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Investigating the Source of Claims with the Importance of BIM Application on Reducing Construction Disputable Claims in KSA

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Abstract: The construction industry in the Kingdom of Saudi Arabia (KSA) is a significant sector in the Middle East, with annual expenditures surpassing USD 120 billion. It employs approximately 15% of the workforce and consumes more than 14% of the country's energy resources. However, the Saudi construction sector encounters numerous challenges, including a deficiency in skilled labor, escalating costs, disputes, and material shortages. This study aims to investigate the origins of construction disputes in KSA and emphasize the significance of employing Building Information Modeling (BIM) applications to diminish the factors causing claims in both commercial and residential construction projects. The methodology employed comprises a comprehensive literature review and a field survey consisting of interview sessions. This study analyzes a total of 50 contributing factors to the causes of claims, along with conducting a field survey interview session involving 35 participants. The findings reveal seven substantial sources that give rise to construction claims in the KSA, impacting 75 projects, as discussed in this study. Furthermore, the research critically evaluates the advantages of utilizing BIM technology to mitigate construction disputes in the KSA. The data analysis results indicate that the reliance on traditional project management approaches is one of the catalysts for the emergence of disputes in the construction industry, particularly in the KSA.

Keywords: building information modelling; Kingdom of Saudi Arabia; disputes; construction; contracts; procurement

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1. Introduction

The construction industry in the Kingdom of Saudi Arabia (KSA) constitutes one of the largest sectors in the Middle East, boasting annual expenditures exceeding USD 120 billion [1,2]. Recently, Saudi Arabia has made significant investments in its construction and infrastructure development, aligning with the government's Vision 2030 plan to diversify the economy through the establishment of new industries such as tourism and entertainment [3]. Consequently, numerous large-scale construction projects are currently in progress, as exemplified by the NEOM project, projected to incur costs of approximately USD 500 billion [4,5]. The NEOM City initiative was officially introduced by Crown Prince Mohammed bin Salman in 2017 in adherence to the Vision 2030 plan, aiming to diversify the Saudi Arabian economy and reduce dependence on energy resources. Encompassing an expansive land area of 26,500 square kilometers, the NEOM City project will surpass Belgium in size [6]. Geographically, it will be strategically situated near the Red Sea and the Gulf of Aqaba, as well as the borders of Egypt, Jordan, and Israel [7]. Nonetheless, despite the thriving construction sector in the KSA and the ongoing NEOM project, various challenges persist, including frequent delays and cost overruns, often leading to contentious claims [8]. A research study conducted on the NEOM project reveals potential challenges in numerous realms, including finance, politics, and design [4]. Furthermore, Assaf and

Al-Hejji [9] ascertain that a staggering 70% of Saudi public projects experience significant delays due to cost overspends, possibly stemming from inaccuracies in project budget estimation [8]. Westland, J [10] proclaims that with enhanced cost estimation techniques at the disposal of project managers, time and financial resources could be better managed. Research confirms that the absence of construction technology, namely advanced software for cost estimation and comprehensive planning, may be a primary factor contributing to the lack of accuracy in early-stage construction project estimates [11,12].

Implementing Building Information Management (BIM) has the potential to be a viable solution for addressing the common challenges of delays and cost overruns in the construction sector of the KSA. While the adoption of BIM in this field may be relatively gradual, it offers significant benefits, such as the reduction in construction claims, clash detection, and minimizing changes in the original scope of work. Another advantage of using BIM is its potential to facilitate amicable resolution of disputes among conflicting parties, thereby mitigating the need for legal action. However, despite the evident advantages, the utilization of BIM in KSA projects remains limited, as indicated by previous studies [13–15]. In practice, the introduction of new approaches, such as BIM, for accurate project cost estimation is crucial for achieving precise budgeting. Moreover, leveraging advanced technology for accurate project calculations during the tender stage may convince contractors to eliminate the contingency amount, typically allocated as 5–7% of the budget to account for hidden risks [16]. The insufficient utilization of BIM in KSA construction projects has resulted in various disputes stemming from ambiguities in contracts, documentation, and unprofessional claim presentations. Additionally, neighboring countries to KSA, Egypt and the United Arab Emirates (UAE) have yet to fully realize mandatory implementation of BIM in their construction industries. Existing literature indicates the absence of specific regulations for BIM in KSA, Egypt, and UAE, highlighting that the adoption of BIM is not currently obligatory in these countries [13,17,18].

To mitigate frequent contentious construction claims, it is highly recommended for participants involved in construction projects to employ Building Information Modeling (BIM) technology. The utilization of BIM can enhance collaboration, facilitate efficient change management, and ensure the use of accurate and updated information in a proactive manner [19]. Moreover, the absence of BIM poses challenges for managing variations during the construction process. While variations are inevitable in any construction projects, effectively tracking and managing them becomes arduous without the support of BIM, potentially leading to disputes among project stakeholders [20]. Despite the benefits of implementing BIM, several obstacles hinder the widespread adoption of this technology in the KSA construction industry, including a lack of awareness and training, standardization issues, high implementation costs (particularly for small organizations), and insufficient government support [10]. Overcoming these barriers necessitates collaborative efforts among construction professionals, government agencies, and educational institutions to promote the integration of BIM technology within the KSA construction sector. Accordingly, this article aims to inquire into the root causes of contentious claims within the KSA construction industry, emphasizing the significance of BIM employment in overcoming such issues. The subsequent section will review pertinent literature, followed by an elucidation of the research methodology, and subsequently present the findings and discussion before concluding this article.

2. Literature Review

2.1. The Importance of the Construction Sector in KSA

During the last 20 years, the Kingdom of Saudi Arabia (KSA) has seen an extraordinary increase in construction projects [21]. It boasts the Middle East's largest construction sector, which is expanding, with current expenditure exceeding USD 120 billion per year [9,22]. In addition, the construction industry employs 15% of the Kingdom's workforce and consumes more than 14% of the country's energy [13]. The awarded construction contracts in the public sector of the KSA increased from USD 78 billion in 2013 to USD 141 billion in 2018 [1,23]. The private and public sectors of construction focus more on Vision 2030, in which the demand for infrastructure development is expected to be increased [24]. Albarrak [25] stated that the economy of the KSA is transitioning into the post-oil era, wherein the construction sector is growing the fastest, with 3727 active projects worth USD 386.4 billion by 2025. Additionally, the construction market of the KSA is expected to grow at a compound annual growth rate of 6% between 2019 and 2024 [24]. The NEOM project is currently considered the largest project in the KSA as part of Saudi Vision 2030, in which the initial cost estimation of the NEOM project is targeted to reach USD 500 billion [5]. The developers believe that NEOM will exist entirely outside the current Saudi judicial system [6]. NEOM is designed to be home to oxygen, a seven km-long floating city, which would be the world's largest floating structure [4]. NEOM announced plans for the world's largest coral reef restoration project, located further on the Red Sea coast from this industrial hub [26]. Even though the construction sector is booming in KSA, it is struggling to measure and improve its performance. Common concerns include but are not limited to time delays, cost overruns, and issues with safety and quality [27]. Inevitably, the delayed construction industry in KSA is an old challenging issue that has harmed the industry's reputation [21]. As a result, this paved the way for researchers to investigate and resolve this issue, in which USD 147 billion is in jeopardy due to delayed public projects [9,21,27]. On the other hand, construction parties are increasingly concerned about delays in large-scale construction projects in the Kingdom of Saudi Arabia, which is regarded as a construction engineering facility [21]. In the following section, the challenges that hinder the KSA construction sector are investigated and explained in depth.

2.2. Legal Challenges in the KSA Construction Sector

The construction sector in the KSA faces challenges from different perspectives; for instance, the legal system in the KSA is distinct from other countries such as the USA, UK, and Europe [23]. Appointments controlling projects in the KSA are governed by Saudi law, which primarily comprises Shari'ah and Islamic laws. According to Islamic law, Contracts that include provisions for payment or receipt of interest are generally unenforceable, which might not be preferable for foreign contractors and investors involved in Saudi construction in the event of their delayed payments from the local client's side [28]. The KSA lacks an overarching civil code or commercial law, although individual Royal Orders, Ministerial Circulars can impose additional legal obligations [23]. Therefore, foreign investors must be aware of the principles of conflicting laws when drafting a contract under Saudi law. Shari'ah law requires parties to preserve the principles of fairness and equity during the execution of the work [19]. Contractors and consultants, when completing a construction project, must adhere to the Saudi Building Code and Sustainability Standard that was recently issued in 2020 [29]. Decennial liabilities represent a risk for some construction projects in Saudi Arabia due to the lack of awareness of the need for indemnity insurance for any construction project [13]. A study survey demonstrated that the NEOM project might face legal and contractual challenges due to the involvement of foreign investors, which might not be familiar with Saudi law [4]. Lack of advanced technology and a shortage of skilled manpower is considered other challenges that face the NEOM project [5]. Therefore, the KSA government is drafting special legislation that would safeguard investors while also facilitating the ability to introduce multinational companies to reimburse the lack of technology and skilled labor [19].

