

## Article

# The Impact of Change Orders Caused by Legislative Changes on Program Management in the UAE Construction Industry

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**Abstract:** Program management is an important strategy for organizing and managing multiple interdependent construction projects to achieve strategic goals. However, when change orders occur, they can have a serious impact on the quality, time, cost of projects and, ultimately, affect the construction program. Furthermore, when change orders are caused particularly by legislative changes, such as environmental laws, taxes, tolls, safety codes, transportation, design or building codes, their impacts are unavoidable, yet can be managed through mitigation strategies. The existing literature only reports the implications of change orders on the project level and reports legislative changes as one of the contributing factors to change orders, but does not consider the implications on a program level. This study aims to close this knowledge gap by assessing the implications of change orders caused by legislative changes on program management in the construction industry during the construction phase, and explore what the possible mitigation strategies to manage change orders caused by legislative changes are. The objectives of the study include identifying the implications of change orders on construction projects in the UAE through a literature review using peer-reviewed journals and reliable industry sources. Additionally, we investigate the implications of change orders caused by legislative changes on construction programs through interviewing subject matter experts, evaluating the importance of the reported impacts, with possible mitigation strategies, through a structured questionnaire and Relative Importance Index (RII) and, finally, proposing a set of recommendations for key industry stakeholders. A mixed methods approach is adopted in this qualitative study, and the participants include clients, contractors and consultants from the construction industry, with a defined scope covering the construction stage only. The outcomes of the study can guide program managers, decision-makers and practitioners in the construction industry to successfully deliver all projects by directing proper resources to accommodate legislative changes.



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## 1. Introduction

The construction industry plays a significant role in shaping the built environment, contributing to economic growth, social development, and environmental sustainability. Its importance spreads out of economic considerations, enabling the functioning of society and the efficient movement of goods and people. The construction industry has a lot of room for innovation and technological adoption, which may help it face future problems and provide a built environment that is more effective, sustainable, and lucrative [1]. The global construction industry is projected to reach a value of USD 15.5 trillion by 2030, reflecting significant growth. This would represent approximately 14.7% of the world's GDP, indicating its substantial contribution to the global economy [2,3]. One of the important contributions of the construction industry to the economy is job creation, as it employs around 7% of the world's workforce [4]. Construction projects, marked by their complexity

and involvement of numerous stakeholders, experience ongoing changes that affect their scope, schedule, and budget. These ongoing changes, commonly termed 'construction change orders', are also known as 'variation orders', though in government projects, they are typically called 'contract change orders'. Change orders can be initiated by the owner, contractor, or other project's stakeholders regarding the specifications, design or/and construction phase(s). Although change orders are common in construction projects, they can also significantly affect how well a project turns out. Depending on the size, nature, and complexity of the project, change orders may be issued more or less frequently, and since most construction firms have to deal with multiple projects at once, a planned, thoroughly considered and methodical approach is crucial when firms need to deliver a network of concurrent and/or related projects due to challenges that could arise related to budget, schedule, quality, risk, procurement, resources, high level of cross-projects integration, conflicting stakeholders, and socio-economic-political pressures, where any issues from one project automatically affect others. Therefore, program and project management should create a clear change order procedure in order to handle change orders successfully [5,6].

The key difference between projects and programs is that projects are temporary, with the goal of delivering a good or service; however, a program is often made up of several projects, and may also include components that go beyond the initial scope of work. The management of a portfolio of connected construction projects, such as several building projects on a big campus or numerous infrastructure projects within a region, is referred to as construction program management. The construction program manager is in charge of managing resources and stakeholders across various projects to ensure that all projects under the program are in line with the organization's overall strategic goals. On the other hand, construction project management entails overseeing a single construction project from beginning to end. Planning, organizing, and resource allocation, including labor, materials, and equipment, are the responsibility of the construction project manager. This guarantees that the project is finished on schedule, within budget, and to the appropriate quality standards, and the same applies for programs [7,8].

The construction program manager gives the overall direction and management for all projects under the program, including tracking the project progress, identifying and reducing the risks and bringing the stakeholders and resources together. The construction project manager, in turn, is in charge of managing the daily operations of the specified project, making sure that it is finished on schedule, on budget, and in accordance with the necessary quality standards. The success of construction projects depends on the efficient management of change orders, where both program and project managers play a vital role in this process by working together to identify, evaluate, and manage change orders to guarantee that projects are completed on time, within budget, and to the required quality standards.

