a connected way and reflects the overall

building design. Publications on plans, policies, legislative bodies, approaches, skills, design techniques, decision-support tools, case studies, and experiments are also welcome. IDs that really are theoretical, formal, and empirical will be regarded. The feasible use and administration of natural capitals throughout building structures and the built environment will require caution as well. Papers focusing solely on energy concerns in building structures will be excluded. Opinion IDs will only be cautious if they highlight a suitable scenario for future research that is supported by previous study findings [20].

A crucial task that is beyond the capabilities of the majority of small particle and protein-protein docking technologies is attempting to anticipate the binding method of adaptable polypeptide chains to proteins. On a collection of 19 non-helical peptides, we are now testing the tiny specific chemical flexible ligand docking software Glide. We carefully increase pose prognostication accuracy by expanding the Glide sample for adaptable polypeptide chains. Additionally, post-processing using particles made it possible to do better calculations for posture counting. The achievement rate rose from 21% with Avoidance Glide configurations to 58% with the improved protein sampling then ability to score method when redocking to the native protein building projects, measured using the best of the top ten scoring poses. This method is up to 100 times quicker and comes close to the accuracy of the newly released Rosetta k method. Only a small portion of instances when an unbound binding site structure was available were passed, and in those instances, roughly half of the peptides docked successfully. The extended proteins with a small number of formal custodies and a restricted size are where the modified polypeptide technique is most accurate, according to our analysis of the data, identifying a prospective application area for this method [21].

The purpose of this paper is to determine the primary research concepts studied inside the literary works of resists in construction projects. two bibliometric analysis tools, were used to examine the library and information science indices of documents and envision one‘s interrelationships as a net, respectively. To uncover the main study melodies, a research emphasis parallel ship network analysis and topic co-occurrence net examination were carried out. The research was organized into three major groups: evaluating sustainable development, project planning for sustainability, as well as drivers of sustainable building.. Whereas each paper had one different focus, the study suggests that the core principle of all groupings was sustainability, building, and project management. While ‘sustainability' was

the most important keyword in the primary cluster, evaluating conservation, it was the second most important keyword in the other binary clusters, with an eigenvector centrality of more than 0.94. that discovered that the concept of sustainability must be incorporated into global construct from the early stages of design and survivability studies, and that it ought to be supervised throughout the program's life. This evaluation revealed that previous researchers studied sustainability in building projects using a wide range of mathematical and statistical tools such as structural reckoning modeling and fuzzy decision-making methods. This paper provides researchers with insights on how they can frame new research to study sustainable development in buildings by using an integrated approach to identifying the research gaps in this vicinity [22].

Achieving sustainability-related targets in construction schemes is becoming more common. While some investors recognize it as significant, others hold opposing views. The results of an explorative academic outcome interview sessions with 25 senior design managers from the construction sector who are implicated in sustainable development in the some way are reported in this article. The primary findings suggest that holistic sustainability initiatives and ploys in the construction manufacturing life cycle have not been fully embraced. Although all interviews were conducted in Nigeria, the outcome may well be applicable or intriguing to other nations as well [23].

The inquiry's goal is to first define what sustainable development throughout construction works remains. The significance of sustainability can vary greatly depending on the viewpoint of a client and a building scheme manager, as well as within business entities and through anomalous knowledge transfer. A thorough evaluation of the use of sustainable construction language is then authorised, and an ideal for enabling a consumer to manage sustainability substances in connection with building works but then verify this model within such a specified context is identified.. Because the construction industry is complex and disorganized, it has an tendency to oppose modifications that lead to sustainable development. Clients and project managers face opposing barriers to implementing sustainability, such as a lack of pro-active sustainable measures, battles over real and apparent costs, and insufficient application expertise. A common misconception is that sustainable development in building works is more cost-effective in terms of investment costs when compared to 'normal' normal buildings. It is critical to professionally transfer

information from the research public to mainstream practitioners to aid in the execution of corporate sustainable development without delay or misconception of research methods [24].

The climate law is a unique pillar of European Union policy, indicating, among other things, a requirement for explaining environmental environment and personal possessions in all kinds of business activity. Dispute between procedures as well as the natural habitat abound in the construction industry. In order to achieve sustainable development in construction projects, environmental flaws must be included in the scope of project risk management. The achievement of the project's objectives in terms of time, cost, grandeur, protection, and sustainability is thought to be aided by the effective management of risk. This article's attention will be mostly on the latter feature. The best results from project risk management come from methodical implementation across the whole life cycle of the construction project. The type of building asset projects is significantly influenced by the special features of construction activity, claims the text. They are ecologically demanding, both throughout the building phase and during one's maintenance and bankruptcy stages, and they are linked to bottomless and long-term disturbance in the typical environment. It calls for the investment of significant sums of financial resources as well as the involvement of several authorities and organizations in making choices at later phases of the life cycle of ornamented buildings. In these projects, a wide range of interested stakeholders are involved in different project stages to differing degrees. The findings of a survey of company owners in the construction industry in 2015–2017 on the use of fuel and energy in the logistics of these ideas are provided. This lays the groundwork for addressing the degree to which entrepreneurs take sustainability concerns seriously. The hazard map for the construction project shows the risks related to environmentally responsible development. Construction projects must be carried out using energy-saving technological methods that enable the most effective use of conventional resources throughout the building and maintenance phases, and in the final stage will allow informal liquidation of the construction project[25].

The sector is without a doubt the largest and oldest industry in human history, and it plays an actual important role in the socioeconomic development of a nation, especially in emerging economies where the development of built environment and physical infrastructural facilities is critical. This sector is fragmented, complex, and solitary in nature, and it frequently faces persistent challenges such as time and cost overruns and massive

waste generation. Furthermore, this industry has been blamed for being the greatest consumer of common resources, putting him at the forefront of the quest for sustainable development. The above paper examines ideas for sustainable performance of the project and categorizes challenges to introducing sustainable construction in developing countries. The research raises awareness at every level of development activities, and full investigation as well as research for asset advancement and technological advancement are required[26].

Building production should play an active role in assisting labors in achieving global sustainability. As a result, it is becoming increasingly important for construction governments to deliver initiatives that address the environmental, financial, and communal sustainability aspects. The purpose of this paper is to examine how building governments actually engage in sustainable practices. This paper presents the findings of an investigation conducted using a multi-method approach combining qualitative and quantitative data analysis. Stages of full quasi meetings were held, followed by a sector review of 200 intra-structural leaders in UK servicer and consulting firm organizations. The data analysis revealed that building organizations are committed to green initiatives such as purchasing, program management, waste disposal, whole life likely to cost, materials and resource utilization, corporate accountability mechanisms, and community engagement in the delivery of building projects. According to the survey results, construction institutions are actively engaged in environmentally friendly waste management, which is influenced by sustainable design. The findings show where contractors are taking any responsibility well and where govs need to step up their efforts to implement sustainable practices [27].

Understanding how to critically evaluate scholarly publications is a crucial skill taught by universities. It is crucial to provide students and professionals with the essentials for appraising the honesty and value of current research given the diversity, amount, and quality of publications accessible through print, electronic, and Internet databases today. It's not easy to track down high-quality articles that you can read, understand, and critique. This piece discusses instructive indicators for assisting the newcomer in making label sense of research. Growing populations and increased demand for building materials raise new concerns about the environmental impact of materials and their production processes. Forests and wetlands are being depleted at an alarming pace to make way for development as a result of the strain that a growing population puts on the Earth's limited supply of land and water. Unless artists,

engineers, and lawmakers take drastic action, natural capitals will vanish because of the ever-increasing need for basic building materials [28].

The percentage of construction projects using environmentally conscious practices has increased dramatically during the last decade. Green building construction is gaining popularity as politicians, celebrities, filmmakers, and journalists draw attention to the built environment's contribution to carbon dioxide emissions and resource depletion. Higher energy value systems, higher prices of building materials, and regulatory benefits are undoubtedly driving production and expansion in the lemon construction sector. But there are still challenges to lime construction, such as meeting budgetary targets for a lime project. Traditional scheme management practices need to be modified if project managers are to provide customers with environmentally responsible building rendering at a fair price. This research aims to offer specific adjustments to conventional building techniques that will improve the efficiency with which lime construction projects are completed. This article provides an overview of research on the expenses and tendencies of green construction, and then utilizes these results to create recommendations for greening program management in the building manufacturing industry. Our research shows that a self-sufficient building project may gain substantial value from greening plan methods while maintaining within reasonable budgetary parameters. There is evidence that the odds of economic success for a green plan increase when a cross-discipline side is included from the start and throughout the project, as shown in a comprehensive study utilizing a medium present approach in order to make to usual project management does [29].

The paper categorizes a construction's effect on the environment, people, and their health, while taking into account its consequences. The authors propose an optimal combination of construction in order to meet environmental control standards, which have an impact on the environment. There are a few environmental material criteria that differ from conservative materials. The purpose of this investigation is to create a method for ranking building projects. The paper analyzes the construction options for one-flat dwelling houses. A few options for selecting an optimal scheme are provided. The effect of construction on the environment is discussed. The exam is carried out while taking into consideration the building's living impact on the environment, as well as his economic and social situations.. The investigation comprises pollution of building physical production, construction

procedures , taking into explanation building longevity, value , running cost then utilization input of vigor . The multicriteria evaluation of the alternative solutions is complete, taking into account not only the impact on humans, but also the impact on the environment. As per the described enviro, financial, and qualitative standards, and with the assistance of a newly-industrialized multicriteria technique, it was determined by calculating that a blockhouse, typically made of bamboo materials, with the result of is by 6.6 percent a healthier alternative than a wood constructing with the result of 0.286, complete from lumber and nutrient materials, but worst result of 0.280 was in a building from old-sty (a wood- founded house is by 7.5 percent healthier than a brick household) [30].

This study focuses on the analysis and valuation of the ecological impact in the building projects sub - division. This intends to propose a model for analyzing environmental resource governance during the construction process. This industry has a high potential for negatively impacting the environment through pollution, energy usage, and waste generation. Ecological responsibility serve the ecological consequences and implementing appropriate treatments for environmental resource governance. Innumerable life cycle evaluation approaches are used to design a new model of environmental wealth management, beginning with the factors that influence the setting. . The eventually results perfect takes such factors into account as well as transmits several benefits from an organizational standpoint. Each novel result is that the perfect could be applied on a micro - economic level as well as an economic and financial level. The prerequisites for rearranging operational procedures and policies with meaningful effect on resource usage within construction projects can be shaped at a company equal by implementing this model. As a result, the goal for the construction industry is to manage resource use efficiently while also restoring areas that may have been affected by military missions [31].