Challenges in the KSA construction sector are not limited to the private sector. In the public construction sector, the Public Works Contract (PWC) is the local standard form of contract used, which is silent on employers' liability for non or delayed payment in various remedies [10]. Charging interest for late payments is prohibited by Shari'ah law, which is applicable in Saudi Arabia. Consequently, a party involved in a construction project is often compelled to provide services even if the payment is delayed [30]. However, most commercial disputes in the KSA are heard by Shari'ah courts, which have broad jurisdiction over all civil and criminal cases. The Board of Grievances is a specialist tribunal with jurisdiction over many commercial and contractual disputes involving government entities [31]. It is likely to consider any case that involves a public sector entity. There are no specialized professional bodies in the Saudi Arabian construction industry to tackle or develop that field. In contrast to the UK construction industry, for example, the Institution of Civil Engineers (ICE) in addition to other professional bodies in the UK field created the New Engineering Contract (NEC) more than four decades ago, which is still applicable and periodically updated and used in the UK and other countries such as South Africa [32,33]. One of the reasons why project owners choose the NEC family of contracts in the UK is to avoid the risk of claims and disputes long after the completion of the project [34]. Even under the doctrine of law, there are no specialized courts or construction lawyers to act professionally in the construction cases of the KSA.

Under the UK legal system, the Technology and Construction Court (TCC) is a specialist court with specialist judges who deal with all forms of construction, engineering, and technology disputes that arise both within the UK and internationally [35]. In addition, the Housing Grants, Construction, and Regeneration Act of 1996 is the legal code that governs construction cases in the United Kingdom and English Courts [36]. Regardless of the path taken under the legal system of the KSA, the enforcement process is typically lengthy and challenging, and in some cases, the ultimate speed of the court's decision is dependent on the clarity of the plaintiff's presented documents. Another challenge is the slow payment procedure, which can put contractors and suppliers in bankruptcy. To address this issue in the public sector, the government might create a detailed payment plan and ensure that payments get paid on time [31]. Furthermore, there is a lack of transparency in the government contract bidding process, which can lead to corruption and favoritism. This problem can be solved by putting in place a transparent procurement procedure that provides fairness and equal opportunity for all bids. However, the government recently launched an electronic system called "Manasat Etimad" for interested parties who desire to deal with public tenders [37]. While the government contract in the construction public sector in Saudi Arabia faces several challenges. These issues can be addressed through increased clarity in contract terms, timely payments, transparency in bidding processes, investment in local expertise, and improved communication and coordination between government agencies [38].

2.3. Types of Legal and Contractual Claims in the KSA Construction Projects

Claims and legal disputes are common in both public and private construction projects; therefore, this section explains the distinction between legal classifications and types of construction claims. Contractual claims are based on the provisions of a legally binding contract between two or more parties involved in a construction project, while legal claims may arise based on implied terms that are not necessarily part of that binding contract [39]. Variations in quantity or quality and liquidated damage for defect repair are examples of contractual claims [40]. It is a common practice in the construction business to refer to common law claims as extra-contractual or legal claims [41]. Therefore, it is important to differentiate between contractual and extra-contractual claims that may arise in contract terms. Prolonged time and money claims are examples of loss and expense claims. Common law-based contract forms commonly include procedures for handling claims [41]. Furthermore, legal claims may arise beyond contractual terms, such as a breach of contract conditions or failure to comply with health and safety regulations, leading to significant harm, or death. In addition, there may be legal claims for damages if a part or the entire building collapses because its structure is not stable [39].

A claim under quantum meruit may arise in various circumstances, not all of which will include a breach of contract by the owner [40]. For example, the evaluated claim under a quantum meruit may be subjected to a Letter of Intent (LOI), which is a general word for a document that states a party's intention to engage in a formal contract later and, in the meantime, requires the other party to carry out work before the contract is finalized [42]. This document is typically in the form of a letter from an employer to a contractor containing instructions to carry out work, with the final agreement negotiated or finished later [41]. A quantum meruit claim cannot arise if the parties have a contract to pay an agreed sum. Ex gratia claims are made when money is paid against work done without the owner having any obligation or liability to do so. An owner may pay an ex gratia sum to save a contractor from becoming insolvent when it costs far more to hire another contractor [43].

2.4. Common Claims Factors That Drive up Construction Project Costs

This study investigated from the relevant literature 50 common factors that drive up construction project costs and cause disputable claims, as shown in Table 1. Preventive actions to mitigate the source of potential claims, such as errors during the design stage, must be considered in the initial stages of any project [38]. The purpose of preventive actions to reduce design errors is to reduce potential claims during the construction stage, which may lead to legal disputes. In large construction projects, the direct costs related to disputes can reach 0.5–5% of the contract value [44]. A study conducted in Malaysia stated that 92% of construction projects were delayed, whereas only 8% of projects had been completed within the planned time [45]. Variation orders that lead to time and cost overruns are considered the most common factors related to disputable claims. The number of projects experiencing claims related to variations and delays in the KSA increased from 700 to 3000 in the last five years [43].

Table 1. The 50 common claims factors that drive up construction projects costs.

No	Claim Factors	References	No	Claim Factors	References
1	Improper design	[8,19,20,27,32,35,37]	26	Extension of time	[8,9,15,19,32,35]
2	Variations and change orders	[8,9,13,20,35,37]	27	Delay Contractor's payments	[8,9,13,20,35,37]
3	Change in the original scope	[7,9,14,16,30,35,38]	28	Time schedule acceleration	[7,9,14,16,30,35,38]
4	Incomplete drawings from the client	[8,9,15,19,32,35]	29	Changes in the original quantity	[15,21,24,30,35]
5	Changes in specifications	[19,21,30,39]	30	Drawings not fitting construction sites	[19,21,39]
6	Ambiguous and incomplete drawings	[19,20,27,32]	31	Modifications in the construction stage	[20,27,32]
7	Changes in the site location	[9,14,16,30,35]	32	Slow decision making from the consultant	[9,14,16,30,35]
8	Poor safety measures	[9,11,20,35,37]	33	Prices increase in materials	[8,9,15,19,32,35]
9	Force majeure	[8,9,15,19,32,35]	34	Errors and defects in contract	[19,20,27,32]
10	Different site conditions	[8,9,15,19,32,35]	35	Lack of communication between parties	[20,21,25,32]
11	Use of unsuitable techniques	[14,16,23,35,37]	36	Lack of contract awareness	[14,16,23,35,37]
12	Concurrent delays from both parties	[9,14,16,30,35]	37	Instability of political situation	[9,14,16,30,35]
13	Economic conditions	[15,21,24,30,35]	38	Financial problems	[19,21,30,39]
14	Weather conditions	[19,21,30,39]	39	Failure to possess site work	[19,21,30,39]
15	Planning and scheduling problems	[8,9,15,19,32,35]	40	Procurement plan deficiency	[19,20,27,32]
16	Delay in supply drawings	[15,21,24,30,35]	41	Delay in handing over the site	[15,21,24,30,35]
17	Ambiguities in contract documents	[19,21,30,39]	42	Poor construction management	[19,21,30,39]
18	Failure to provide Bond claims	[12,27,32,36,39]	43	Construction defects	[12,27,32,36,39]
19	Breach of contract by either party	[19–21,27,32]	44	Personal injuries due to lack of safety	[19–21,27,32]
20	Changes in price and inflation	[19–21,27,32]	45	Government regulations and laws	[15,21,24,30,35]
21	Lack of control over subcontractor	[19,21,30,39]	46	Poor quality of contractor's work	[19,21,30,39]
22	Delay caused by the contractor	[19–21,27,32]	47	Variations Vs original designs	[12,19,27,32,35]
23	Underestimation of projects cost	[15,19,21,30,39]	48	Site permits delays from a municipality	[19,21,30,39]
24	Low productivity and efficiency	[19,20,27,32]	49	Lack of communication and coordination	[20,27,32]
25	Unqualified manpower	[19–21,27,32]	50	Change orders during construction	[8,9,15,19,32,35]

Construction projects with time and cost overruns can become overburdened with substantial repercussions for all involved parties. For example, clients may be unable to use facilities at the planned time, wherein the consultation and design fees may increase. From a contracting perspective, the consequences could include reputational damage and being stuck on a single project for an extended period [46]. The Channel Tunnel project was one of the most well-known cost-overrun examples, with construction costs increasing from GBP 4.80 billion to GBP 9.50 billion [47]. The Great Belt Link, which is 18 km long and connects the eastern and western parts of Denmark, incurred 54% of cost overrun [46]. Other international examples of projects with cost overruns include the Humber Bridge and Paris Nord TGV 25% cost overrun [47]. A study conducted in Korea's construction industry showed that the average final cost of seven mega-projects increased by 122.4% compared with the initial planned cost of USD 1 billion [46,47]. A study included a survey conducted on 130 public projects in Jordan and found delays in 106 projects, represented by 82%. Another study in Ghana observed that 33 (70%) out of 47 construction projects were delayed [48].