The FIDIC contracts follow a multi-tier dispute resolution process for addressing change orders in construction projects. This process typically begins with adjudication before an Engineer or Dispute Board, followed by an amicable settlement period. If no agreement is reached, arbitration becomes the final stage. Change orders, which are expected to range from 10% to 50% during project implementation, result in disputes in 60% of instances. However, there are no alternative resolutions in the FIDIC contract if both parties fail to reach a joint consent regarding the filed change order. One of the key challenges faced is the non-competitive pricing of the filed change orders, as they fall outside the baseline scope of the program. Additionally, the commonality of oral change orders without supporting documentation and the deferral of related discussions to the final stages of the program can complicate cost implications. This underscores the importance of clear documentation and the timely dating of each change order to be considered in arbitration. It is recommended to consistently follow the Clause 13 Variation order in the FIDIC Red Book throughout the implementation stage of the program to effectively manage change orders [9].

Generally, change orders in construction projects can lead to possible disputes that require resolution, as well as imposing impacts on the project cost, timeline, or quality. Such impacts could possibly be mitigated by avoidance or implementing proper control actions. The objectives of this study include identifying the implications of change orders on construction projects through a literature review, investigating the implications of change orders caused by legislative changes on construction programs in particular. The researchers proceeded with interviewing subject matter experts, evaluated the importance of reported impacts associated with possible mitigation strategies, using a structured questionnaire and Relative Importance Index (RII) and, last but not least, proposed a set of recommendation for industry stakeholders.

### *1.1. Impact of Change Orders on Construction Projects and Programs*

Change orders in construction projects are inevitable, and may occur frequently [10], not necessarily from errors or rectifications, but due to scope-related changes not anticipated during the planning stage. Those change orders may lead to disputes between the contractor and the program owner, and the generated modifications may lead to an overall increase of up to 10% from the originally forecasted cost. Total construction costs are the aggregate of three core cost components: materials, labor and margins [11,12]. The variables of a change order are comprised of the reason for the change, the party implementing the change order, potential work stoppage, the change order's nature (rework whether addition or omission, also known as credit, idle), the compensation mechanism, the change order's work season, the approved change order's incurred hours, extension, and restricted access. Having a robust change order model is a critical tool to comprehend the cost implication of change orders on the overall project(s) or program [13].

In lump sum contracts, change orders and variations can have a significant impact on the profitability of the project. This is because the contract sum is fixed, and any additional work that is required results in additional costs that the contractor is expected to bear. On the other hand, in cost-plus contracts, change orders and variations may not have a significant impact on the profitability of the project. This is because the contractor is reimbursed for any additional costs that are incurred [14]. In design-build contracts, change orders and variations can be complex and time-consuming. This is because the design and construction are integrated, and any changes to the design can have a significant impact on the construction process. However, in turnkey contracts, change orders and variations are typically less frequent because the contractor is responsible for the entire project, from design to construction [14]. The frequency of variations and change orders also differs among construction contracts. For example, in traditional design-bid-build contracts, change orders and variations are more frequent during the construction phase. This is because the design is completed before the construction begins, and any changes to the design during construction may result in additional work [15]. On the other hand, in design-build contracts, change orders and variations are more frequent during the design phase. This is because the design and construction are integrated, and any changes to the design can have a significant impact on the construction process [16]. While variations are a common occurrence in construction projects, and can have a significant impact on different types of construction contracts as mentioned above, the impact of variations on contractors can vary depending on the level at which the variation occurs, whether on a project level or program level. At the project level, variations can significantly impact the contractor's profitability, schedule, and resource allocation. When a variation occurs, it may require additional work or materials, causing the project to extend beyond the original deadline. This can result in cost overruns, and may require additional resources to complete the work, which can negatively impact the contractor's profit margins. In addition, variations can also affect the quality of work, leading to additional reworks and potential disputes between the contractor and client [17,18]. On the other hand, the impact of variations at the program level can be more complex, as it can affect multiple projects and the overall program schedule, budget, and quality. The contractor may have to manage

changes across multiple projects and manage communication and coordination between stakeholders. The impact of program-level variations can also depend on the contract type, as different contract types have different variations management procedures and mechanisms. For example, design–build contracts may have more flexibility in managing variations, whereas fixed-price contracts may result in more cost risk for the contractor [19]. Contractors also face challenges when managing variations at both the project and program levels. These challenges include managing client expectations, managing resources and schedules, and ensuring that the variations are managed effectively. In addition, variations can lead to disputes between the contractor and the client, which can lead to additional costs and potential legal issues [20]. Despite the challenges, there are several strategies that contractors can use to manage the impact of variations. One strategy is to implement a robust variations management process, which includes clear documentation, change control procedures, and effective communication with stakeholders. This can help to ensure that variations are managed effectively and minimize their impact on the project or program. Contractors can also negotiate with the client to ensure that the impact of variations on the contract terms is minimized [20,21].