Building manufacturing is a crucial industry that contributes to the country's wealth and social and economic development. Inadequate waste management procedures in building projects have resulted in ineffective results in reducing environmental impacts and unauthorized removal. The said paper provides a review of current literature on building waste management in Malaysia, as well as proposals that have put in place in the Malaysian construction manufacturing industry. The trend of literature suggests that the Malaysian govt's existing construction end up wasting organisational initiatives are insufficient in terms

of inert landfill to meet the rise in waste disposal. Furthermore, the initiatives used appear inefficient due to a lack of implementation and implementation. As a result, it is critical to close the gaps through more powerful and significant and improvements to current methods in order to achieve efficient construction wing management [32].

The concept of "Sustainable development," as characterized for the first time by the Brudland Account, , has been central to various studies and practices. Adaptation of environmental and energy policies to support financial development without jeopardizing normal life in the global community forces states, foundations, institutions, the corporate world, and non-governmental institutions, as well as other stakeholders, to use this method. Eco-friendly and smart structures are the result of sustainable environmental policies in the building sector, which is heavily responsible for resource extraction pollution and consumption. Maintainable structures, also known as smart structures or green buildings, are high-tech structures with control and automation systems. Architects, technicians, landscape architects, equipment manufacturers, energy consultants, scheme managers, building operators, and local managers are all working together to achieve this type of building design. This same identification of potential threats and opportunities by following such technologies, the choice of the right technical prowess for the company and the industry, the acquirement of the these innovations from inner before external providers, and their practice are all required for technology planning. Firms that invest in research and advancement (R&D) in the future construction production of a world through strategic skill management and can maintain their power to compete on a global scale will be able to establish a niche for themselves after the market [33].

Motivation: This article seeks to conceive a structurally ideal green supply chain organization based on natural resources, then link that organization's ideal performance measurements and drivers to their respective causes. The model's design, methodology, and approach include a critical evaluation of the aforementioned literature and a reliance on narratives about resources, metrics, and authorities. Conclusions: Constructs are uncovered by examining bury-organizational environmental activities, performance metrics, and institutional motivations. Some of the suggested theories address the fundamental relationships both inside and between the various constructions. Current research limitations seem to be related to the fact that this model is still merely conceptual, with postulated causal

links. The model and hypothesis must be empirically tested. Practical Implications: This study has the potential to give managers with verified measurement balances that can be used to assess the success or failure of an organization's application of best practices for supporting sustainable industrial growth. There has not been a complete synthesis of originality from a Thing that comes standpoint, followed by performance metrics, and institutional drives. This line of thought is a beginning [34].

The incorporation of natural assets into productive technological processes generates direct resource consumption again for satisfaction of product and service needs. Misappropriation of environmental assets can be carried out in a complex, coordinated manner by simultaneously satisfying more ingesting demands. The current generation clearly supports the decay and sometimes reduction of natural resources caused by previous generations. Future generations will bear not only the actual price of environmental deterioration and the exhaustion of natural resources, but also the cost of the buildup of atmospheric pollutants and toxic heavy metals in the environment, in addition to the loss of tropical forests and bio - diversity. As a result, actual regard of a needs of future generations is required, even if this implies additional costs for democratic structures that are only obligated to satisfy the economic, social, and environmental demands and needs of the present generation [35].

3. METHODOLOGY PROCESS

Estimates that are activity-based, detailed, or unit-based tend to be the most accurate of the several methods for estimating costs because they employ information down to the most granular level feasible. One of the many ways to calculate costs is to use one of the many different strategies. The biggest number of people are able to comprehend and apply these techniques of estimation because they are the most straightforward. The accuracy of activity-based detailed cost methods or unit cost methodologies is dependent on the accuracy of the information that is readily available, the resources that are used to construct the cost estimate, and the validity of the grounds on which the estimate is developed. The majority of the time, a work statement, in addition to a collection of drawings or specifications, is utilized in order to specify the activities that make up the project. The analyst will break down each operation into granular activities in order to list and quantify the amount of time spent on labor, the cost of materials, the cost of equipment, and the cost of subcontractors. It is usual, when estimating costs, to make the initial word in a description of an action a verb. This is done in order to facilitate the estimation process. When explaining the task that needs to be completed, utilizing verbs provides a definitive explanation while also facilitating clear and concise communication. The total amount of the direct expenses can be broken down into its component parts and then subtotalled. After that, indirect costs, overhead costs, potential outcomes, and escalation are factored in, although this step is conditional on the specifics of the situation. As more information becomes available, the estimate may be subject to revisions in order to account for it. This is done in order to guarantee that the working progress of the project and the budget for the project may be brought into harmony as fast as possible, which will result in a reduction in the overall cost of the project. This should include specifics regarding the most efficient way for monitoring and diagnostics, in addition to the approach that will be taken to evaluate costs. In addition to that, a description of the technique ought to be included here. In the course of his inquiry, the strategy that was proposed was made up of three primary phases, all of which were executed in order to accomplish the research objectives. The first step was to calculate the actual cost of the project items, and the second step was to identify the cost weight of each type of project item based on the efficient parts by making use of a method that was appropriate. This was done by utilizing a strategy that was satisfactory.

3.1 COLLECTING DATA

The process of gathering the relevant data for the thesis constitutes the initial phase in the current methodology. In order to acquire the essential information from the Iraqi market, both interviews and a survey were carried out there. When compared to surveys that are less personal, this type of research has the advantage of delivering the most accurate and comprehensive information on the research subject. On the other hand, it does not allow the researcher to investigate the interviewee's personal preferences and aims in the same way that other types of research do. The scale and intricacy of the geographical level that will be surveyed will decide the sort of survey that will be planned, and the process itself can be divided into either one or two stages, depending on the specifics of the situation. When it comes to selecting the type of survey to carry out, one of the most significant factors to take into consideration is cost, as this is typically the responsibility of the local government, and as such, it is one of the most important driving elements that is taken into account. In order to strike a balance between the statistically required size of the sample and the precision of the data that is obtained, a multi-level survey has been developed [31]. A multi-level survey was used to facilitate the development of this compromise, which was then implemented. Multilevel modeling is widely applied when dealing with the findings of difficult surveys that include components such as multistage sampling, uneven sample probabilities, and stratification. It makes it feasible to cover a larger sample with a lesser degree of precision, but it does so without sacrificing the ability to identify characteristics that are essential for defining the typology. This makes it possible to cover a larger sample. This indicates that the purpose of the first stage is to collect the fundamental information that is required, and that the specific, material, technical, or other qualities would be acquired in the second round on a more select sample. In other words, the primary objective of the first stage is to collect the fundamental information that is required. The principal assumption that is used in the process of estimating the size of the sample is based on the appraisal made by an expert regarding the number of projected building kinds. This is accomplished without making significant changes to the fundamental ideas underlying categorization. Interviews that go into a great deal of information "are an efficient method of inspiring folks to take part in a more in-depth discourse about their own thoughts and experiences in a manner that is qualitative. They offer a means of acquiring insight into how individuals evaluate the world

and how others see it by providing a method of comparing one's own evaluation with those of others." In addition, the interview questions were formulated in accordance with Iraqi initiatives and the historical context that was important to the matter at hand in the questionnaire. This was done to ensure that the questions would elicit responses that were adequate. This was done in order to guarantee that the questions were responded to in the appropriate manner. It is the responsibility of the researcher to ensure that the interview produces the intended results, and it is expected of the participant that they would contribute to the research in an honest and open manner [17].

3.2 INDEPENDENT FACTORS

Insufficient information about the current process and the needed alterations in the process flow that are accomplished throughout project execution continue to be challenges for efficient process planning in construction projects. In many of the field procedures, the planners continue to rely on manual process methods to collect information all the way through the execution of the project. As a result, our understanding of the actual building process is insufficient, fraught with the potential for error, and not always available on time. In point of fact, the information problem accounts for 27 percent of the causes of disruption in the building project [32]. In addition, the inability to integrate the information into a flexible process modeling restricts the availability of alternative process planning and contributes to delays in the process. to ensure that there is a continuous and effective flow of information, communication, and cooperation among all of the involved participants in the execution of the project. When there are significant differences between actual performance and planned performance, "project control," which is regarded as a function of project management, "involves taking the appropriate corrective action (or directing others to take this action), and it will produce the desired outcome in the project. " Considered a component of project management, "project control" "involves comparing actual performance with projected performance and adopting necessary remedial actions." Project controls, in its simplest form, are a group of instruments that cooperate to assist guarantee that a project remains on time. They provide knowledge that, when combined with expertise in people skills and project management, enables for correct decision making. Measurement of anticipated performance in comparison to actual performance is one of the primary foci of the project control process. Ongoing analysis of the performance of the project, with the

goal of determining whether preventative or corrective actions are required, Keeping information that is both accurate and up to date, depending on the output of the project and any accompanying documentation, The provision of information that enables status updates, as well as the forecasting and evaluation of progress, Providing forecasts that incorporate recent changes to the project's budget and schedule, Monitoring the implementation of any alterations or timetable revisions that have been granted permission. Sae-Hyun Ji et al. presented the most important effective aspects in the project execution life cycle in [33]. [33] They came up with a modified version of the technique for coming up with parameters, which merges a big number of relevant elements into a small number of significant parameters. They did this by coming up with a modified version of the original technique. According to the proposed model, an estimate of the cost may be obtained by multiplying the quantity-based adjustments to the parameters by their individual costs. Using a case study that was carried out using a 24-residence construction project as the basis for the research, comparisons of the estimation accuracy of the recommended technique and a CBR model were made using a CBR model as the basis for the research. The strategy that was recommended was effective in increasing both the overall accuracy of the cost predictions and their level of consistency. A significant number of the model's influential components may be simplified into representative models in order to get around the constraints that are imposed by a typical cost estimating model. This may be done in order to circumvent the limitations that are imposed by the model. The provision of a modified parameter-making technique is the novel contribution made by this study. The study's overarching objective is to achieve more precise cost estimations through the implementation of this procedure. In addition to this, the cost model that was described is one that is capable of dynamically reacting to the iterative requirements of recalculating the costs. This was discussed further in the previous section. Variables that affect a structure's cost include, but are not limited to, elements that both describe the characteristics of the structure and have an impact on the cost of the structure. A project can be characterized by the influencing variables that are a part of it, and as the number of influential components in a project grows, one is able to provide a more accurate description of the project. On the other hand, if there are a great many factors that have an influence, then there will also be a great many examples that need to be estimated. As a consequence of this, it is critical to select the optimum number of components in order to achieve the highest possible level of precision in the estimation. We

investigate the price differences and similarities between cities across the nation. A survey of relevant research literature [34] was used to identify the factors that influence preliminary building cost estimates. For such vast endeavors, budgets in the hundreds of crores or millions of dollars are typical, as is an innovative approach to administering the available resources.As a prerequisite for the formation of communities with a stronger economic position than the capital region [35], it is necessary to compile an inventory of pricing trends in various regions of the country. There are faults in both the design documents and the actual structure. The problem is exacerbated by the use of untrained laborers and the absence of quality control throughout the construction process. Depending on the environment, the concrete solidifies at various rates and the reinforcing rods corrode and crack. Rebuilding or restoring the structure's components would incur greater expenses than demolishing and reconstructing the structure [36]. The notoriously high resource demands of the construction industry are a significant barrier to efficient resource management. Imported materials must be thoroughly evaluated in terms of cost, availability, quality, and quantity [37]. The relationship between particle shape and size in relation to gradations is inadequately understood, and there is a paucity of data linking these characteristics to the mechanical performance of materials [38]. Particles "graduate" based on their size and shape distribution. The cumulative effect of these variables on the economy is substantial, and in some cases catastrophic [39]. Accurate cost estimation is frequently a prerequisite for effective budgeting. Throughout the planning phase, a project manager must consider numerous factors, including inflation, interest rates, fixed and variable expenses, and administrative expenses [40]. Despite the fact that parametric modeling and program evaluation and review are examples of quantitative methodologies, some businesses prefer qualitative approaches [41]. One can approach the issue from various angles, including from above and below. You can use a top-down approach if you have simple access to historical pricing information. Project managers have the most pertinent experience and therefore make the most informed decisions. When an organization lacks sufficient experience, a bottom-up approach that employs task-specific cost estimates and then aggregates them at the project level may be advantageous [42].