2.5. Source of Claims in the KSA Construction Sector

Generally, claims are not welcome; however, employers and financial institutions place a high priority on price and time certainty. It is not surprising that construction contracts restrict the contractor from modifying any part of the original scope of work during the construction stage without prior written approval from the owner [44]. A change order from the owner might lead to additional time and cost. In such a case, the contractor must notify the owner immediately in writing and obtain written approval from him of such an additional charge and a new completion date before beginning such work [22]. As found in the existing literature and shown in Table 2, the sources of claims in the KSA construction sector are diverse. Most crucially, the principal causes of claims are associated with the lack to adopt new technology such as BIM in project management. Poor coordination, an incomplete BIM model, and an underestimated budget are just a few examples that might be sources of claims [49]. Further, major causes of claims in KSA are related to contractor payment delays from owners' side. Financial difficulties challenge the contractors because most of them might not be able to inject the required money into a project if the owner delays or holds the contractor's payments unreasonably [6]. Importantly, contractors shall be entitled, under Sub-Clause 14.7 of the FIDIC contract conditions to receive financing charges compounded monthly on the amount unpaid from the owners [50]. Moreover, from a risk-sharing perspective, the contractors may not be charged if they slow down the progress of the work and reduce the project's resources due to payment delays by the owners. Unlike a construction agreement between a contractor and the government in the public sector in KSA using PWC local contract form, where the contractor cannot stop or slow the progress of work even if the government's payment is delayed. In addition, the contractor who signed a contract with the public sector is not eligible to be compensated with additional charge money for the delayed payments. Therefore, contractors must be aware when signing a contract with the public sector and be prepared for funding sources in the event of delayed payments. Hence, this study investigates the source of claims in the KSA using primary data from a field survey, which will be analyzed and discussed in the data analysis and discussion chapters, respectively.

2.6. Key Factors to Mitigate Potential Claims in Construction Projects

Construction projects are challenging and necessitate extensive planning, coordination, and execution. Several key factors must be considered to ensure the success of a construction project [41]. Quantifying a project's success is a complex process because success is subjective and difficult to agree upon. However, success factors can be defined as the extent to which project aims and expectations are realized. An unclear contractual agreement is one of the main sources of disputable claims in construction projects due to a lack of clarity in the contract conditions [40]. A key success factor for avoiding disputable claims is the clarity of the contract, which must be concise and outline the scope of work, such as payment terms, timelines, and quality standards. Further, the language of the contract and the simplicity of the terms and conditions are essential for the engineers and contracts managers to manage. The New Engineering family of Contracts (NEC) is a good example of the simplicity of contract language [51]. It is a formalized system developed by the UK Institution of Civil Engineers that guides the drafting of documentation for civil engineering, construction, and maintenance projects to obtain tenders, award contracts, and administer them [52]. In both the United Kingdom and Hong Kong, the NEC contract is frequently used [41]. Since at least 1994, there have been mainly failed attempts to introduce the NEC contract into both Australia and New Zealand, but the contract remains somewhat obscure in both countries [41]. This study investigated important success factors for any construction project, as listed in Table 3 [39]. From the researcher's experience in the KSA construction industry, most of the winning tenders in both the private and public sectors of construction are based on the lowest price, which is not always the best option. This prevalent technique is due to intense price competition among tenders, which in some cases jeopardizes project quality. Furthermore, regardless of the lowest agreed-upon price, the owners frequently rely on consultants to control the quality of the project. Controlling quality from the consultant's perspective with an underutilized contractor, on the other hand, is challenging and may result in disputes. To minimize future problems, owners must examine the short-listed contractors technically and financially during the bidding stage.

Table 2. Source of claims in the KSA construction industry.

No	Factors Group Related to Time Claim and Cost Overrun	References
1	Financier and Cost Group Causes	
1.1	Financial difficulties from owner side	[8,19,20,27,32,38]
1.2	Underestimated budget for the potential project	[14,15,20,22,27,38]
1.3	Slow and delay payments of completed work	[9,14,16,30,35,37]
1.4	Contractor financial challenges	[15,16,21,24,30,35]
1.5	Low-cost contract related to severe contractor competition	[19,21,30,39]
1.6	Payment delayed from the project client	[19,20,27,32]
1.7	Factors due to unbalanced bidder	[9,14,16,30,35]
1.8	Factors due to inadequate bid information	[20,35,37]
1.9	Factors due to the actual work done but not measured and paid	[19,20,27,32]
2	Claims Factors Related to Time Overrun	
2.1	Suspension of project work from the client side	[20,24,27,35]
2.2	Poor coordination and supervision	[20,35,37]
2.3	Delay in procurement or delivery of material	[9,14,16,30,35]
2.4	Un-interoperability of BIM tools	[15,21,24,30,35]
2.5	Shortage on materials on the market	[19,21,30,39]
2.6	Suspension of work from the owner or the contractor	[19,20,27,32]
2.7	Delay in mobilization time by the contractor	[9,14,16,30,35]
2.8	Oral change orders by client	[20,35,37]
2.9	Low productivity from the contractor's labors	[19,20,27,32]
2.10	Delay in Supply of Drawings	[7,14,35,35]
2.11	Poor BIM integration and management	[8,20,29,37]
2.12	Incomplete BIM model at the time of budgeting	[19,20,27,32]
2.13	Design changes to the BIM model	[9,14,16,30,35]

Table 3. Key factors to mitigate potential claims in construction projects.

No	Key Success Factors	References
1	Good coordination between the project parties	[19,20,27,32,38]
2	Using advanced technology in design and construction	[20,24,35,37]
3	Panel optimization	[9,14,16,30,35]
4	Proper choice of materials selection	[15,21,24,30,35]
5	Avoid underestimated tender price	[19,21,30,39]
6	Contractor experience	[19–21,27,32]
7	A Realistic time plan to complete the project	[9,14,16,30,35]
8	Minimal design changes during the construction process	[9,20,35–37]
9	Reduced labor costs with proper productivity	[19,20,27,32]
10	Value engineering to be studied after finishing the design	[20,21,25,32]
11	Adequacy of plans and specifications	[21,35,37,38]
12	Technical capability of the project manager	[9,14,16,30,35]
13	Adaptability of the project manager to changes in project plans	[15,21,24,30,35]
14	Project Manager early involvement in the project plans	[19,21,26,30,39]
15	Commitment of the project manager to satisfy quality, cost, and schedule	[19,20,27,32]
16	Communication system and control mechanism	[9,14,16,30,35]

2.7. BIM Review in the Construction Industry

Hamil [53] defined BIM as a process for creating and managing information on a construction project throughout its life cycle. BIM is not simply a tool or software; instead, it is a comprehensive process that enables all project parties, including architects, engineers, contractors, and other construction professionals, to plan, design, and build within a comprehensive 3D, 4D and 5D model [54]. BIM is also an acronym for building information modelling or building information management. The National Institute of Building Sciences defines BIM as an automated process that illustrates the physical and functional features of a facility. BIM works as a collaborative knowledge resource for building information, providing people with a consistent place to make decisions throughout a building's service life [54]. When extended and used in facility management as (6D) model, BIM can be used to manage buildings using data. Using BIM during the operational process as (facility management tool) can collaborate with Building Management System (BMS). The lifecycle and process of BIM in the construction industry is explained in the Australia and New Zealand guide as well [49].

It is prudent to acknowledge the significant advancements made in information and communication technologies (ICTs) over the past few decades, and their potential to enhance contemporary management practices [55]. The field of Architecture, Engineering, and Construction (AEC) has undergone significant transformation in its management and information exchange, owing to the swift and pioneering progressions in Information and Communication Technologies (ICTs). The interplay among technology, the construction industry, and legal frameworks is a constantly evolving and dynamic phenomenon, wherein advancements in one domain invariably catalyze transformations in the others [56]. The advent of Building Information Modelling (BIM) has been noted as a significant technological advancement in construction management, with a plethora of reported benefits across various projects [57]. In addition to the technical power of BIM, its capacity for interoperability, early information acquisition, integrated procurement, and enhanced cost control mechanisms, it also offers benefits in the form of diminished conflict and advantages for construction projects [16].

2.7.1. Levels of BIM in the Construction Industry

As indicated in Figure 1, presented below, BIM (Level 0) effectively implies the absence of collaboration in its most basic form. Primarily, two-dimensional CAD drafting is employed for the production of Information [31]. Output and distribution are achieved through the utilization of paper, electronic prints, or a combination of both. BIM (Level 1) amalgamates 3D CAD for conceptual design and 2D drafting for the preparation of statutory approval documentation and production information. The management of CAD standards is conducted in accordance with British Standards (BS 1192:2007) [58]. Data sharing takes place through a commonly shared data environment, often administered by contractors [38]. BIM (Level 2) is characterized by collaborative work and necessitates a project-specific mechanism for sharing information that is coordinated between multiple systems. Each party utilizing the CAD software must possess the capability to export it to a standardized file format, such as the Industry Foundation Class (IFC) or Construction Operations Building Information Exchange (COBIE). Although BIM (Level 3) has not been fully defined, the UK Government's Level 3 Strategic Plan outlines its objectives [19]. The establishment of new international data standards will facilitate seamless data sharing across various industries. Simultaneously, the training of public sector stakeholders on BIM approaches, including data requirements and operational methods, will be prioritized.