Variations and change orders can also significantly impact program management and program success. Program managers play a critical role in managing change orders and minimizing their impact on the overall program. However, they face several challenges when change orders occur. One of the significant impacts of variations and change orders on program management is the delay in the schedule. A program manager must assess the impact of a change order on the project’s schedule and identify strategies to mitigate any potential delay. The delay in the schedule may have a ripple effect on the program, delaying subsequent projects or milestones, which can have a significant impact on the program’s success [22]. Another challenge program managers face is the increase in cost. Change orders and their caused variations often result in additional costs, which can significantly impact the program’s budget. Program managers must work with the contractor to minimize the cost impact and ensure that any additional costs are reasonable and justified [5,22]. Program managers also face challenges with maintaining communication and coordination between stakeholders. Change orders can result in confusion and conflict between stakeholders, which can have a negative impact on the program’s success. Program managers must ensure that all stakeholders are informed of the changes and are in agreement with the proposed solutions [5,6].

Overall, the impacts of a change order includes cost, quality and time, while the effects of contract change orders fall into one of the following categories: (1) building materials availability, (2) work equipment availability (3) workforce availability, (4) out of schedule, (5) the cash flow of contractors is disrupted, (6) capital to be spent by the contractor, (7) over budget/cost overrun, (8) profits rise, (9) profits are down, (10) working out of procedure, (11) the quality of work is down, (12) the performance and morale of labor are decreased, (13) rework and demolition, (14) the quality of communication between contractors and stakeholders is disrupted, (15) legal issues—disputes and claims rise, (16) reputational damage, (18) a decrease in the productivity of workers, and (19) safety [10].

## *1.2. Impact of Change Orders Due to Legislative Changes*

### *1.2.1. Legislative Changes in Design Codes*

Building design codes are a set of guidelines and regulations that define the standards for constructing buildings in a particular jurisdiction. These codes are intended to ensure the safety and functionality of buildings, and are regularly updated to reflect changes in building technology and societal needs. The changes in building design codes and regulations can have a significant impact on the construction industry, including running construction projects [23,24].

Some of the changes in building design codes that could impact construction projects are: (1) Energy efficiency standards, where many governments have introduced regulations that require buildings to meet specific energy efficiency standards, as this can include

requirements for insulation, windows, lighting, and HVAC systems. These regulations aim to reduce energy consumption and greenhouse gas emissions associated with buildings. (2) Fire safety regulations where, basically, fire safety regulations dictate how buildings are designed, constructed and maintained to prevent or mitigate the spread of fire; this can include requirements for fire-resistant materials, sprinkler systems, smoke detectors, and emergency exits. (3) Accessibility guidelines where, basically, accessibility guidelines dictate how buildings are designed to ensure that they are accessible to people with disabilities; this can include requirements for ramps, elevators, doorways, and bathrooms that are accessible to people with mobility impairments. (4) Structural requirements, which dictate how buildings are designed to ensure that they are safe and stable; this can include requirements for building materials, foundation design, and load-bearing walls. (5) Sustainability standards that aim to reduce the environmental impact of buildings by requiring them to be designed and constructed in a way that reduces energy consumption, water usage, and waste generation; this can include requirements for renewable energy systems, water-efficient fixtures, and sustainable building materials. (6) Indoor air quality standards where, basically, indoor air quality standards aim to ensure that buildings have adequate ventilation and are free from pollutants that could harm occupants' health; this can include requirements for ventilation systems, air filters, and indoor air quality monitoring [23,24]. Overall, construction projects could be affected by the changes in laws and regulations related to changes in design codes by having a delayed project timeline due to additional time required for project planning and design review, increased construction costs due to additional materials, labor, or equipment to meet new standards, increased risk of noncompliance and possibility of penalties, increased complexity of the project design and construction methods, and delayed availability of construction materials [25–29].

### 1.2.2. Legislative Changes in Material Usage Codes

Running construction projects can be significantly impacted by changes in laws and regulations related to material usage codes. Material usage codes dictate which types of materials can be used in construction projects, and these codes are put in place to ensure that buildings and structures are safe and durable. Changes in material usage codes can impact construction projects in several ways. For example, if a material that was previously allowed is now prohibited, construction teams may need to find alternative materials or modify their plans to comply with the new regulations. This could result in delays or additional costs for the project. On the other hand, if a new material is approved for use, it could present an opportunity for construction teams to incorporate new and innovative materials into their projects. However, this would require teams to re-evaluate their plans and potentially undergo additional training to ensure they are properly using the new materials. Changes in material usage codes may also impact the availability and cost of certain materials. If a previously approved material is no longer allowed, it may become more difficult to source alternative materials, or the cost of the alternatives may increase due to increased demand. This could result in delays and increased costs for the construction project. Overall, changes in material usage codes can have significant impacts on construction projects, requiring construction teams to be adaptable and well-informed in order to ensure that their projects remain in compliance with current regulations [29,30]. Overall, construction projects could be affected by changes in laws and regulations related to changes in material usage codes by having increased costs due to the need to purchase new materials that meet the new standards, delays in project due to contractors' need to take additional time to source and incorporate the new materials into the construction process, increased liability for contractors due to contractors having to ensure that they are using materials that meet the new standards to avoid legal actions, increased need for training and education to ensure ability of construction workers to use new materials and equipment, changes in building design due to new materials having different properties that require different design considerations and a possible impact on sustainability, as new materials may have different environmental impacts than the materials they replace [30–32].