a. Delphi process

When it comes to identifying and ranking challenges for management decision-making, the Delphi method in information systems research has shown to be an effective and extensively utilized approach. In spite of this, the vast bulk of the earlier Delphi research that was done did not use a systematic method. The Delphi methodology is generally utilized by researchers when they are unable to apply alternative methods that provide greater degrees of proof and when the material presented to them is either insufficient or subject to some degree of doubt. The gathering of the expert viewpoints of a heterogeneous group of participants is intended to facilitate the identification of areas in which all parties involved can find common ground. When it comes to providing answers to research questions, the Delphi method is a proven and tested approach. Finding a perspective that the vast majority of experts in a certain field agree on is the first step toward accomplishing this goal. It allows for the opportunity of reflection among the participants, who are able to modify and assess their perspective in light of the anonymous perspectives of others voiced throughout the session. This gives the possibility for reflection among the participants. The Delphi method involves the participation of professionals who have knowledge of building expenditures in order to accurately anticipate the results of likely future scenarios, determine the probability of an event occurring, or arrive at a conclusion on a certain subject. As a direct consequence of this, the participation of the professionals in the survey is made possible. In order to determine how much money ought to be spent on building construction, the percentage scoring approach that was described earlier in this thesis was applied, and it was used to score each of the building's features. In order to properly identify all of the components that are necessary for the successful functioning of the building project, the technique for identification must adhere to a stringent approach. The first round of Delphi method presents the effective main group of factors as in below

Table 3.1: The Main Used Material and The Alternatives in House Construction In Iraq.

M1	Engineering Brick
M2	Concrete block
M3	Red Brick
M4	Poured concrete

Table 3.2: Effective House Construction Factors.

F1	Transfer of materials to the site
F2	How to store materials on the site
F3	Space required to store materials
F4	Skills required to carry out the work
F5	The amount of waste from the materials used
F6	Work completion speed
F7	Floor height
F8	Building height
F9	Work hazards
F10	The cost of the materials used
F11	Durability of the materials used

b. WASPAS (Weighted Aggregated Sum Product Assessment)

New multi-criteria decision-making (MCDM) methods incorporate the weighted aggregated sum product assessment (WASPAS) method. When it was first developed in 2012, Zavadskas et al.23 recognized it as a helpful extension of the SAW and WSM. This procedure's steps are outlined in the following. In the first stage, suitable evaluation criteria and options are defined. Next, an equation serving as a decision-making framework is presented (1). A decision matrix or template is a grid in which each row represents a possible action and each column represents a criterion (price, storage, data transfer speed, weight, volume and so on). As a result, DT's eij (eij; i=1, 2,..., a number of options (n), j=1, 2,..., a number of characteristics (m)) denotes inputs.

$$DT = \begin{bmatrix} e_{11} & e_{12} & -- & e_{1j} & — & e_{1m} \\ e_{21} & e_{22} & -- & e_{2j} & — & e_{2m} \\ -- & — & -- & — & — & — \\ e_{i1} & e_{i2} & — & e_{ij} & — & e_{im} \\ — & — & — & — & — & -- \\ e_{n1} & e_{n2} & — & e_{nj} & — & e_{nm} \end{bmatrix} \quad (3.1)$$

Using linear normalization, the obtained data of "DT" are rendered dimensionless in

Step 3: Use equation (2) for positive criteria like profit and equation (3) for negative criteria like price. The linear normalization method yields the normalized decision matrix, NDM_{ij}, when the superior value is wanted (as in the case of profit) and when the inferior value is desired (as in the case of cost), as shown in equations (2) and (3), respectively. This study employs weights should add up to one.

Step 5: A dual optimality criterion is used based on the SAW, which is shown in Equations below and the WPM, which is represented as in below:

$$Qi^{SAW} = \sum_{j=1}^{m}(NDMij \times wj \tag{3.2}$$

$$Qi^{SAW} = \prod_{i=1}^{m}(NDMij)^{wj} \tag{3.3}$$

where

NDM: normalized decision matrix

WPM : weights of the criteria of the decision-maker,

Qi performance index based on SAW and WPM approaches,

The computed as illustrated in the following equation:

$$Qi^{WASPAS} = \lambda Qi^{SAW} + (1-\lambda)Qi^{SAW} \tag{3.4}$$

$$\lambda = \frac{\sigma^2(Qi^{WPM})}{\sigma^2(Qi^{SAW}) + \sigma^2(Qi^{WPM})} \tag{3.5}$$

σ is the standard deviation of dimensionless criteria

Step 6: The performance index QWASPAS I of alternatives is assigned for final ranking, with the highest value of QWASPAS I at the top and the lowest value at the bottom.

4. RESULTS AND DISCUSSION

House building projects are expected to be completed on schedule and under budget. Project timelines and budgets often need to be adjusted at the last minute when it comes to environmentally friendly initiatives. When working on a civil development project, you should always be prepared for the possibility of claims, budget overruns, and timetable changes. When considering a building's performance over its entire lifecycle, concrete offers significant sustainability benefits over other building materials due to its inherent properties, such as its strength, durability, resilience to extreme weather and hazards like fire, thermal mass, recyclability, carbon uptake, and local availability. The material concrete is versatile and simple to reuse. When concrete is delivered and mixed on the site, it produces relatively little waste. After its original purpose has been served by a concrete building, the material can be reused as a building material by being crushed and used as a component of new concrete, backfill, or road base. It is possible to recycle and reuse even the reinforcing steel used in concrete, which is itself commonly created from recycled materials. In the present research, the conventional used materials for construction in Iraqi houses building were engineering brick, hollow block, engineering red brick and poured concrete. The challenge is whither the used materials are sustainable or not. A comparison between the for types of materials present a significant observation on housing project performance. Figure 1 shows the rank of materials based on the effective factors in this type of projects. the selected factors are the general building construction factors that cause overrun on building cost.

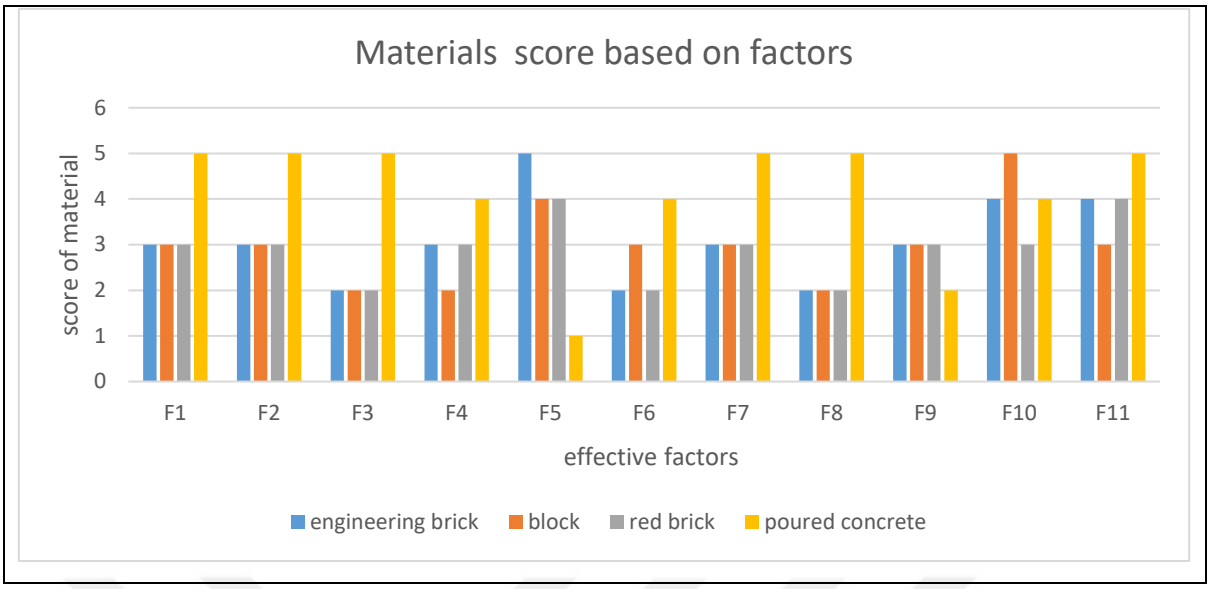

Figure 4.1: The Rank of Used Materials in Building Houses In Iraq.

Table 4.1: The Rank of Used Materials in Building Houses In Iraq.

		engineering brick	block	red brick	proud concrete
F1	Transfer of materials to the site	3	3	3	5
F2	How to store materials on the site	3	3	3	5
F3	Space required to store materials	2	2	2	5
F4	Skills required to carry out the work	3	2	3	4
F5	The amount of waste from the materials used	5	4	4	1
F6	Work completion speed	2	3	2	4
F7	Floor height	3	3	3	5
F8	Building height	2	2	2	5
F9	Work hazards	3	3	3	2
F10	The cost of the materials used	4	5	3	4
F11	Durability of the materials used	4	3	4	5

The effective factors tested and used to evaluate the house project's cost.