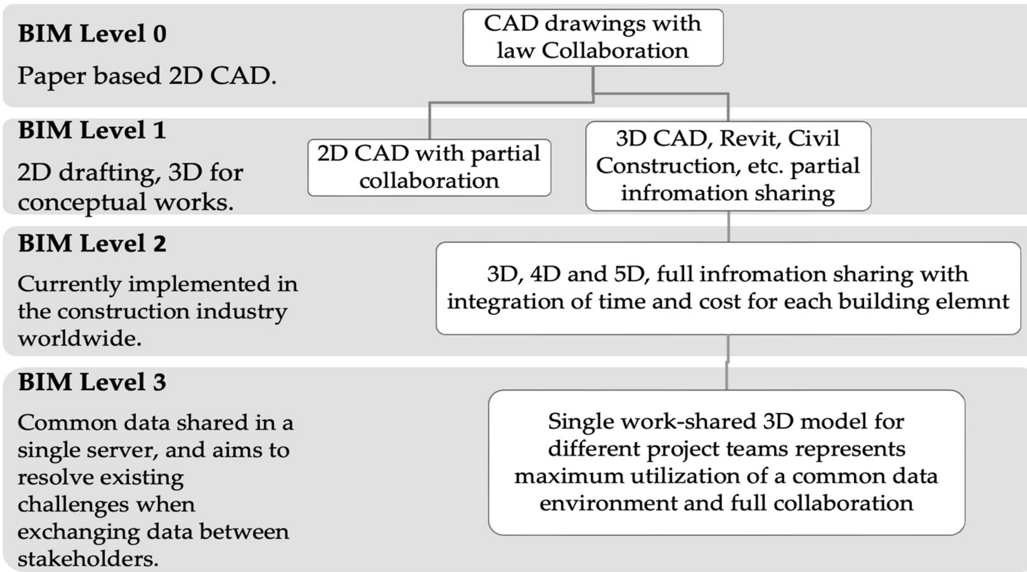


Figure 1. An illustration of BIM level uses in the construction industry [19,38,58].

2.7.2. Benefits of BIM Application for Claims Reduction in the KSA Construction Industry

BIM, which is a computer-based approach to building management that aims to improve efficiency and reduce claims, is a relatively new technology that is rapidly gaining acceptance in the construction industry [10]. BIM makes it easier to look at more options and analyze them better, filing fewer claims, and going over budgets and schedules less often. BIM has been proposed for use in the construction industry in Saudi Arabia and other adjacent construction neighborhoods in the Gulf Region. The primary goal of proposing BIM to be used in the KSA is that the implementation of BIM is not yet mandatory. A field survey case study explained that only 20% of construction companies in the Middle East are implementing BIM, and 80% are not applying or involved in the adoption process [59]. BIM is a virtual approach that encompasses all parts of a facility in a virtual model so that all design team members can work together more efficiently than with old techniques [54]. BIM combined with other digital software can significantly impact the Saudi construction sector.

The construction industry in the KSA is highly dependent on local sources; therefore, it must be technologically advanced. Adopting BIM can yield benefits in many areas, such as the economy and sustainability. BIM allows designers to produce multiple design options and perform numerous tests on a BIM model. A conference paper by Banawi and Aliobaly [60] mentioned that a small number of large construction firms use BIM in their significant projects. Barriers to BIM implementation can be categorized as legal, business, human, and technical; the entire sector has limited expertise in BIM implementation as well [16]. BIM enables the virtual building of projects before their actual construction, reducing the inefficiencies and complications that occur during the construction process [30]. The following sections explain the top benefits of BIM when implemented in the KSA construction projects to reduce construction disputes.

Early Detection of Design Errors: A BIM model might never be completely accurate to reality, but it can be accurately modelled, and the construction conditions will, of course, validate everything. However, even if the BIM model recognizes at least some of the errors before the construction stage, it may simply avoid them on the construction site. Since BIM tools assist users in automating the detection of items such as electrical cables, sewer pipes, and ventilation ducts [47]. Simply, BIM may enable a clash detector, which will automatically verify clashes and generate reports. Instead of manually reviewing drawings from multiple sources, which could prolong the time needed to discover clashes and may give the contractor the right to raise a time claim if he discovers design errors during the construction stage [31]. However, as a rule of thumb in the KSA industry, when following the traditional methods of designing a project, not all clients able to visualize their projects on papers. As a result of their inability to visualize the scope of the project in the planning stages, many of them are likely to require design modifications during construction works. Owners should avoid a lack of design visualization by finalizing the BIM Level of Development (LOD 300) during the detailed design phase as shown in Figure 2 [61]. By visualizing the project in (LOD 300), the owner or his technical representatives can minimize the likelihood of scope changes throughout the construction phase.

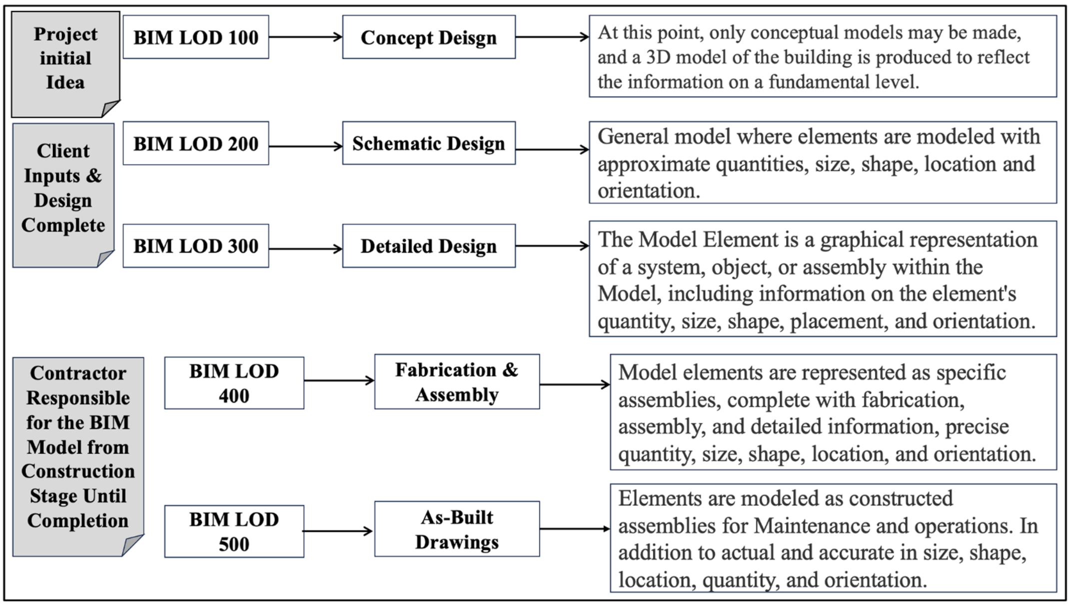


Figure 2. Level of developments of BIM application in construction projects [24].

Mitigate Risk and Reduce Cost: A study by McKinsey found that 75% of organizations that have embraced BIM have experienced positive returns on their investments. Closer coordination, especially from contractors, can result in reduced tender risk assessments, lower insurance costs, fewer overall variations, and fewer claims' opportunities. A better understanding of the project before beginning enables more prefabrication and avoids waste of unneeded materials [54]. Contractors in the (LOD 400) stage can run the BIM model to detect any clashes, if any, and then begin fabricating the necessary objects and materials to finish the project activities precisely, without conflicts and saving time.

Reducing Delays and Errors: Most design offices in KSA develop 3D models of their constructions, but they still transfer them on papers since papers authorizes everything, which increases the likelihood of errors. Therefore, the logical next step is to eliminate the transitional phase and solely use the 3D model as a final product [62]. A contractor with a reinforcement model can make his or her own orders by generating bending lists immediately on the job site, independent of the designer. An example is when the contractor on one of the projects received a reinforcement list with 40 pages and over 200 tons of reinforcement, and nothing was separated into pieces. Because it was easier for the designer, the foundations, walls, and the rest of the building skeleton were all combined in one document [31]. As a result, the contractor had to sift through tons of paper to identify the items needed. In cases involving drafting a money claim compensation from a contractor side due to market fluctuations in steel prices, and when traditional methods are used rather than BIM to examine the compensation claim, the contractor may spend a long time developing the compensation claim, with doubtful accuracy of the claim amount.