### 1.2.3. Legislative Changes in Taxes, Tariffs, Laws, Tolls, Building Permits and Government Fees

Changes in taxes have a significant impact on the cost, duration, and quality of construction projects. An increase in taxes on construction materials can result in an increase in the project's cost and duration due to delays in material procurement. This increase in cost and duration can also lead to a decrease in project quality, as contractors may be forced to cut corners to stay within the budget. Conversely, a reduction in taxes on construction materials can result in a decrease in the project's cost and duration due to the availability of materials. This decrease in cost and duration can lead to an increase in project quality, as contractors may have more resources to invest in quality materials and workmanship [33]. Taxes can also affect the decision-making process of project managers in the construction sector. Taxes can affect the adoption of green building practices. An increase in taxes on energy consumption can result in a decrease in the adoption of green building practices, as it can increase the project's cost. Conversely, a reduction in taxes on energy consumption can result in an increase in the adoption of green building practices, as it can reduce the project's cost [34]. Furthermore, taxes can also affect the financing of construction projects. Changes in taxes can affect the financial performance of construction companies. An increase in taxes can result in a decrease in the profitability of construction companies, while a reduction in taxes can result in an increase in profitability [35].

Changes in tariffs have a significant impact on project cost, duration, and quality. An increase in tariffs on imported materials can result in an increase in project cost and duration due to delays in material procurement. This increase in cost and duration can also lead to a decrease in project quality, as contractors may be forced to cut corners to stay within the budget [36]. Conversely, a reduction in tariffs on imported materials can result in a decrease in project cost and duration due to the availability of materials. This decrease in cost and duration can lead to an increase in project quality, as contractors may have more resources to invest in quality materials and workmanship [36]. Tariffs can also affect the decision-making process of project managers in the construction sector. Changes in tariffs can affect the selection of construction materials. An increase in tariffs on imported construction materials can result in the selection of locally sourced materials, while a reduction in tariffs can result in the selection of imported materials [37]. Furthermore, tariffs can also affect the financing of construction projects. Changes in tariffs can affect the profitability of construction companies. An increase in tariffs can result in a decrease in the profitability of construction companies, while a reduction in tariffs can result in an increase in profitability [38].

Changes in tolls have a significant impact on project cost, duration, and quality. An increase in tolls on roads used to transport construction materials can result in an increase in project cost and duration due to delays in material procurement. This increase in cost and duration can also lead to a decrease in project quality, as contractors may be forced to cut corners to stay within the budget [39]. On the other hand, a reduction in tolls on roads used to transport construction materials can result in a decrease in project cost and duration due to the availability of transportation. This decrease in cost and duration can lead to an increase in project quality, as contractors may have more resources to invest in quality materials and workmanship [39]. Changes in tolls can also affect the decision-making process of project managers in the construction sector. Changes in tolls can affect the selection of transportation modes. An increase in tolls on roads used to transport construction materials can result in the selection of alternative transportation modes, such as rail or water transport, while a reduction in tolls can result in the use of road transport [40]. Furthermore, tolls can also affect the financing of construction projects, since changes in tolls can affect the financial performance of construction companies. An increase in tolls can result in a decrease in the profitability of construction companies, while a reduction in tolls can result in an increase in profitability.

Changes in building permit fees have a significant impact on project cost, duration, and quality. An increase in building permit fees can result in an increase in project cost

and duration due to delays in obtaining permits. This increase in cost and duration can also lead to a decrease in project quality, as contractors may be forced to cut corners to stay within the budget [41]. Conversely, a reduction in building permit fees can result in a decrease in project cost and duration due to the expedited permit processing. This decrease in cost and duration can lead to an increase in project quality as contractors may have more resources to invest in quality materials and workmanship [41]. Changes in government fees can also affect the decision-making process of project managers in the construction sector. Changes in government fees can affect the selection of construction materials. An increase in government fees on imported construction materials can result in the selection of locally sourced materials, while a reduction in fees can result in the selection of imported materials [42]. Furthermore, government fees can also affect the financing of construction projects. Changes in government fees can affect the financial performance of construction companies. An increase in fees can result in a decrease in the profitability of construction companies, while a reduction in fees can result in an increase in profitability [43].

Overall, changes in taxes, tariffs, tolls, building permits and government fees can significantly impact project management in the construction sector. An increase on all of these aspects can result in an increase in the project's cost [44], duration [45], logistics and transportations fees [46], the budget of smaller projects [47], and a possible decrease in the project quality [48]. Conversely, a reduction in taxes, tariffs, tolls, building permits and government fees can result in a decrease in the project's cost and duration, which can lead to an increase in the project quality. Therefore, it is crucial for project managers in the construction sector to be aware of these changes and its potential impact on their projects. By doing so, they can make informed decisions and take appropriate actions to mitigate any adverse effects on their projects.