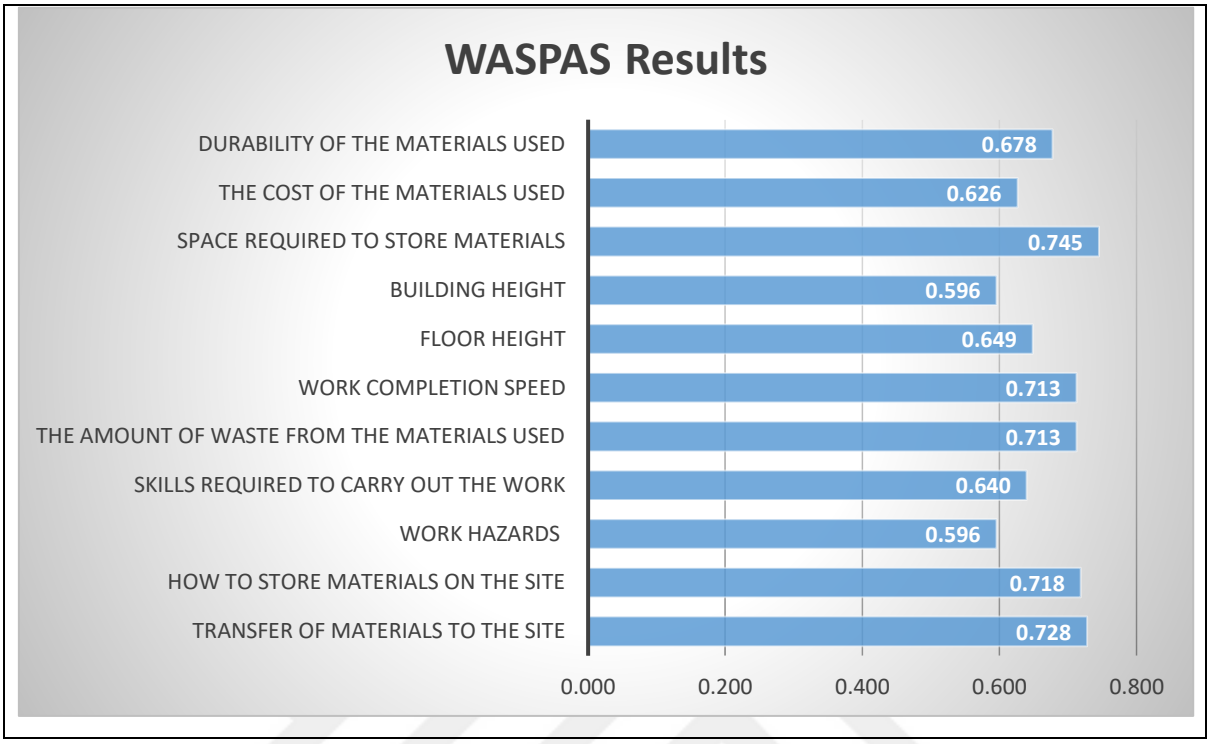

Figure 4.2: The WASPA Score of Effective Construction Project Factors.

From the perspective of engineers, the most significant factors affecting the performance of construction are construction techniques, improper planning, site management, construction errors, a lack of labor and technical personnel, and productivity. The study employed the ideation technique to generate ideas from a group of informants in order to identify crucial design process elements. Methods are selected based on the quantity of interaction between researchers and informants. Due to the fact that the informants in the current study were able to communicate effectively with one another, ideation is an appropriate method of data acquisition. Two separate ideation sessions, one with a government organization and the other with a private developer organization, were conducted to identify the design development phase factors that could affect project performance.

Table 4.2: The WASPA Score.

		Very effective factor	effective factor	Neutral factor	Weak factor	The factor is not belong to this area
F1	Transfer of materials to the site	4	5	5	4	2
F2	How to store materials on the site	5	5	5	3	2
F3	Space required to store materials	7	7	3	2	1
F4	Skills required to carry out the work	7	5	4	3	1
F5	The amount of waste from the materials used	5	6	4	3	2
F6	Work completion speed	6	5	3	4	2
F7	Floor height	6	5	5	3	1
F8	Building height	7	7	3	2	1
F9	Work hazards	5	5	4	3	3
F10	The cost of the materials used	6	7	3	1	3
F11	Durability of the materials used	5	7	2	2	4

The higher score was factor one which considered the planning and controlling a project's materials. It is a crucial part of the process. The cost of materials is substantial in every building project, making it crucial to find ways to reduce the money spent on their acquisition. Large, unnecessary expenditures might also emerge from sloppy materials management on construction projects. To begin, there is the possibility of tying up cash and incurring interest costs on excess inventory of commodities if they are purchased ahead of schedule. Even worse, if proper precautions are not implemented, items may decay or be stolen while being stored. Examples include the need to keep electrical equipment away from moisture, such as in a waterproof cabinet. Second, if certain materials needed for specific tasks are unavailable, progress may be slowed and additional costs may be paid. Therefore, project managers must prioritize the timely delivery of materials. In addition to the monitoring phase of construction, materials management is an issue at any point in the

process. It is possible that decisions about material acquisition will need to be made during the preliminary planning and scheduling phases.

Table 4.3: The WASPA Score of Effective Construction Project Factors.

Transfer of materials to the site	0.728
How to store materials on the site	0.718
Work hazards	0.596
Skills required to carry out the work	0.640
The amount of waste from the materials used	0.713
Work completion speed	0.713
Floor height	0.649
Building height	0.596
Space required to store materials	0.745
The cost of the materials used	0.626
Durability of the materials used	0.678

In fast-track or extremely time-constrained projects, materials availability can be a major factor in scheduling. As a time-saving measure, it's possible to use pricier suppliers or shippers. The second effective factor is the needed space to store materials in the site. The engineering brick, red brick and block need a wide space to storage, while, the poured concrete need no space to store in the site. The final effective factors are the amount of waste from the materials used and work completion speed. The poured concrete has no waste and no need a high experience to implement the project.

4.1 THE PROJECT PERFORMANCE RESULTS

Maintaining ongoing awareness and control over the procedures involved and the different ways in which expenses can grow is essential for successful construction management. To make a dynamic prediction of a project's success, the present way proposes employing an

evolutionary project success prediction model. In statistics, it's a term for a collection of methods used to estimate the links between a dependent variable and one or more independent variables. The actual value of spent money to house project through the project time as shown in figure 3. It is clear that poured concrete is significant due to its cost and the strength of this material in implementing project walls.

4.2 THE ACTUAL VALUE OF THE FOUR MATERIAL CASES

For project assessment to become an asset for the organization, project managers and proprietors must believe they will profit from the input and be willing to put in the additional work required. The benefit must outweigh the time and effort necessary to master a new resource. In order to determine the extent to which additional project review and development was deemed necessary.

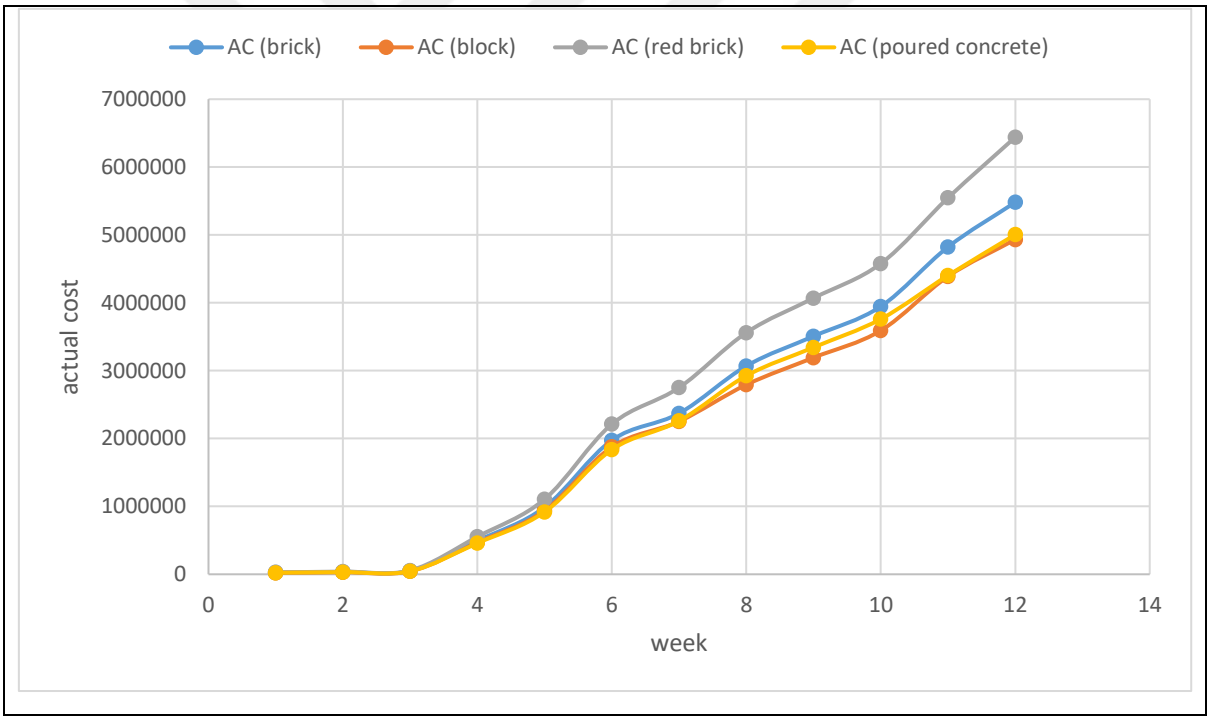

Figure 4.3: The Actual Value of The Four Material Cases.

The interviews seek to elucidate the perspectives of stakeholders on the following topics: the perceived need for project follow-up and forecasting during the project; the labor associated with carrying out follow-up duties contentment with the present circumstance. The possesses the project or its resources bears the most responsibility for ensuring its successful completion. In the data project, analyzing the already-existing data for the project, a

simulation was created to investigate the possibility of SPI and CP conflicts. Isolating SPI and CP conflicts required potentially immense pools of data, as doing so with the available data was arduous and difficult to organize and understand. The simulation will provide project schedules and compute the CP and SPI for each time period throughout the duration of the project. The section then proceeds to identify instances in which CP and SPI present information that is inconsistent.