2.7.3. Connection between Claims and BIM in the Construction Industry

Construction claims have become widespread, and it is expected that when projects grow in complexity, the number of reasons for filing claims might increase as well. One of the reasons for increasing the degree of claims nowadays is the complexity of modern architectural projects that involve hundreds of activities [59]. According to an industrial report, the average time required to resolve a construction dispute in KSA can reach 17 months, and the average value of these disputes is approximately USD 33 million worldwide [40]. Construction claims management depends on the quality of the construction claims report. Claims evidence can be delivered verbally through handwritten paperwork or computer-generated digital data. With the BIM application, all project information is recorded in a central database linked to a 3D model that can be used to aid in the identification, quantification, and visualization of claims [31]. BIM has not been effectively employed to manage construction claims. This can be attributed to the fact that BIM platforms and tools do not have the capability to handle construction claims [59]. BIM can improve construction quality, shorten the duration of project delivery, and reduce construction claims. It can improve building processes through enhanced analysis, a more superficial investigation of more alternatives, fewer claims, and reduced budget and time overruns [62]. There is evidence that BIM is beneficial to the industry despite several potential challenges. Government and building experts have offered BIM as a solution to difficulties in the construction industry [40]. Several BIM technologies facilitate the production of designs that are consistent with the owner's budget and specifications [59].

2.7.4. Potential Hurdles of Implementing BIM in the KSA Construction Industry

Even though BIM is not yet mandatory in Saudi Arabia, the KSA has been actively promoting the adoption of BIM in the construction and infrastructure sectors since 2021. The local National Transformation Program (NTP) 2020 guidelines and standards aim to increase BIM use in the KSA construction industry [63]. It emphasized the significance of adopting advanced technologies such as BIM to improve construction project efficiency and quality. In addition, the Saudi Buildings family of Codes, which is published by the Saudi Arabian Standards, Metrology, and Quality Organization (SASO) in 2020, provides guidance on construction practices refereed to BIM application [37]. It is probable that BIM requirements and standards are incorporated into specific sections of the code. Currently, most foreign construction companies and consulting firms operating in the construction sector of the KSA employ their own project management systems, which often incorporate BIM technology [20]. The authors argue that most multinational construction firms operating within the construction industry of the KSA have the potential to improve the project management system of local subcontractors upon their participation in construction projects. Hence, it is imperative for the government of the Kingdom of Saudi Arabia (KSA) to actively promote the dissemination of BIM inside the country.

Similarly, this study investigated further the implementation of BIM in Egypt, a neighboring country to the KSA, which found that BIM is still in its nascent stage [18,63]. A comprehensive study was conducted in Egypt through an online survey that reached out to a sample of 42 professionals specializing in architecture, engineering, and contracting [18]. The findings of the survey highlighted that a significant portion of the participants expressed limited familiarity with or comprehension of the concept of BIM [64]. However, it was observed that professionals in the construction industry and governmental bodies were increasingly recognizing the advantages of BIM. Notably, the Egyptian construction sector lacks explicit building legislation pertaining to the application of BIM [65]. Nonetheless, practitioners from the construction field argued that BIM has the potential to enhance collaboration, mitigate errors, optimize project efficiency, and foster streamlined communication among various stakeholders [64,65]. The Egyptian government has exhibited a proclivity for acknowledging the potential benefits of BIM.

Likewise, the study investigated the construction sector in the United Arab Emirates (UAE), in which most construction projects are delivered on a fast-track basis. The main driving force behind this is the incentives that developers, including government organizations, offer [17]. Despite the significant growth of the construction sector in the UAE, research indicates that BIM is currently mandated in Dubai for specific project types, but it is not yet obligatory for all construction projects in the UAE or in all its emirates. Only a small percentage, ranging from 6% to 10% of contractors in the UAE industry possess knowledge or awareness regarding the complete extent of BIM [17,66]. There is a need to establish BIM standards and protocols specifically tailored to the UAE construction industry. It is imperative to standardize the BIM process within the context of the UAE industry to ensure the successful implementation of BIM [17,66,67]. Although the utilization of BIM is emerging in the UAE, there is a lack of BIM contractual documents. Since the Dubai Municipality mandated the use of BIM in 2013, it has increasingly been employed in large-scale projects across the UAE [68]. Unlike jurisdictions such as the UK, few standards have been developed for BIM adoption in the UAE, and the contractual agreements often fail to reflect the BIM approach. This leads to potential ambiguity regarding the obligations and responsibilities related to BIM [17]. Consequently, it is crucial to carefully consider the relevant standards and contractual position for any BIM project in the UAE.

Despite the substantial advantages of BIM, as explained in the preceding sections, the construction sector in countries such as the KSA, Egypt and UAE have yet to implement BIM [10,17,63]. This is due to a variety of barriers, challenges, and hurdles to its adoption and implementation [20]. Several research investigations have focused on this fact [20,69–71]. This study highlighted four areas of potential obstacles, challenges, and impediments to BIM adoption and implementation. (1) Legal Conditions: the implementation of BIM in Saudi Arabia may be hindered by the country's current legal framework [10]. BIM-specific regulations and standards may not be well established or enforced, creating uncertainty, and impeding the widespread adoption of BIM practices [10,72]. In addition, it may be necessary to update the legal framework to resolve issues such as intellectual property rights, data ownership, and liability concerns related to BIM implementation. (2) Cultural practices can influence the adoption of new technologies such as BIM. There may be resistance to change in Saudi Arabia, where traditional construction practices are significantly rooted [72,73]. The construction industry's reliance on hierarchical decision-making processes and conventional project delivery methods may pose obstacles to the adoption of BIM enabled collaborative workflows. It may be necessary to resolve cultural attitudes toward information sharing and collaboration through awareness campaigns and training. (3) Technological limitations might also make it more difficult to implement BIM in Saudi Arabia [10]. The availability of a dependable Internet connection, a compatible hardware infrastructure, and software compatibility are essential for the successful implementation of BIM [10,20]. For effective collaboration among project stakeholders, it is essential to ensure access to current software tools and promote interoperability between different software platforms. (4) Organizational impediments: when using BIM, organizations in the construction industry may encounter internal impediments [73]. Resistance to change, a lack of understanding of the benefits of BIM, and insufficient training can all stymie the adoption process [71,73]. Furthermore, firms must invest in employee training and development programs to ensure that employees have the essential abilities to work effectively with BIM [10,20].

As indicated in Figures 3 and 4, the sources of claims and the strategy of claims avoidance rely on the usage of BIM technology. However, it is essential to establish a universally accepted definition of BIM and develop a systematic approach to evaluate the benefits of BIM [70]. Although the adoption of BIM is increasingly prevalent in the (AEC) worldwide, the lack of skilled professionals poses a significant challenge to the widespread implementation of BIM [72]. Clients are required to provide their consent in the contractual documents and accept it as a binding condition in order to incorporate the data-rich BIM model into their projects. It is vital for owners to embrace a paradigm shift, moving away from relying solely on the Rate of Investment (ROI) as a means of justification and instead employing an evaluation methodology that comprehensively considers the value and benefits of BIM throughout the entire project lifespan [20,69,73].

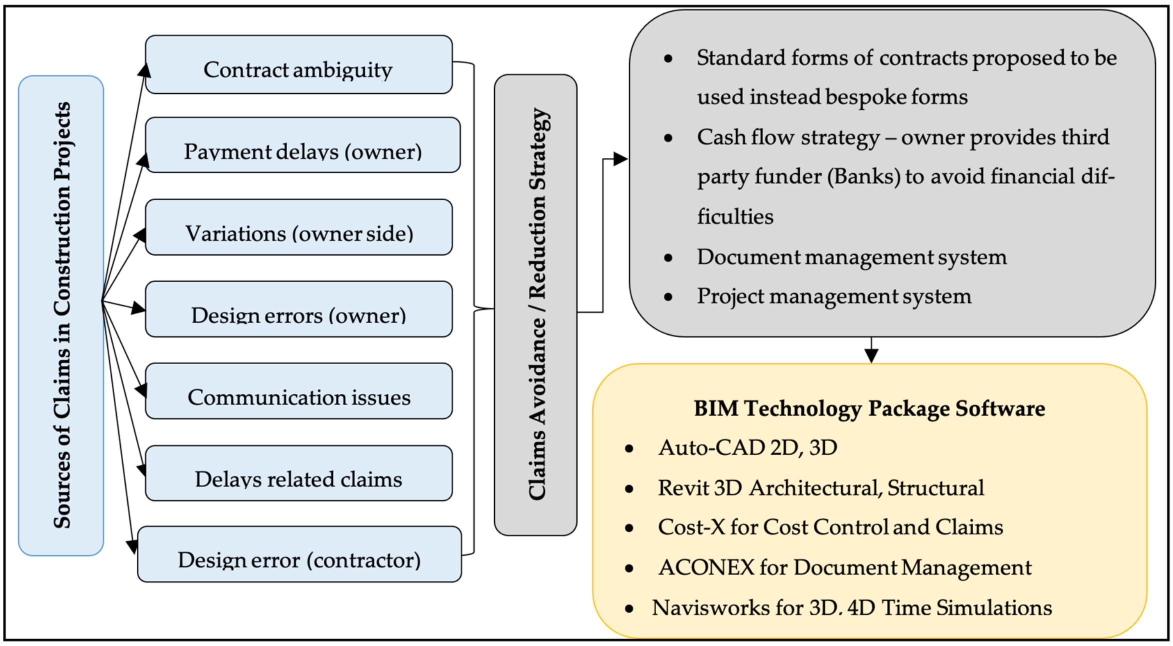


Figure 3. Sources of claims with strategy of claims avoidance based on BIM implementation.