#### 1.2.4. Legislative Changes in Employment and Tax Law

Employment law is a critical area of construction project, which requires firm controlling given the high turnover rates, discrimination, and hostile working environment in this industry [49]. Most large construction contracts contain changes in law stipulations, and the employer/client typically bear this risk arising out of a change in employment law. Any delays resulting from this change would be off-set through an extension in the time required for successfully concluding a project. Recently, both New York City and California updated their labor laws for construction projects. These updates make the main contractor or construction manager accountable for ensuring all workers on the project receive their full and proper wages. This applies even if the worker is employed by a subcontractor, and regardless of how many subcontractors are involved in the project [50]. The change allows the claiming worker to seek payment from both their direct employer and the prime contractor, as they are seen as jointly liable for the damages caused inclusive of the back wages, benefits, and any associated penalties. This forces the prime contractor to police their subcontractors regarding the payment of wages [51]. Moreover, on a federal level in the USA, the removal of the non-compete clauses in employment contracts within the construction industry increases the earnings of workers. This would dictate to the main contractor or its subcontractor to increase hiring and retention strategies of workers, and may have them sign non-disclosure agreements and/or client solicitation agreements as a measure to protect trade secrets and proprietary information [52]. Additionally, changes to the Swedish employment protection act (EPA) have been adopted, whereby objective reasons instead of objective grounds for terminations take effect, an extended exemption from the seniority rules, general fixed-term employment is replaced by special fixed term employment and full-time employment being considered as the norm in construction projects. Those rules are optional, and any deviation from them may only be made through collective bargaining agreements (CBAs) which are to be concluded by the central parties on the Swedish Labor market. Moreover, a collectively agreed adjustment support for construction workers who lose their jobs was reinforced, and those not covered are entitled for a new public adjustment and competence support [53].

In terms of tax law, any increase or decrease in tax or the introduction of any new tax is applicable to any duty of customs or excise on goods raw materials and to any tax on the built unit(s). The difference imposed due to tax needs to be added to the contract value of the construction project, or the client would be allowed to reduce the equivalent amount of decreased sum from the contract price and the contractor would be liable to pay that sum to the client [54]. In the United Kingdom, changes to the minimum wage legislation resulted in pay rises for all staff on low-level salaries through what is known as The National Living Wage increasing the minimum wage of workers aged 23 or over. Moreover, the National Insurance contributions are paid by employers and employees as the Treasury raised cash to overhaul the UK's health and social care systems [55]. Overall, the reported impacts of legislative changes in employment and tax laws on construction projects mainly revolved around budgetary implications or timeline impacts.

#### 1.2.5. Legislative Changes in Transportation and Machinery Law

Pouring red diesel into the fuel tanks of vehicles and machinery used for construction purposes in the United Kingdom forced contractors to find alternative fuel sources or, alternatively, purchase white diesel, which has an increase tax value of 58 pence per liter rather than the 11 pence per liter (ppl) of red diesel. Gradual deployment of this law change was applied, i.e., construction sites that already contain the rebated fuel can still use under the condition that contractors keep record of the fuel receipts, associated invoices, hire contracts and driver time sheets, i.e., all date stamps to justify that the fuel was purchased prior to this law taking effect [55]. Overall, the previous case demonstrated that changes in transportation and machinery law imposed a budget impact on construction projects, as the banning of red diesel for construction vehicles increased construction costs and housing unit costs.

#### 1.2.6. Legislative Changes in Safety Laws

Even though the success of a construction project is tightly linked to the ability to accommodate and manage change orders by the project team and the effective change management strategies, there is still the possibility of facing external factors that are quite challenging to mitigate, such as environmental protection or conservation restriction, or legislative changes in government policies. For example, changes in environmental protection, sustainability assessment, waste management, or brown field use, can cause variations in the construction project scope, which have an impact on the progress and the overall cost [56]. Another example is the safety requirements in Singapore, where the well-being of construction workers is of the highest importance, and should not be put at risk. Therefore, the government issues statutory requirements and strict rules and regulations that must be followed and, accordingly, such law changes or new regulations, which are of external nature to the construction project, may impose scope changes and further increase in the project cost [57]. Moreover, changes in government regulations with relation to work place reforms impose an external uncertainty in construction projects, causing an effect over operational procedures on site and impacting the project's schedule. To illustrate, the implementation of a noise control policy may require the use of a pneumatic plant for piling operations rather than a percussive plant, which would result in extra costs being endured by the contractor, subcontractor(s), or the client [42].