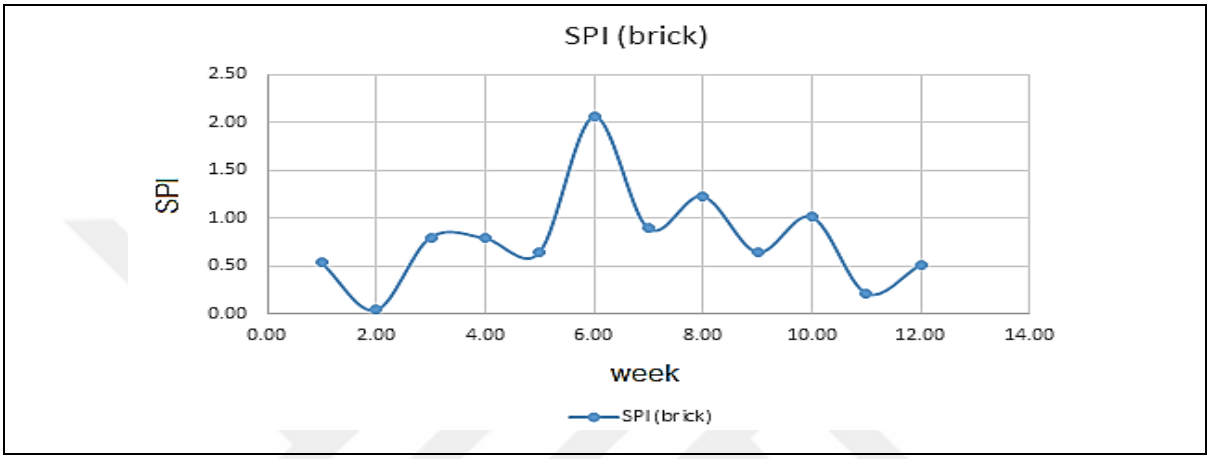

Figure 4.4: The Actual Value of SPI(brick).

Table 4.4: The Results of The Actual Value of SPI (brick).

WEEK	SPI (brick)
1.00	0.54
2.00	0.04
3.00	0.80
4.00	0.80
5.00	0.64
6.00	2.06
7.00	0.90
8.00	1.23
9.00	0.65
10.00	1.02
11.00	0.22
12.00	0.52

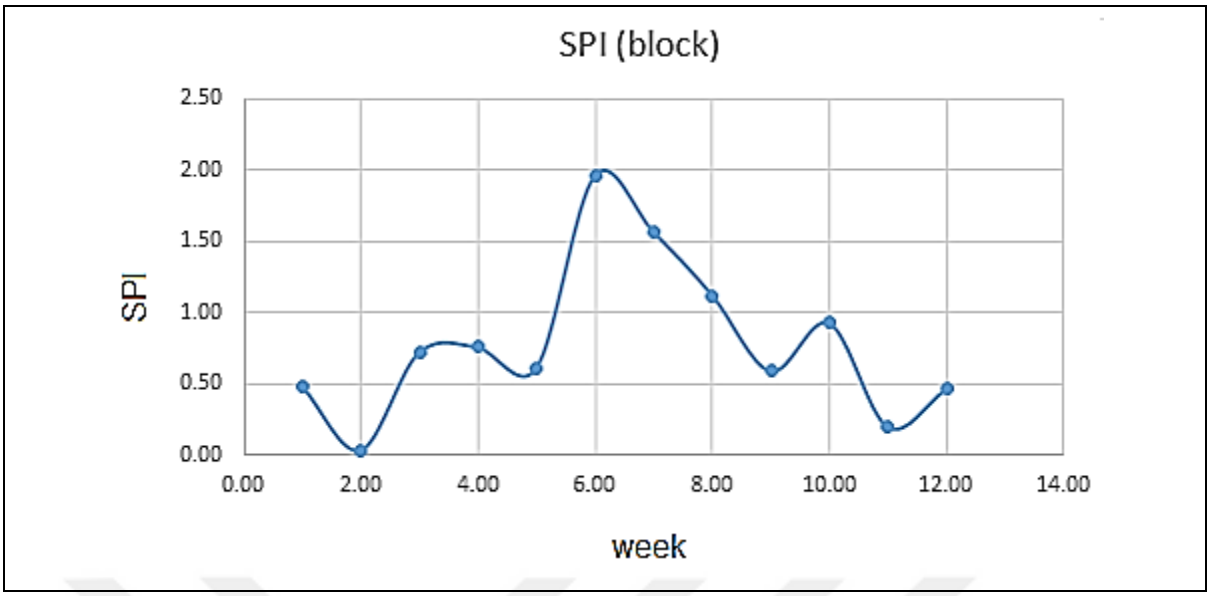

Figure 4.5: The Actual Value of SPI (block).

Table 4.5: The Results of The Actual Value of SPI (block).

WEEK	SPI (block)
1.00	0.49
2.00	0.04
3.00	0.72
4.00	0.76
5.00	0.61
6.00	1.96
7.00	1.57
8.00	1.12
9.00	0.59
10.00	0.93
11.00	0.20
12.00	0.46

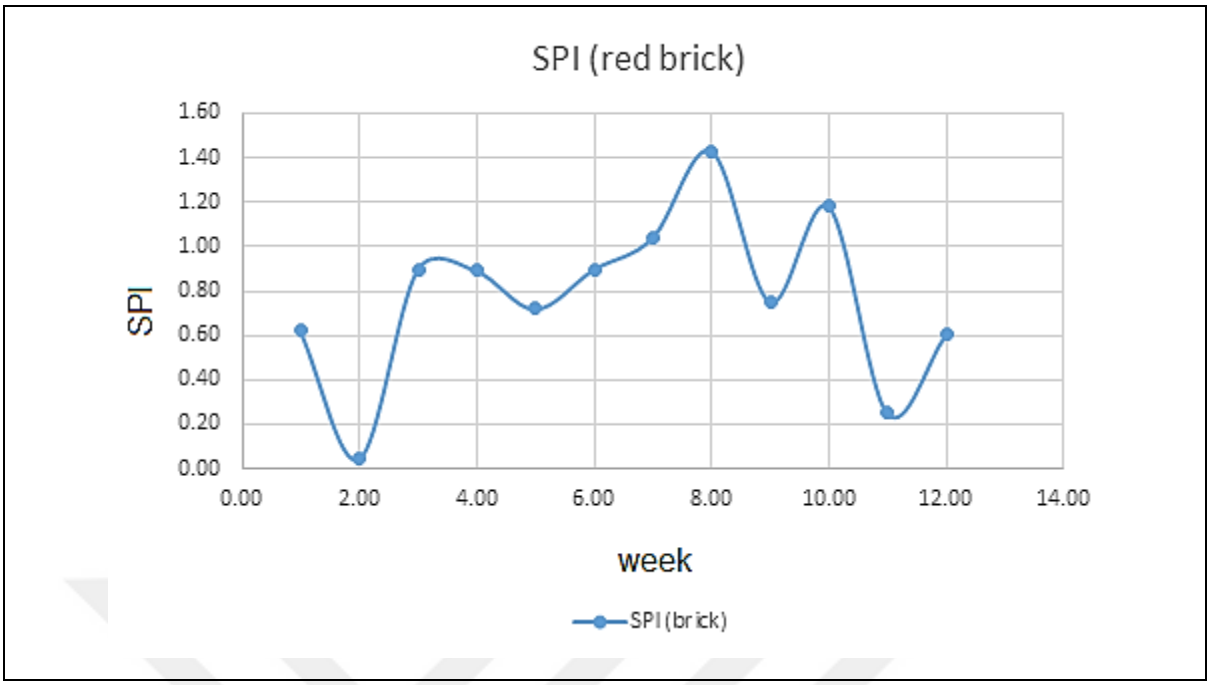

Figure 4.6: The Actual Value of SPI (Red Brick).

Table 4.6: The Results of The Actual Value of SPI (Red Brick).

WEEK	SPI (red brick)
1.00	0.62
2.00	0.05
3.00	0.90
4.00	0.89
5.00	0.72
6.00	0.90
7.00	1.04
8.00	1.43
9.00	0.75
10.00	1.18
11.00	0.25
12.00	0.61

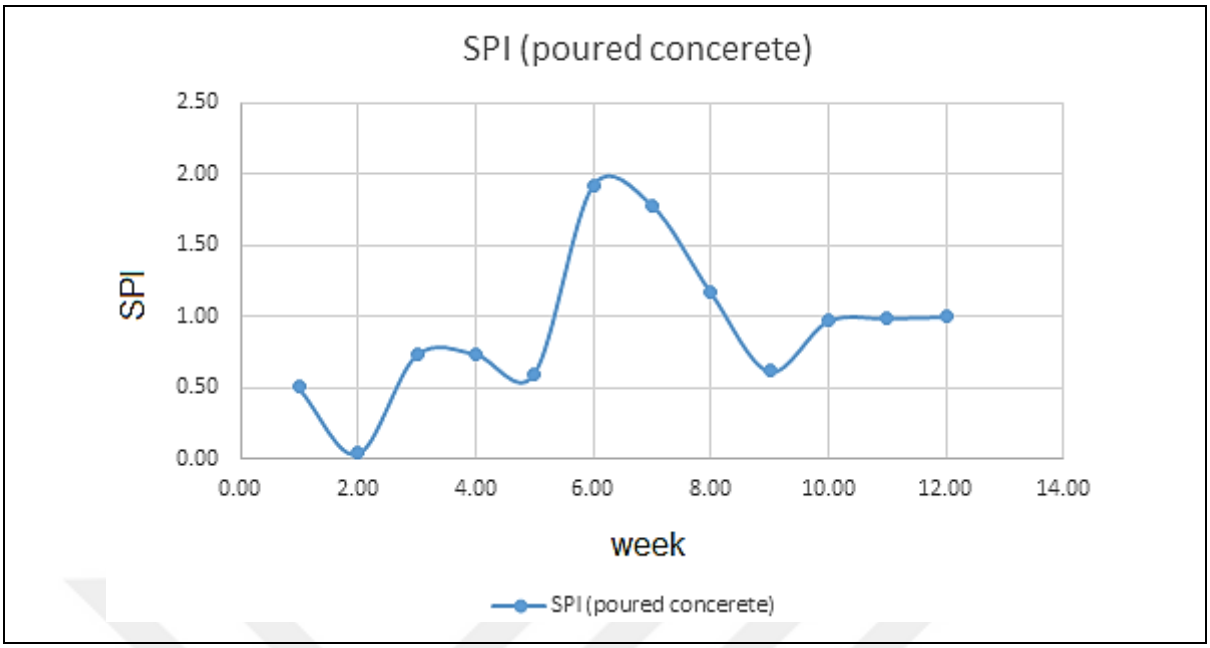

Figure 4.7: The Actual Value of SPI (Poured Concrete).

Table 4.7: The Results of The Actual Value of SPI (Poured Concrete).

WEEK	SPI (poured concrete)
1.00	0.50
2.00	0.04
3.00	0.73
4.00	0.74
5.00	0.60
6.00	1.92
7.00	1.79
8.00	1.18
9.00	0.62
10.00	0.97
11.00	0.99
12.00	1.00

Figure 4.8. comparison of the cost performance index using different materials

Figure four shows the cost performance index based on the four types of materials. The poured concrete is the best choice due to its characteristics in implementing the structural projects.