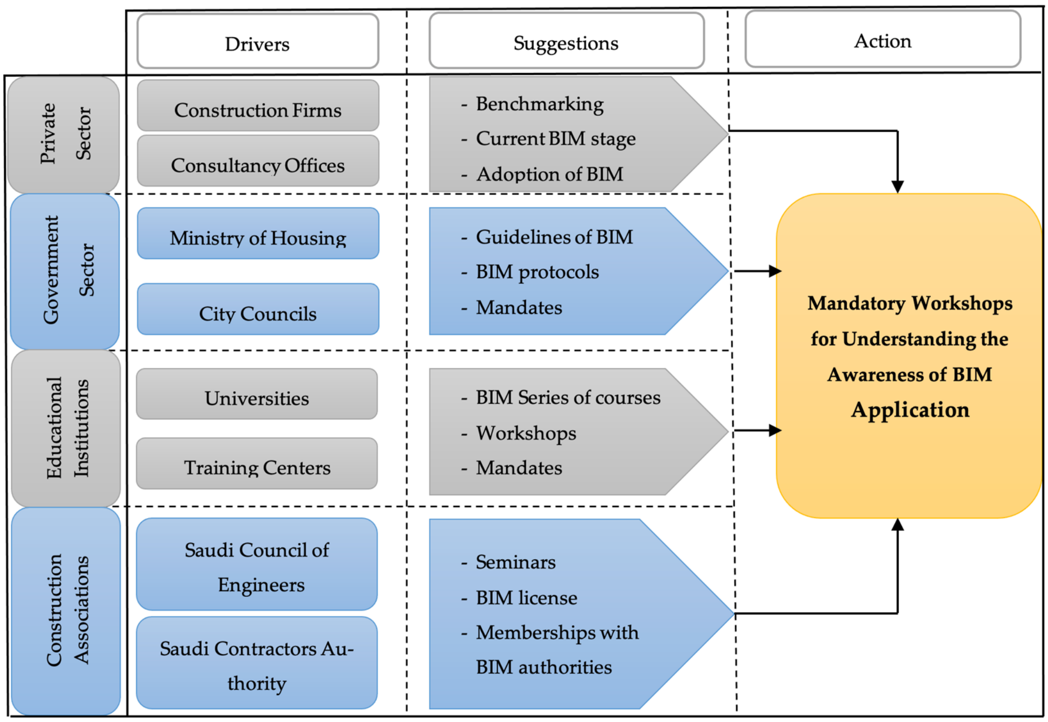


Figure 4. A conceptual flow chart for BIM awareness in the KSA industry [18].

3. Research Methodology

The methodology applied in this research is based on extensive review of the relevant literature with field survey interview sessions as structured in stages in Figure 5.

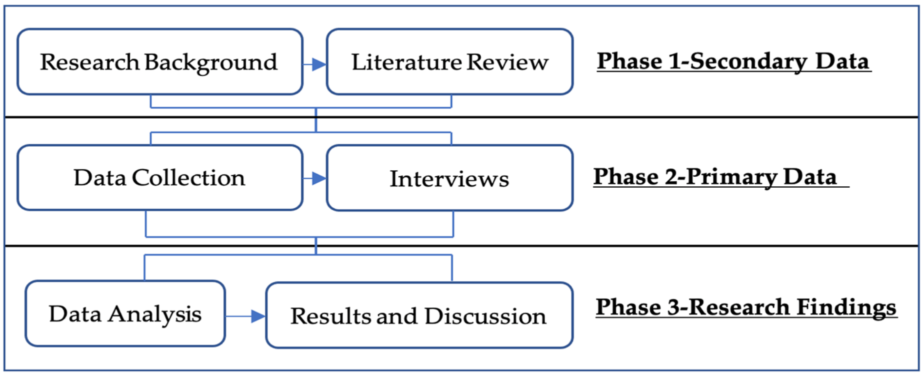


Figure 5. Research methodology flow chart.

3.1. Phase 1: Research Background and Review the Previous Literature

This was accomplished by conducting a comprehensive review to produce a descriptive summary of the relevant literature that suited the background of this study. Additionally, a historical literature analysis was conducted to investigate the factors, causes, and sources of disputed claims in the construction industry generally and in KSA. Finding out what has already been studied in the field of building information modelling (BIM) in Saudi Arabia, Egypt, and the United Arab of Emirates (UAE) were critically investigated.

3.2. Phase 2: Data Collection from the Field Survey as Primary Data

The primary data were collected from the industry based on interview sessions held with professionals in the KSA construction projects. The field survey interview sessions were held with practitioners of different experiences, including owners, project managers, contractors, designers, and consultants. The researcher held 35 sessions and spent approximately 60 min discussing each practitioner, and the number of investigated claims raised by practitioners totaled 175 cases as shown in Table 4. The highest number of claims were related to commercial projects (105 cases), compared to 64 claims for 35 residential projects.

Table 4. Respondents from the KSA construction industry.

Respondents Categories	No of Respondents	No of Projects	No of Claims Faces
Owners	7	12	25
Consultants	8	20	35
Designers	5	18	20
Contractors	9	15	65
Project managers	6	20	30
Total	35	75	175

The data collected in this study employed a qualitative method, which provides insight into the prospective advantages of BIM implementation. Face-to-face interviews with respondents provide a wealth of accurate data from a small sample size, which is an advantage of this method. However, such an approach restricts the ability to generalize, and it uses the lessons learned to formulate theories in a particularistic context. In addition, the purpose of using a qualitative approach lies in its strength and ability to provide complex descriptions of how individuals experience a given research issue. It also provides information about the human side of an issue that is often characterized by paradoxical behaviors, opinions, beliefs, and relationships among individuals. Psychological research aims to address questions regarding experience, meaning, and perspective, typically from the participant's perspective. Typically, these data cannot be counted or measured [74].

3.3. Phase 3: Data Analysis and Discussion

The fourth phase of the research methodology involves the selection of the appropriate mathematical concept for accurate analysis of the collected data. In this regard, the findings of the field survey interviews were examined to determine the weighted average. The weighted average is a mathematical Formula (1) that assigns weights to each quantity that needs to be averaged. This weightage assists in estimating the relative importance of each quantity. Utilizing the weighted average formula, it is possible to achieve a more precise average as all the values within the dataset are assigned equal weights [74].

$$\sum = W * \frac{X}{N} \tag{1}$$

(W) is the weight of the claims factor,
(X) is the number of respondents who were chosen, and
(N) is the total number of respondents (35 practitioners in this study).

The second formula No (2) used in the data analysis is the significance index

$$\sum * \frac{100}{7} \tag{2}$$

For each data point, the index is calculated by dividing the column % of the crossing cell by the percentage of the whole cell and then multiplying the result by (100), and divided on (7) which is the total number of claims sources. The data analysis will be explained in detail in the data analysis section and as shown in Table 4. Indexes in this range are not usually noteworthy, although they might be instructive when investigating large audiences and common traits [74].

4. Data Collection and Analysis

This study employed face-to-face interview sessions as a qualitative technique to gather primary data from various projects in the construction industry of Saudi Arabia (KSA). These interviews were conducted with 35 experts who have been actively involved in the KSA construction industry for a period ranging from 5 to 20 years. The participants' experiences can be categorized as follows: 13 participants with 20 years of experience, 10 participants with 15 years of experience, 9 participants with less than 7 years of experience, and 3 participants with less than 5 years of experience. Out of all the participants, 33% reported a lack of awareness regarding Building Information Modeling (BIM), while 37% and 30% mentioned having three and two years of experience respectively with BIM. The practitioners who involved in this comprehensive survey, encompassing a total of 75 projects, included owners, consultants, designers, contractors, and project managers, as evidenced in Table 4.

Table 4 provides comprehensive insights into the number and categorization of respondents, the projects subjected to claims, and the overall count of investigated claims. In the domains of statistics and psychometrics, reliability refers to the overarching consistency of measurement. High reliability is attributed to measurements that consistently yield similar results under stable conditions. It represents the property of test scores associated with the extent of random measurement error that might be present. Scores with high reliability are dependable, reproducible, and consistent across multiple testing instances. In essence, if the testing procedures were to be repeated with the same group of test-takers, comparable results could be anticipated [75].

Out of all the participants, the contractors constituted the largest group, encountering 65 claim situations across 15 diverse projects, as indicated in Table 4. Commercial projects predominantly faced claims, whereas water line infrastructure projects were comparatively infrequent, as demonstrated in Table 5. In addition to the BIM-related questions posed during the interviews, special attention was given to seven key sources that often lead to the emergence of contentious claims, as shown in Table 6.

Table 5. Distribution of 175 claims cases for different types of construction projects.

Project Category	No of Projects	No of Claims Faces	Percentage of Claims
Commercial	40	105	60%
Residential	35	64	37%
Water lines	5	6	3%
Total	75	175	100%

Table 6. Source of claim frequency.