#### 1.2.7. Legislative Changes in Environmental Laws

As the construction industry operates within the boundaries of codes of practice, safety regulations and environmental laws, problems may arise when changes in such laws and regulations are imposed during the life cycle of a construction project and, eventually, client activities and the contractual relationships within such projects are affected [58]. Furthermore, when changes in environmental laws are required to be implemented, projects have to endure some consequences, mainly increases in construction and operation costs, as reported in a review of the reported external risks on transportation projects [59], where



the factor of changes to laws and regulations, like land management and environmental law, is possible during any phase of the life cycle of a transportation project, and considered the most difficult risk to be controlled. Accordingly, some of the reported challenges hindering the implementation of Environmental Management Systems (EMS) in the construction industry include the high cost, lack of government pressure or client support, poor cooperation between subcontractors, lack of qualified personnel/human resources and, sometimes, the limited knowledge or understanding of the benefits of implementing Environmental Management Systems [60], while some of the reported motivation factors include abiding by environmental legislation, image enhancement, seeking better environmental performance, better awareness among employees and, finally, meeting the market demand [60].

### *1.3. Mitigation Strategies to Tackle Change Orders in Construction Projects*

Some of the reported strategies to ensure the proper implementation of safety and environmental laws in construction projects include the use of Building Information Management (BIM) systems to ensure project compliance with the requirements of safety management, by ensuring accident prevention and avoiding personal injury or property damage, as well as environmental management, which is necessary to confirm that projects follow laws and regulations relating to the environment [61]. Additionally, the reported mitigation strategies in the literature that focused on tackling change orders were mainly divided into Design Management (e.g., sufficient stipulated time for design and establishment of project management plan), Quality Management (e.g., periodic reviews of project requirements), Documentation Management (e.g., reviewing the sufficiency of contract documents for changes), Financial Management (e.g., detailed breakdowns and pricing of change order components), Dispute Resolution Management (e.g., establishment of a claims and disputes resolution system as set out in the contract), Communication and Relationship Management (e.g., regular meetings between contracting parties to discuss changes), and Procurement Management (e.g., early identification of lead items during design stage), to name a few [62–66].

Overall, the previously reviewed literature showed that changes in laws and regulations lead to an increase in change orders that impact the progress of construction projects, mainly because of the implications on cost, time or quality, as well as additional project elements. However, there is still a scarcity of literature focusing on the impacts of change orders caused by legislative changes on construction program management. Therefore, the proposed methodology of this research aims at filling this gap by investigating such impacts from subject matter experts representing the construction industry in the UAE to gain an insight from their experience and knowledge in this field and fill the research gap, as well as providing beneficial outcomes to the regulatory authorities that are concerned with imposing legislative changes that impact the construction industry. Leveraging the unique context of the UAE's developed infrastructure, regulations, and a common universal language, the study's findings offer universal principles applicable internationally, as it addresses a universal challenge in the construction industry. This paper is further organized as follows: Section 1 will address the literature review, followed by a brief explanation of the methodology of this research, preceded by highlighting the main results and discussing the key findings and finally, the main conclusions and further recommendations.

## **2. Materials and Methods**

### *2.1. Data Collection*

The research methodology was meticulously crafted, comprising several sequential steps meticulously executed to thoroughly investigate the effects of change orders resulting from legislative changes on program management within the construction industry during the construction phase, while also exploring potential mitigation strategies. This study employs a four-phase methodology, outlined in Figure 1. Initially, the study embarked on a comprehensive literature review to establish a robust foundation by examining existing

studies, identifying the overall impacts of change orders and, specifically, those arising from legislative changes in construction projects and programs. This phase also involved pinpointing research gaps, thereby facilitating the clear definition of the research problem, as well as the formulation of precise research aims and objectives.