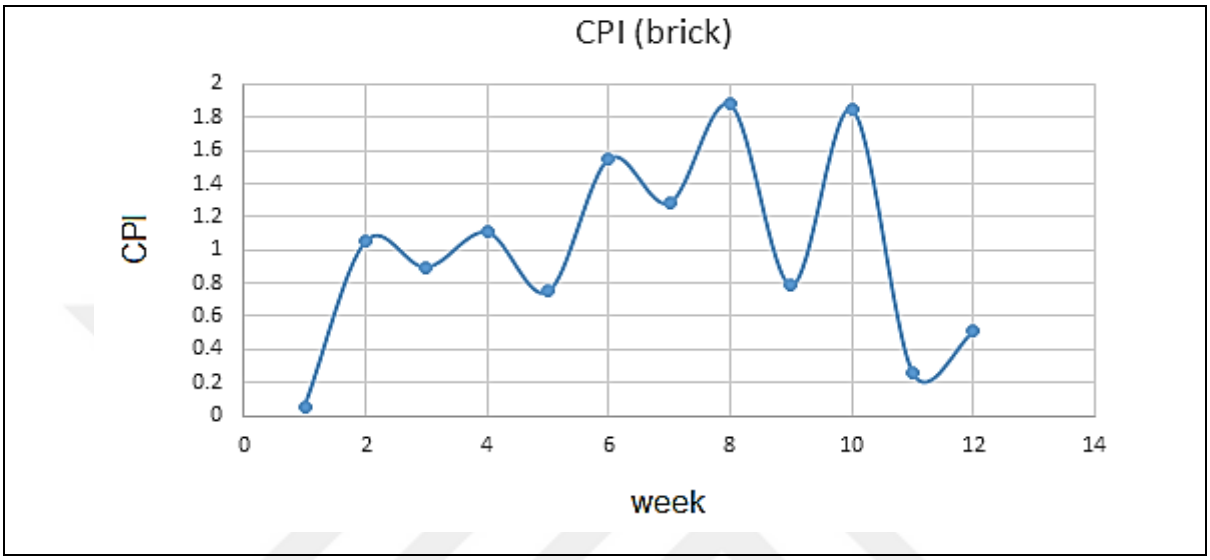

Figure 4.8: Comparison of The Cost Performance Index Using CPI (Brick).

Table 4.8: The Results of Comparison of The Cost Performance Index Using CPI (Block).

WEEK	CPI (block)
1.00	0.05
2.00	0.95
3.00	0.81
4.00	1.00
5.00	0.68
6.00	1.40
7.00	2.16
8.00	1.69
9.00	0.71
10.00	1.67
11.00	0.23
12.00	0.46

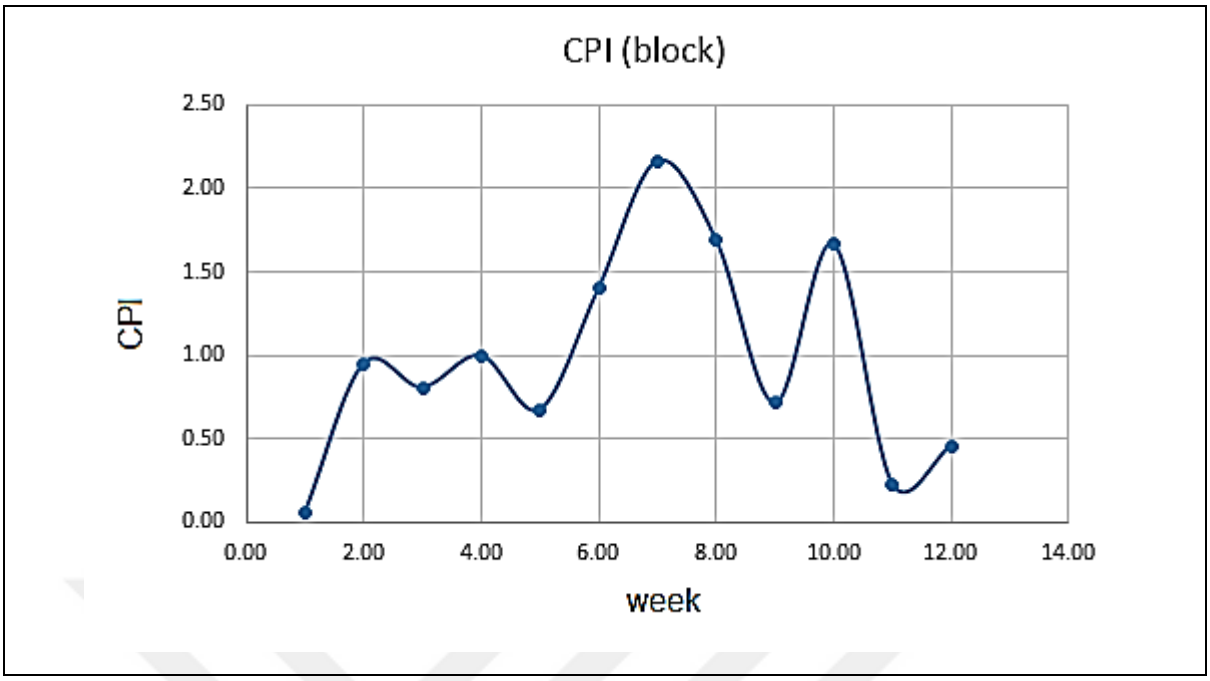

Figure 4.9: Comparison of The Cost Performance Index Using CPI (Block).

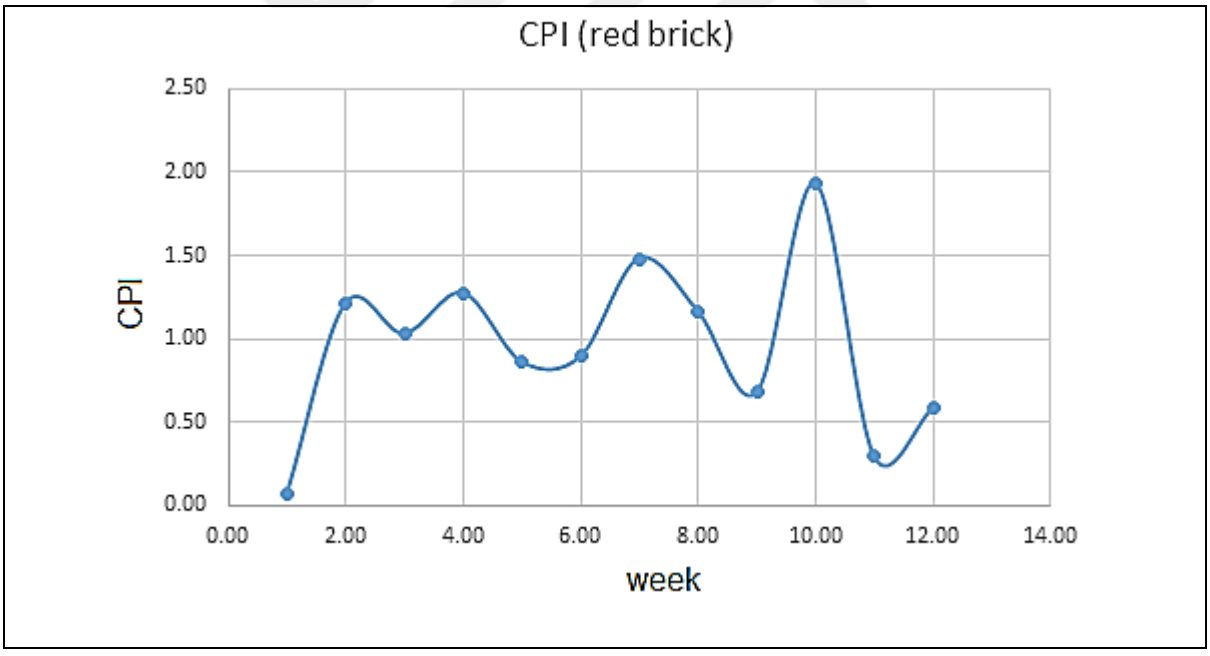

Figure 4.10: Comparison of The Cost Performance Index Using CPI (Red Brick).

The construction a financial plan for better and more efficient results needs a significant budget, all anticipated expenditures for the duration of the endeavor have been accounted for. Before work can commence, the project manager and contractor must construct a plan that takes the budget into account. Several indicators are currently in place to monitor the

project's development. It is also reflected if problems or unfavorable opinions are discovered while the project is being executed. The cost performance index is one such metric that helps evaluate financial and cost effectiveness. It functions as a price metric. This component plays a crucial role in variance analysis. The CPI is used to evaluate a project's profitability relative to its actual costs. For the CPI formula, actual cost and earned value are required inputs. When analyzing the stated cost/schedule performance statistics of defense contractors, the Cost Performance Index (CPI) is a crucial metric.The performance parameters can be used to calculate an approximate estimate of the total cost and time required to complete the project, allowing for early identification of schedule slippage and rising costs. This prediction can only be accurate if environmental conditions remain unchanged from when the model was created. Staffing changes and creeping scope are two examples of external variables that may affect performance and should be considered.

Table 4.9: The Results of Comparison of The Cost Performance Index Using CPI (Red Brick).

WEEK	CPI (red brick)
1.00	0.06
2.00	1.21
3.00	1.03
4.00	1.28
5.00	0.86
6.00	0.89
7.00	1.48
8.00	1.16
9.00	0.68
10.00	1.93
11.00	0.29
12.00	0.59

The results of project execution are defined by comparing the intended procedure to the actual progress made at each stage of the project life cycle. The following metrics can be used to monitor the project's progress in relation to its estimated schedule and budget. Many perspectives can be used to enhance usability.