Source of Claims	Participants	Never	Rare	Average	Frequent	High Frequent
1. Contract ambiguity	35	1	1	2	9	6
2. Delays factors	35	1	2	3	9	12
3. Variation orders	35	1	2	8	7	12
4. Coordination issues	35	1	3	4	5	10
5. Lack of decisions	35	1	2	3	4	9
6. Payment's delay	35	1	2	5	8	9
7. Design error	35	3	4	6	5	8

Respondents were requested to choose one out of the five available alternative claim frequency options to provide a credible estimation of each claim factor's frequency. Two mathematical formulas were utilized to analyze the information collected from the field survey. Moreover, a numerical weight ranging from (0 to 4) was assigned to indicate the category of claim factor frequency. A weight of (0) represented "never", while a weight of (1) represented "rare", a weight of (2) represented "moderate", a weight of (3) represented "frequent", and a weight of (4) represented "high frequent". For instance, respondents rated the claim causes associated with contract ambiguity as (6) for high frequent, (20) for frequent, and only (5) for rare. The weighted average formula marked as (No.1) which was employed to scrutinize the data presented in Table 6 was computed and analyzed. Here, (W) denotes the weight of the claims factor, (X) represents the number of respondents who selected it, and (N) indicates the total number of respondents (35 in this study).

To provide a clear sense of the importance of each source of the claim, a significance index (%) was calculated and shown in Table 7. based on the given weighting scores from the participants as shown in Table 6. The results of the significant index are used in the combination formulas No (1 and 2).

Table 7. The significance index of each claim type with its frequency in KSA.

Types of Claims	Significance Index (%)	Rank
1. Contract ambiguities	23%	6
2. Delay related claims	35%	2
3. Variation orders	36%	1
4. Coordination issues	27%	4
5. Lack of decisions from the owner and consultant	23%	6
6. Payment's delay	29%	3
7. Design error claims	27%	5

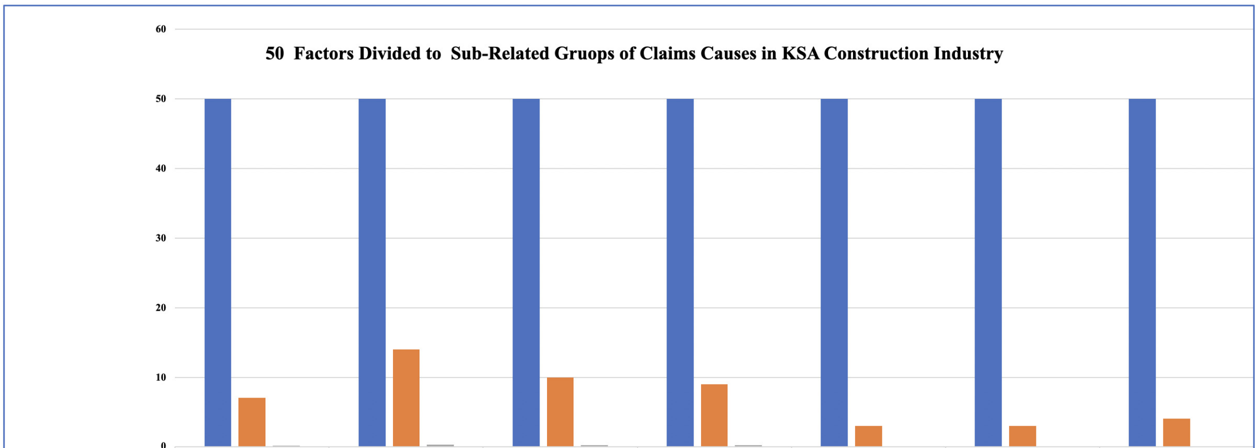
Table 7 displays the significance index value for each source of the claim. For example, in Table 6, the weighted average for contract ambiguity is $(0 \times 1 + 1 \times 1 + 2 \times 2 + 3 \times 9 + 4 \times 6)/35 = 1.6$, which has a significant index of $(1.6 \times 100)/7 = 23\%$, while the significant index value of variation order is $(2.48 \times 100)/7 = 36\%$ as the highest importance index score. Furthermore, delays factors claim ranked $(2.46 \times 100)/7 = 35\%$, which is nearly equal with variation orders as a source of claims. Design errors ranked 27%. The weighted average of payments delays is $(0 \times 1 + 1 \times 2 + 2 \times 5 + 3 \times 8 + 4 \times 9)/35 = 2.06$, and its significant index is $(2.06 \times 100)/7 = 29\%$, in which Table 7 shows the rankings for all sources of claims that were investigated in the KSA.

5. Discussion of the Literature Review and Results

The literature review in this paper showed that the total income of the KSA would reach USD 834 billion by 2021. The Saudi construction industry accounts for a significant portion of the country's total income and has a long history dating back to the 1950s. Since then, it has grown significantly, with the government investing heavily in infrastructure projects. The construction industry is currently one of the largest sectors in the Middle East, focusing on residential, commercial, and industrial projects. According to Saudi Vision 2030, large-scale projects are underway, and this paper discusses two significant projects from the total portfolio of the KSA. The project of Neom City is budgeted at USD 500 billion, construction is underway, and the project goal is to build a futuristic city powered solely by renewable energy sources. In addition, the Saudi construction industry offers numerous opportunities for investors and developers to suit the country's ambitions for future expansions. With the government's focus on infrastructure development, the demand for construction projects is growing. In addition, the government has implemented various incentives to attract foreign investment, such as tax breaks and low-interest loans. However, a research conducted in KSA stated that, numerous disputable claims have been raised regarding the Saudi construction industry [76]. This has led to delays and a lack of investment in many projects.

This study investigated 50 claim factors that frequently occur in construction projects, as shown in Table 1. The 50 factors investigated as causes of claims were divided into 7 groups as sources of claims, as illustrated in Figure 6. The indications in Figure 6 shows that 28% of the total 50 factors of claims are related to changes in the original design scope and shifting the project baseline, while 20% of the total factors of claims are related to poor coordination from all involved parties in construction projects. Contract administration-related claims were 18%, while other factors caused minor impacts on the project. It is evident from Figure 6 that the interpretation of the higher percentages causing the claims is due to changes in the project during execution, which may indicate that the owner lacked vision when designing the project prior to execution. This may lead the owner to request modifications to satisfy his requests as he perceives them, which may incur extra costs with additional time. Furthermore, the difficulty of communication between project parties, which scored 20% of the total 50 claim factors, may be related to a lack of coordination, relying on traditional management approaches rather than an advanced methodology. Claims factors related to contract administration are not less important, which may be due to an unclear scope of work for the contract manager because of the project team not using an integrated project management system in many cases, which causes poor communication between project parties.

The primary data have been collected from the field survey conducted by the author, in which the study identified seven significant frequent factors as sources of claims in KSA construction projects, as shown in Table 6. Each participant in the researcher's study, in which a total of 35 professionals involved from the KSA construction industry, as shown in Table 5, voiced their opinions in response to the open-ended questions. The study found that the most frequent factor as a source of claims in KSA construction projects was variation orders ranked (36%), while claims related to delays ranked (35%) as the second rank, as shown in Table 8. As a result, it is clear from the percentages that most delay cases are associated with variations, and variations are typically associated with owner-requested scope changes. One of the reasons for the frequent changes from the owner's side might be due to the lack of virtual conception of the project design before the commencement of the construction stage, and this could be due to the lack of 3D modelling with the related information, which BIM can handle. Contractor payment delays and coordination issues are not less important claims factors in KSA projects, which ranked (29%) and (27%) respectively as sources of claims. Even though payment delays were ranked second in the field survey, it mostly irritates most contractors. For example, in a large-scale commercial building including a hotel in Jeddah, KSA, with a budget of USD 53 million (200 million Saudi Riyals) [77]. The construction process of the commercial project was held up for four years owing to contractor payment delays. Both the contractor and the project's owner went to court, where the contractor raised delay claims and the owner raised a counterclaim due to the contractor's failure to complete contract obligations. This legal case is still pending at the Court of Appeal, as the researcher is appointed in this case by the court as an Expert Witness.



	Design Factors (Owner Side)	Changes in Original Scope and Project Time (Owner & Contractor Side)	Poor Communication Factors (Owner & Contractor Side)	Contract Administration with Related Claims(Owner & Contractor Side)	Site Conditions Factors (Owner & Contractor Side)	Safety Gear Factors (Contractor Side)	External Factors (Others)
Total Claim Factors	50	50	50	50	50	50	50
Sub-Claims Related Factors	7	14	10	9	3	3	4
% From Total Factors	14%	28%	20%	18%	6%	6%	8%

Figure 6. The 50 factors divided to sub-related groups of claims causes in the KSA construction industry [19,20,24,27,35,39].

Table 8. The results of the source of claims from the existing literature and field survey of this study.