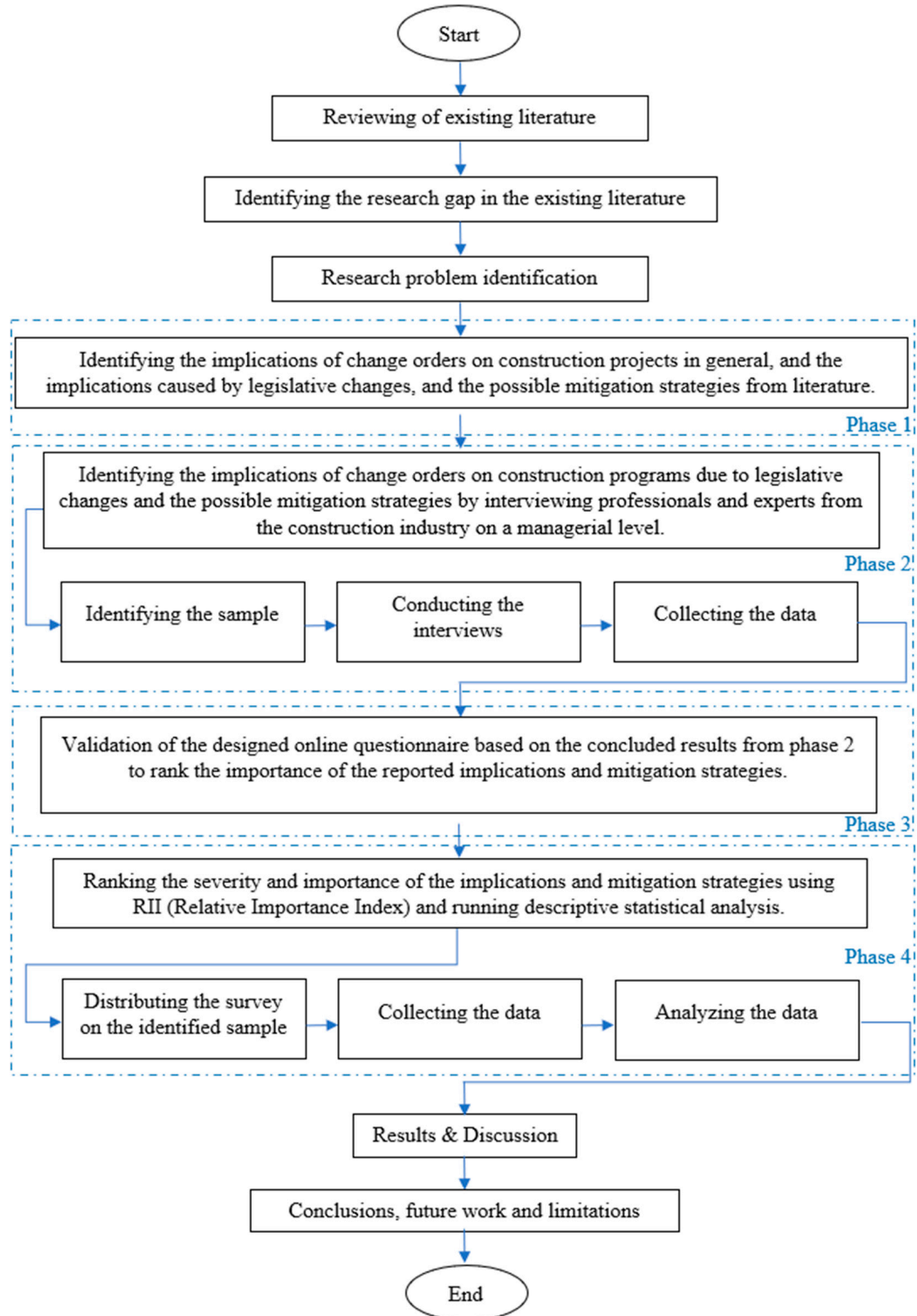


Figure 1. Detailed steps of the methodology.

Subsequently, the second phase involved conducting interviews with a purposive sample of 11 professionals and experts from the construction industry, each possessing a minimum of 10 years of experience in construction program management. These interviews sought insights into the implications of change orders prompted by legislative changes and potential mitigation strategies at the program level. Purposive sampling, distinct from probability sampling, allowed for a focused approach, enriching the collected data with valuable perspectives from this specific group. Moving to the third phase, an electronic questionnaire containing the insights and strategies extracted from phase 2 was circulated among two industry experts for evaluation and validation. Their feedback was instrumental in refining the questionnaire.

Lastly, in the fourth phase, the validated questionnaire was distributed in March 2023 among program managers in the construction industry, including clients, contractors, consultants, and construction management firms. This aimed to rank the validated implications and mitigation strategies identified in phase 3 in terms of importance using the Relative Importance Index (RII). A total of 30 responses were collected during this phase, as depicted in Figure 1.

## 2.2. Data Analysis

The survey consisted of three parts; the first part asked for background information about the respondents' entities, namely company size, company annual revenue, company type, company role in the construction industry, primary company involvement, and number of years in service. The second part included questions to rate the degree to which the respondents agreed or disagreed on how important the implications are. This was performed on a Likert scale of 1–5, where 1 means 'strongly disagree', 2 means 'disagree', 3 means 'neutral', 4 means 'agree', 5 means 'strongly agree'. Finally, in the third part, the respondents were asked to rate the degree of how important the mitigation strategies are, using the same Likert scale as in the second part. The final responses were then processed and cleaned to be prepared for the RII method, which was applied to determine the relative importance of the selected implications and mitigation strategies based on the opinion of experts from the construction sector. The RII is calculated using the following equation [67]:

$$\text{Relative Importance Index (RII)} = \frac{\sum_{i=1}^n n_i W_i}{A * N} \quad (1)$$

where  $W_i$  are the weights given to each indicator by respondents [67], and  $i$  ranges from 1 to 5. The points of the Likert scale used is equal to the value of  $W_i$ .  $n_i$  is the number of respondents corresponding to weight  $W_i$ .  $A$  represents the highest weight in the Likert scale used for the survey; in this study,  $A = 5$ .  $N$  is the total number of responses used in the analysis. The value of RII ranges from 0 to 1 [68]. According to [69], five important levels are derived from RI values: high (H) ( $0.8 \leq \text{RI} \leq 1$ ), medium-high (M-H) ( $0.6 \leq \text{RI} \leq 0.8$ ), medium (M) ( $0.4 \leq \text{RI} \leq 0.6$ ), low-medium (M-L) ( $0.2 \leq \text{RI} \leq 0.4$ ) and low (L) ( $0 \leq \text{RI} \leq 0.2$ ).