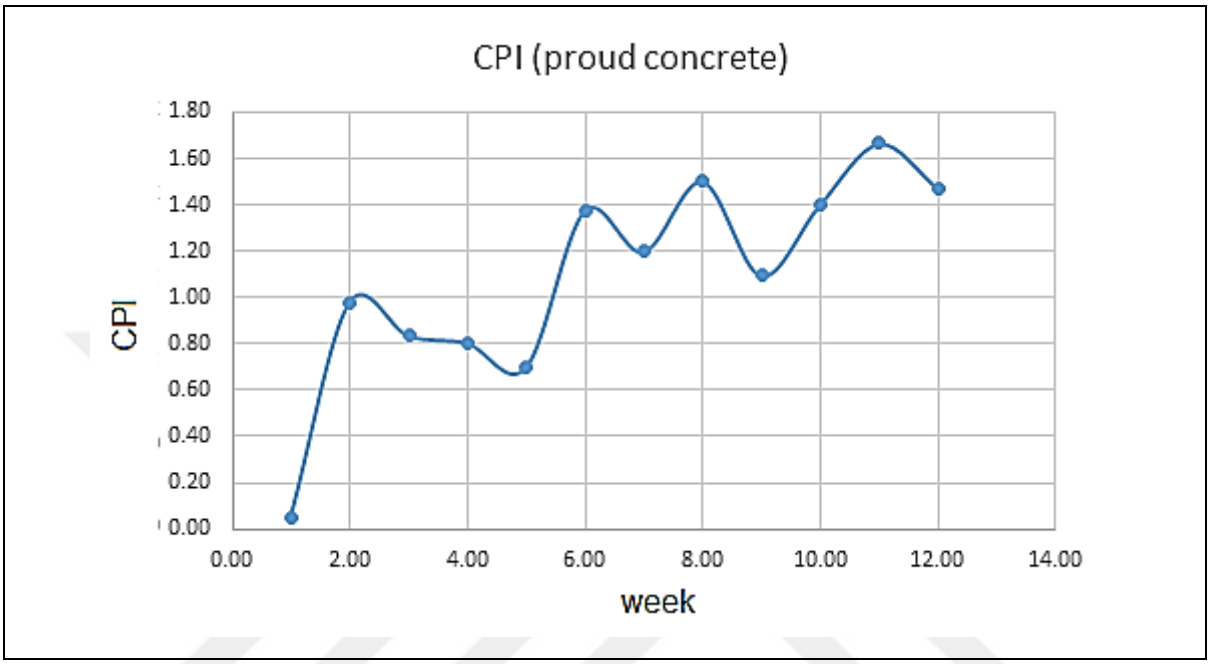

Figure 4.11: Comparison of The Cost Performance Index Using CPI (Proud Concrete).

Earned Value and the calculation of the various indicators and indices are crucial to passing the Project Management Professional (PMP)® Exam; therefore, familiarity with these concepts is required. The Cost Performance Index (CPI) and the Schedule Performance Index (SPI) are both beneficial metrics for measuring a project's effectiveness. The former emphasizes time constraints, while the latter emphasizes financial factors. When both are utilized, a project manager's estimation of the project's completion date improves. The CPI offers insight into this exact topic. Earned value and actual cost are two categories of data required to calculate the Consumer Price Index. Calculating the CPI involves subtracting earned value from actual expenses.

Table 4.10: The Results of Comparison of The Cost Performance Index Using CPI (Proud Concrete).

WEEK	CPI (proud concrete)
1.00	0.05
2.00	0.98
3.00	0.83
4.00	0.80
5.00	0.70
6.00	1.38
7.00	1.20
8.00	1.50
9.00	1.09
10.00	1.40
11.00	1.67
12.00	1.47

4.3 DIFFERENCES BETWEEN PLANNED VALE AND ACTUAL VALUE

The value that was planned to be achieved by a certain date is referred to as the "planned value." The actual value is another name for earned value, which reflects the quantity of actual work performed. The earned value of a lagging undertaking will be less than its projected value. Planned value and actual cost play a significant role in project management. it is an all-encompassing project management system that includes templates for resource and schedule administration and earned value analysis. Working on complex projects necessitates a bird's-eye view of the team's progress, making it easier to react to setbacks. BAC is the total PV for your project, whereas PV is the approved value of the work that should have been completed through a given period. The difference between the initial and ultimate budgets is the "Planned Value," also known as the "incremental budgeted portion" for a particular event. Material requirements planning (MRP) primary function is to calculate the quantity of basic materials and other components required to manufacture a product. The three main components of material planning are inventorying what is already available,

determining what will need to be made or purchased, and then making the necessary preparations.

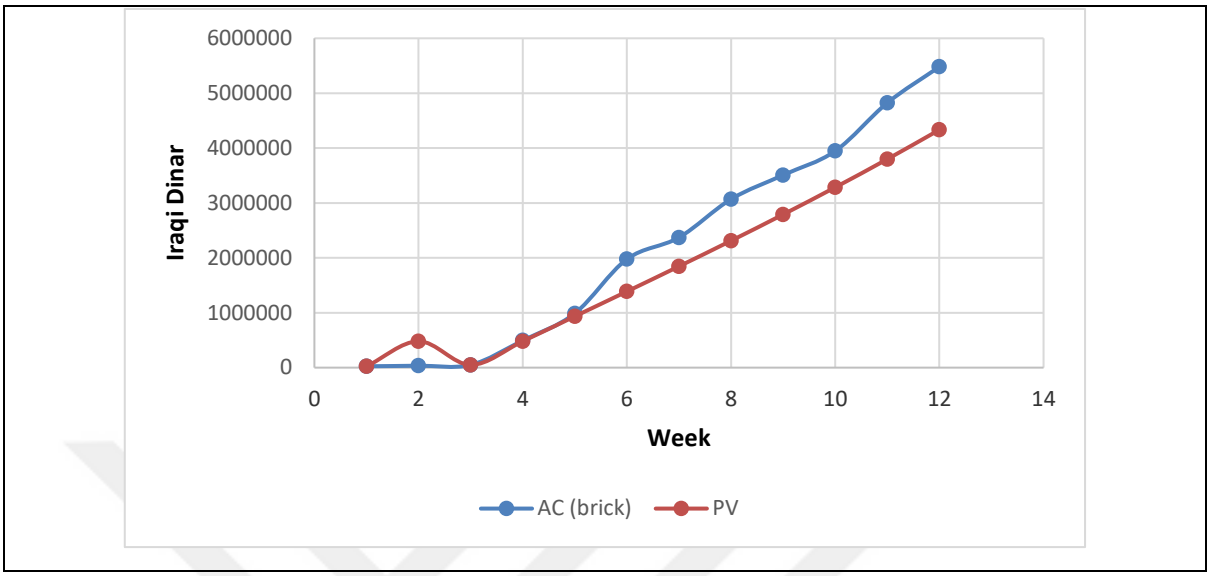

Figure 4.12: Differences Between Planned Vale and Actual Value.

Table 4.11: The Results of Differences Between Planned Vale And Actual Value(Brick).

WEEK	AC (brick)	PV
1	25031.23	21635.83
2	34729.3	480032
3	50164.54	49770.83
4	493927.8	480032
5	987855.5	933651.5
6	1975711	1387213
7	2370853	1845128
8	3069254	2311498
9	3507719	2790118
10	3946184	3284473
11	4823113	3797742
12	5480811	4332794

Resource planning (RP) is a process for ensuring that the right quantity of inventory is available at the right moment for the manufacturing process at the lowest possible cost. Therefore, RP improves the effectiveness, adaptability, and profitability of manufacturing processes. The output of factory workers, product quality, and resource utilization can all benefit from its application. In addition to facilitating revenue growth and stability, MRP helps producers respond quickly to rising product demand by decreasing the likelihood of production delays and stockouts.

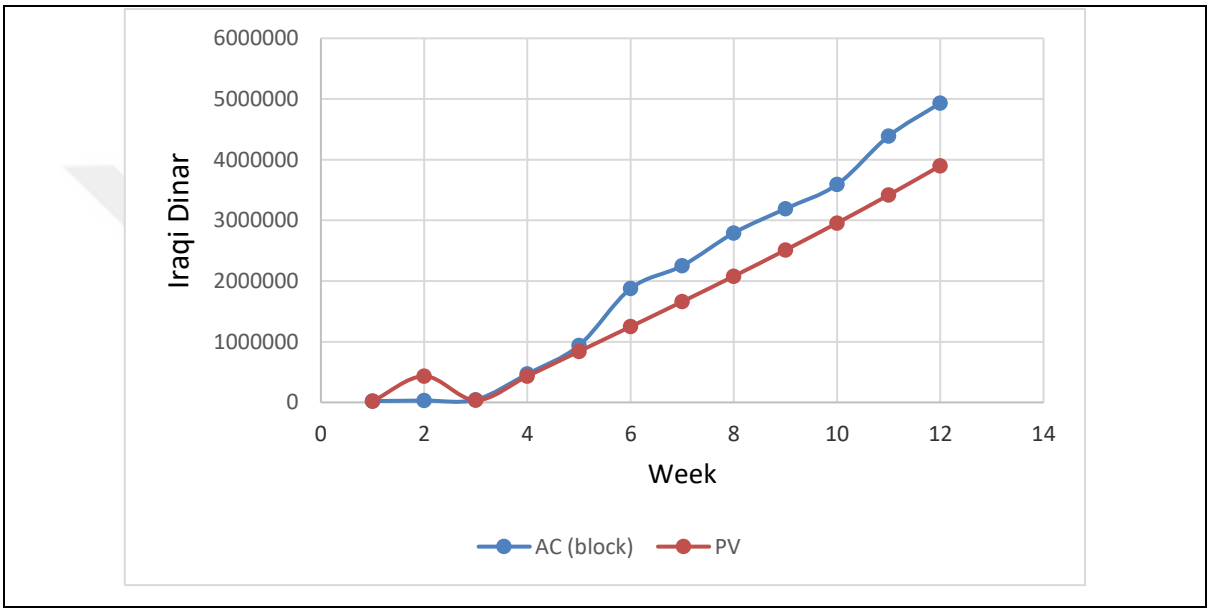

Figure 4.13: Differences Between Planned Vale and Actual Value(Block).

Materials are widely used in the manufacturing industry, and it is undeniable that it has played a crucial role in the expansion and pervasive availability of inexpensive consumer products, which has improved the standard of living in the majority of nations. Without a mechanism to automate the complex calculations and data administration processes. There are two primary categories of construction materials: Natural and artificial construction materials include stone, wood, concrete, and steel, correspondingly. Before they can be used in a building, both varieties typically require some form of processing or priming. The most commonly used materials in my engineering consulting work are listed here.

Table 4.12: The Results of Differences Between Planned Vale And Actual Value(Block).

WEEK	AC (block)	PV
1	22528.1	19472.25
2	31256.37	432028.8
3	45148.08	35793.75
4	469231.4	432028.8
5	938462.7	840286.4
6	1876925	1248492
7	2252311	1660615
8	2793021	2080348
9	3192024	2511106
10	3591027	2956026
11	4389033	3417968
12	4932730	3899515

Whether the project at hand is a modest residence or a world-famous office building, many cladding clients are under pressure to reduce costs wherever possible. Cladding is more than just a decorative finish; it also protects a building and its occupants from the elements. Why bother with cladding if it does not sufficiently defend against the elements and other potentially damaging environmental factors. After calamitous events such as fires, perhaps this is why so many municipalities have implemented new masonry codes. Cladding represents a negligible proportion of total building costs.