Source of Claims from the Field Survey	Rank	Groups of Claims from the Literature Review	Rank
1. Contract ambiguities both sides)	23%	1. External factors	8%
2. Delay related claims (owner side)	35%	2. Safety gear factor (contractor side)	6%
3. Variation orders (owner side)	36%	3. Site coordination factor (both sides)	6%
4. Coordination issues (both sides)	27%	4. Contract administration	18%
5. Lack of decisions from the owner and consultant	23%	5. Poor communication (both sides)	20%
6. Payment's delay (owner side)	29%	6. Changes in original scope (both sides	28%
7. Design error claims (owner side)	27%	7. Design factors (owner side)	14%

Table 7 presents the primary data from the field survey, in which contract ambiguity and errors in design had the least impact on construction projects as a source of claims in KSA, accounting for (23%) and (27%) respectively. Contract ambiguity in the KSA industry is inherent and frequent as a major source of claims, and the reasons for this vary. For example, due to a lack of standard forms of contracts in the KSA industry, parties in the private sector are increasingly resorting to the use of bespoke contract forms, as opposed to the UK industry, which employs standard forms such as Joint Contracts Tribunal (JCT) and the family of New Engineering Contracts (NEC) in both private and public projects [78]. As is widely known, standard forms of engineering contracts such as JCT, NEC or FIDIC conditions of contract are well drafted and examined in terms of risk sharing between the signed parties.

There are various potential reasons why countries outside the UK have not embraced the New Engineering Contracts (NEC) in the construction industry. These reasons can include cultural disparities, legal and regulatory frameworks, a lack of awareness and familiarity, and resistance to change. Cultural disparities arise from different countries having their own established contractual frameworks and deeply ingrained industry practices. The adoption of NEC contracts necessitates a significant mindset shift, which may not align with existing practices. Each country possesses its own unique legal and regulatory framework that governs the construction industry. These frameworks may not be compatible with NEC contracts and adapting or modifying them to fit local requirements may pose challenges. Furthermore, NEC contracts were developed in the UK and may not be well known or understood in other countries. Many nations have their own widely used and accepted standard forms of contracts, resulting in limited knowledge or awareness of NEC contracts among industry professionals in these countries. Moreover, implementing new contract forms often necessitates substantial effort, including training, education, and potentially revising existing processes and procedures. Consequently, resistance to change may emerge, particularly if the benefits of adopting NEC contracts are not clearly understood or if stakeholders perceive a higher level of risk or uncertainty associated with this change.

It is common practice for both owners and contractors in KSA to limit their use of standard forms of contracts because they believe that using bespoke contracts might be simple and easy to manage, which is, by the rule of thumb, not true and may not adequately define the scope of work. Consequently, most claims cases in the KSA that raised disputes in court were due to the ambiguities of bespoke contract use. Although errors in design were evaluated by (26%) of the sources of claims in the field survey data analysis, the researchers believe that it is largely related to changes and variations, which ranked top. There is a reason for this as well; most changes in KSA projects are affected due to poor design and a lack of virtual project conception prior to construction.

Table 8 summarizes the similarities between the secondary and primary data of the sources of claims identified in the relevant literature compared to the findings of this study's field survey. For instance, design errors accounted for 27% of the field survey, representing 14% of the relevant literature. This demonstrates that design factors continue to be a prominent source of claims and constantly increased. Furthermore, the field survey indicated that coordination issues accounted for 27%, corresponding to the 20% reported poor communication in the relevant literature. Additionally, contract ambiguities ranked at 23%, which parallels the 18% prevalence of contract administration issues in the relevant literature. Although there may be variations in claim factors, this study focuses on the most frequent and common factors inherent in the long-term construction industry. From the author's experience, it is rare to see a construction project free from variations, design errors, contractual cases, and lack of communication especially in the KSA industry.

The paper suggested a BIM application to limit the sources of claims investigated via field surveys in KSA projects, as many of those sources of claims are caused by variances, errors in design, and a lack of coordination. As researched and explained in the literature chapter, BIM is a vital tool for the Saudi construction sector. It may help streamline the design process, reduce costs, and improve collaboration between stakeholders. In addition, BIM allows better project visualization, which can reduce errors and improve safety. BIM can aid in the reduction in claims in building projects by enhancing communication, identifying disputes, decreasing alterations orders, enhancing coordination, and offering improved project visualization. The limitations of using BIM include the cost of implementation, software complexity, and difficulty in training personnel. However, BIM might not be suitable for all types of projects and might be difficult to integrate into existing systems. From the author's experience in the KSA construction industry, one of the challenges that courts may confront in analyzing the validity of claims is a lack of dependence on modern technology when examining claims, which many Saudi companies lack. This may result in a long period of litigation and, in some situations, an inaccuracy in the value of the submitted claim, which may jeopardize one of the litigants' parties' rights. Therefore, BIM can be implemented in KSA construction projects to overcome construction disputes through the initial training of personnel using the software. This can be accomplished via online courses or in-person training sessions. Once personnel are trained, the software can be used to streamline the design process and improve collaboration among stakeholders.

6. Conclusions

This study examined the significance and difficulties encountered by the construction sector in the Kingdom of Saudi Arabia (KSA) from contractual and legal perspectives. The KSA has an ambitious vision that encompasses 3727 active projects valued at USD 386.4 billion, with the initial phase of this portfolio projected to be finished by 2025. Despite the thriving construction industry in the KSA, there are numerous challenges impeding its progress. Previous literature indicates that approximately 70% of construction projects in the KSA have encountered substantial delays and cost overruns. Furthermore, the construction sector in the KSA confronts obstacles in project delivery due to delayed payment from project owners, a scarcity of skilled workers, inadequate planning, and the non-utilization of standardized contract forms. Consequently, the absence of standardized contract forms employed in the KSA often leads to conflicts among the involved parties. The research examined 50 factors associated with claims described in the existing literature, with a particular focus on the most frequently occurring ones. Among these factors, changes in the original scope ranked highest, accounting for 28%, followed by poor communication at 20% and contract administration at 18%. Design errors were also deemed significant, constituting 14% of the total factors contributing to claim causes. To gather data, the study conducted primary research through field surveys and interviews with 35 practitioners from diverse backgrounds, including consultants, designers, contractors, project managers, and owners. These professionals were able to identify the root causes of claims in construction projects in KSA. The field study encompassed a total of 75 construction projects, which encountered 175 cases of claims. These cases consisted of 105 claims in commercial projects, 64 claims in residential projects, and 6 claims in water line projects. Extensive data analysis revealed seven major sources of claims, namely variation orders (36%), claims-related delays (35%), and payment delays (29%). Additional significant causes of claims included coordination issues (27%) and design errors (26%). It was further noted that relying on traditional project management approaches and underutilizing advanced technologies such as BIM could also contribute to claims in KSA construction projects.

This study examined the significance of BIM application in the Kingdom of Saudi Arabia (KSA), considering that the sources of claims in this domain are primarily related to inadequate management and coordination, which can be addressed through advanced technology. Many construction companies in KSA, both in the public and private sectors, lack experience in implementing BIM, and only a limited number of international construction firms have incorporated BIM in this field. The reluctance to adopt BIM in KSA is partially attributed to the absence of a requirement from the Saudi government, thereby hindering its widespread implementation. Additionally, smaller, and medium-sized companies, which constitute a significant portion of the Saudi Arabian construction industry, may find the implementation of BIM excessively expensive. Nevertheless, despite the various obstacles encountered in the implementation of BIM in KSA, the government has introduced in 2020 the Saudi Building Codes (SBCs), which facilitate the adoption of BIM and promote green buildings. The Saudi Contractors Authority and professional bodies within the industry have also been encouraged to embrace BIM. Furthermore, the study investigated BIM implementation in Egypt and the UAE, where it identified a shortage of BIM applications. Although BIM usage is not mandatory in Egypt and the UAE, both countries have government initiatives promoting its expansion. In contrast to the construction industry in the UK, where BIM was officially endorsed by the government in 2016, BIM can be implemented in both public and private construction projects. This study elucidated the advantages and level of progression of BIM in construction initiatives, encompassing early clash detection, expedited design and construction processes, precise planning, and decreased occurrence of delays and errors.

Future work: Following the analysis of the sources of claims in the Kingdom of Saudi Arabia (KSA) through primary data obtained from a field survey, subsequent research endeavors involve the formulation of a published paper. This paper aims to develop a claims management system based on an evaluation of the advantages of implementing

Building Information Modeling (BIM) in the construction industry of the KSA from the perspective of industry professionals. A comprehensive case study will be incorporated, utilizing pre-planned 30–50 interview sessions with selected participants from the construction sector. Furthermore, the follow-up paper will also include an examination of the disparities between traditional cost estimation methods in construction projects and the implementation of BIM technology, based on the first author's experiential knowledge.

Limitations of This study: This study is limited in scope to the examination of claims originating from the construction industries in the KSA, Egypt, and the UAE in comparison to the UK industry, specifically focusing on legal and construction disputes. The primary data, collected from 35 practitioners, may have implications on the generalizability of the findings. Additionally, secondary sources from relevant literature were utilized to support the research, as a case study from the industry could not be included due to time constraints.

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