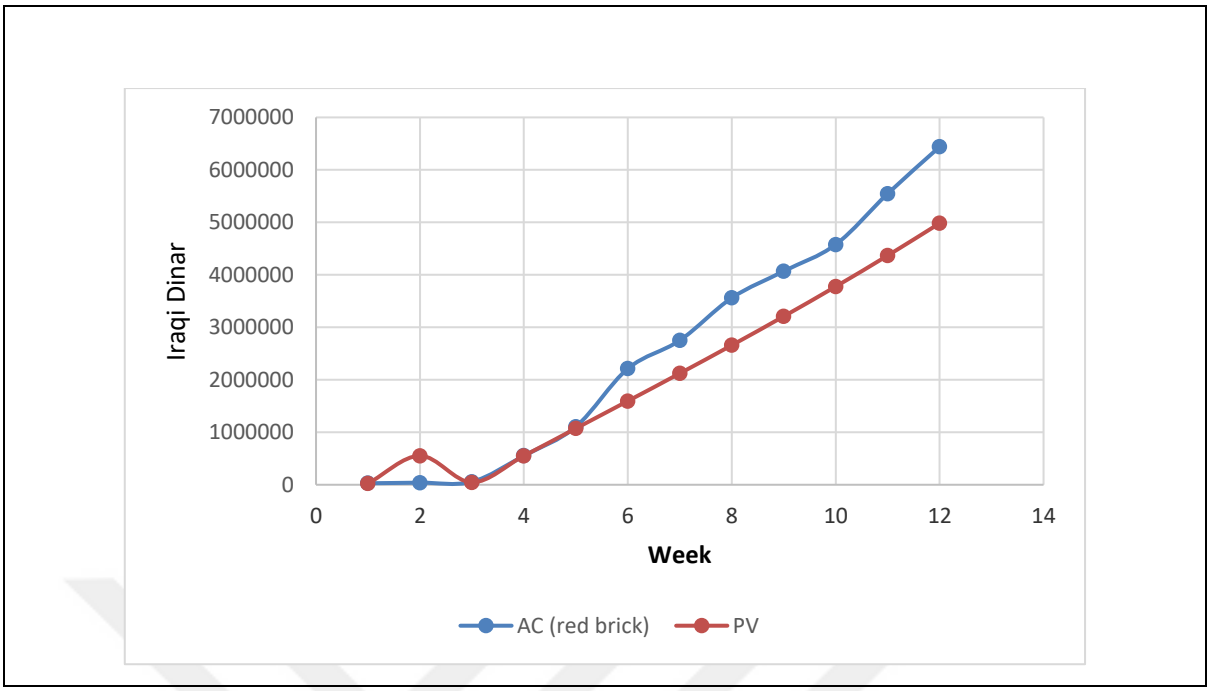

Figure 4.14: Differences Between Planned Vale and Actual Value(Red Brick).

Brick is a common construction material due to its durability and resilience. Mortar is typically used to plaster masonry walls to increase their strength, durability, and aesthetic appeal. Although exposed masonry has many benefits, it is rarely used because it reduces efficacy. Not only does exposing the brickwork allow visitors to perceive and appreciate the building, but it also reveals the skilled labor that went into its construction, which is something we enjoy doing. the cost of brick exteriors for commercial structures is less than 10% of the total. Instead of settling for a subpar facade that will be on full display to passersby, it makes sense to invest in a superior option. Cladding is a permanent addition to the external of a structure. The material's exterior structure and cladding may remain in place while the interior components, such as appliances, office spaces, and even manufacturing equipment, are replaced. This is quite common among brick structures, whether they are historic residences or condominiums constructed from converted warehouses. Brick is a great value because it requires little maintenance. It does not require painting, sealing, or replacement.

Table 4.13: The Results of Differences Between Planned Vale and Actual Value(Red Brick).

WEEK	AC (red brick)	PV
1	28785.91	24881.21
2	39938.69	552036.8
3	56184.28	45736.46
4	553199.1	552036.8
5	1106398	1073699
6	2212796	1595295
7	2750190	2121897
8	3560335	2658223
9	4068954	3208636
10	4577573	3777144
11	5546580	4367404
12	6439953	4982713

Concrete is produced by combining cement, coarse aggregate, fine aggregate, and water. The concrete's strength and durability must be adequate. In Ghana, concrete and reinforced concrete are common construction materials. Concrete is available in a wide range of compositions, coatings, and performance characteristics, making it suitable for a variety of applications. This investigation focuses on both precast and site-cast concrete. The term "precast" refers to a method of construction in which standard structural components are produced off-site and then transported to the construction site for final assembly. To facilitate the rapid and cost-effective construction of a large number of structures, these components are manufactured using mass-production-based industrial processes. Precast concrete has numerous advantages, including reduced labor requirements, material waste, and volume, as well as enhanced environmental and construction site sanitation. Not only do prefabricated materials expedite construction, but they also make it simpler to keep laborers safe. The vast majority of concrete structures are made of site-cast concrete, so named because the damp mixture is frequently placed and shaped at the construction site.

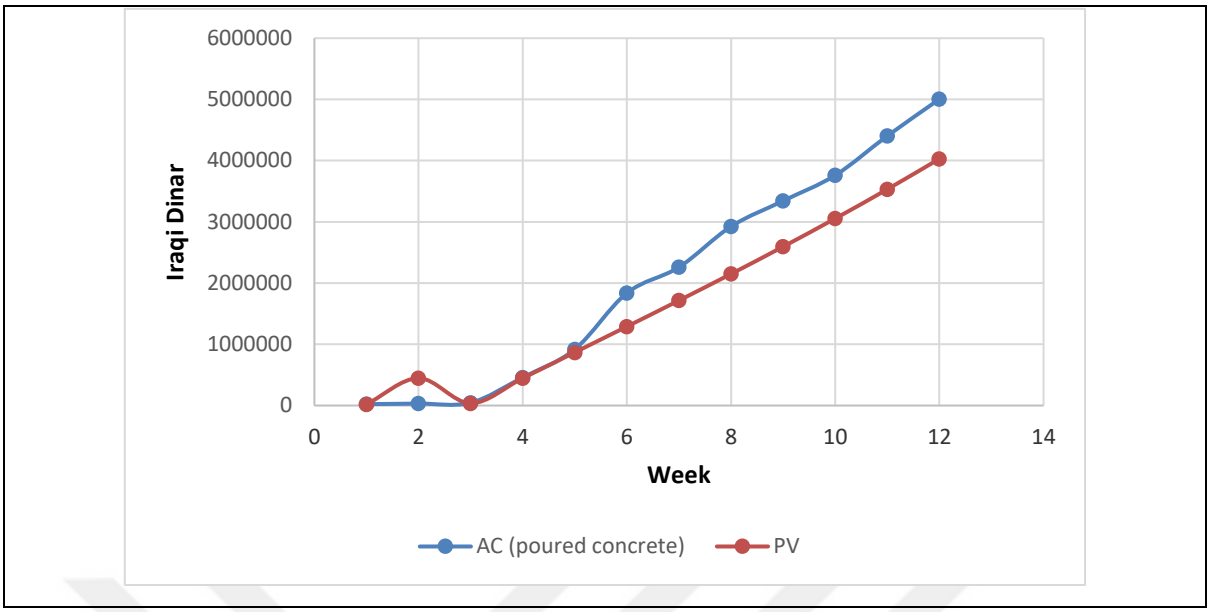

Figure 4.15: Differences Between Planned Vale and Actual Value(Poured Concrete).

Cost estimation is an integral element of the planning phase of every construction endeavor. After you have a clear understanding of how much more expensive precast concrete is compared to poured-in-place concrete, your budget will be more accurate. The price of precast concrete is determined by a number of factors, including the dimension and type of concrete employed. Additionally, there is the complexity of your current undertaking. However, don't worry; this page has compiled everything you need in a single location.

Utilizing prefabricated concrete components may expedite the construction process, abbreviate the duration of the project, and reduce costs. Another advantage of using precast concrete over poured concrete is that molds for precast objects can be fabricated to accommodate any design. It could be structural, decorative, architectural, vast or small.

Table 4.14: The Results of Differences Between Planned Vale and Actual Value(Poured Concrete).

WEEK	AC (poured concrete)	PV
1	23279.04	20121.32
2	32298.25	446429.8
3	45649.73	36986.87
4	459352.8	446429.8
5	918705.6	868295.9
6	1837411	1290108
7	2259423	1715969
8	2924999	2149693
9	3342856	2594810
10	3760713	3054560
11	4403503	3531900
12	5003980	4029498

Legislation and regulations can accelerate technological progress. Generally, concrete is used for public construction endeavors. Up to one-third of Iraq's annual concrete production is purchased by government agencies. This provides them influence in the transition to a low-carbon economy, allowing them to transform the concrete industry alongside academics and corporations.

In addition, the Waste Framework Directive mandates the recycling of 70 percent of all construction detritus. Material passports are an additional viable alternative. The leftover concrete debris from building demolition is typically discarded or sold for substandard uses, such as road backfill. However, with the use of a passport, each piece of concrete would be documented 'from birth' and tracked throughout its existence, allowing for new recycling and reuse opportunities. Finally, the cement industry should publish enhanced emission data so that progress can be monitored.

5. CONCLUSION

The aim of this study was to provide a novel cost estimation approach that could be used for construction projects in Iraq based on different types of materials by developing a model that may aid parties involved in construction projects in acquiring overall cost information at the early stages of a project with minimal data. In the field of construction research, the Delphi technique has proved to be an effective and extensively utilized method for identifying and ranking management decision-making difficulties. However, the majority of previous Delphi studies lacked a systematic approach. When researchers are provided with limited or ambiguous data and have no other viable options for obtaining definitive answers, they frequently employ the Delphi technique. This exercise attempts to identify common ground by collecting the expert opinions of numerous individuals. Specifically, we used the methods and techniques described below to achieve our goal:

a. The most cost-effective materials for construction projects were identified by

   i. data collection survey,

   ii. Interviews with experts in the field,

   iii. an exploratory examination of the relevant earlier research.

b. Selecting the appropriate application with which to build the model was the first step in developing a WASPAS approach connected with alleviation. In addition to being easy to implement and data-extraction-friendly. Before analyzing the data sets, they were encoded.

c. The WASPAS method delivered potentially accurate project cost estimates by factoring in the material characteristics, which can present a major cost model.

d. Finding an argument supported by the overwhelming majority of experts in the field is one method to achieve this objective. Individuals are able to alter and evaluate their own point of view in light of the anonymous opinions expressed by other session participants.

5.1 FUTURE WORKS

The application of sustainable natural resources concepts to residential construction projects requires a new strategy due to structural engineering's central role. To support the findings of this study, additional research is required, and concrete recommendations should be made to decision-makers in the construction industry. The construction industry would benefit from a deeper understanding of the methodology underlying cost estimates and how they compare to actual expenditures on supplies. This innovative approach to building construction makes use of abundant natural resources, and the estimation method should give it more weight.

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