## 3. Results and Discussion

Through this study, it became evident that the current body of literature primarily addresses the impact of change orders at the project level, noting legislative changes as a factor contributing to change orders. However, it overlooks the broader implications at the program level. Hence, this results in a lack of studies in this area; therefore, this study mainly depended on subject matter experts to address this gap by examining how change orders stemming from legislative changes affect program management during the construction phase within the construction industry.

This section highlights the main results obtained during each phase of the research as follows.

### 3.1. Interviews

Background information on the interviewed respondents during phase 2 can be found in Table 1. It is noticeable that the dominating gender of interviewees were males, with a percentage of 100%, while a lack of female construction program managers is observed. This outcome is expected, since the construction industry is mostly dominated by male professionals, especially in higher ranking jobs or positions. Furthermore, the largest category of interviewees was contractors, with a percentage of 82%, followed by clients and consultants, each accounting for 9%. This is also an expected outcome, since the contractors are the most affected party when legislative changes occur, as they have to endure the change orders in the ongoing project(s) and, therefore, would be quite concerned about such an occurrence. In addition, 73% of the participants had an experience of 21 to 30 years in the construction industry, followed by 18% having an experience of 10 to 20 years, and only 9% having an experience of more than 30. This satisfies the sampling criterion, which required that the subject matter experts should have a minimum experience of 10 years in the construction industry, and would therefore provide the best possible insights into the impacts of legislative changes on change orders in construction program management. Furthermore, out of all 11 interviewees, only 18% were involved in construction programs that included more than 20 interrelated projects, while 55% of interviewees were handling less than 10 projects within their construction programs, and the remaining 27% were responsible for managing 10 to 20 projects per each construction program. Such data confirms that construction programs are common, and involve multiple interrelated and correlated projects, which requires a proper management strategy in order to achieve the desired goals.

**Table 1.** Demographic characteristics (open-ended questions).

Demographic Characteristics	Frequency	%
<i>Gender</i>		
Male	11	100%
Female	0	0%
Empty rows		
<i>Category</i>		
Client	1	9%
Consultant	1	9%
Contractor	9	82%
Empty rows		
<i>Years of experience in the construction industry</i>		
10 to 20	2	18%
21 to 30	8	73%
More than 30	1	9%
Empty rows		
<i>Number of projects within construction program</i>		
Less than 10	6	55%
10 to 20	3	27%
More than 20	2	18%

#### 3.1.1. Implications

The interviews yielded a total of 39 implications of change orders initiated due to legislative changes on a construction program level, which were further divided and categorized into six themes: cost overrun, time overrun, resource disruptions, quality management disruptions, legal implications, and positive implications, as detailed in Table 2.

**Table 2.** Implications of legislative changes.

Themes	Implications	Code
<i>Cost overrun</i>	Impact on the requirements of resources (the need for: new specialized workforce, training, material specification and equipment)	CO 1
	Impact on taxes and fees	CO 2
	Impact on administrative rules (e.g., new permits, additional mandated inspections)	CO 3
	Impact on logistics and shipments	CO 4
	Delay in material delivery and causing resources to be expended beyond the planned period	CO 5
	Cause penalties due to failure of adherence to the new changes	CO 6
	Missing business opportunities since the budget variance worth is above the baseline budget due to changes in the law during the execution period	CO 7
	Delay of variation claims approval	CO 8
Empty rows		
<i>Time overrun</i>	Delay in execution of project tasks and completion of projects	TO 1
	Delay in releasing of resources to other projects in the program	TO 2
	Cause additional scope requirements, new design guidelines/specifications	TO 3
	Delay in procurement	TO 4
	Delay in the approval of EOT claims, obtaining permits and NOCs	TO 5
	Legislative changes in the number of working hours per day have an impact on productivity since productivity depends on the number of working hours per day as per the country's laws and regulations	TO 6
Empty rows		
<i>Resources disruptions</i>	Impact on resources availability and allocation due to new requirements of resources (the need for: new specialized workforce, training, material specification and equipment)	RD 1
	Delay in releasing of resources to other projects in the program	RD 2
	Cause pressure and disruption in the supply chain and the logistics	RD 3
	Impact on the procurement arrangements	RD 4
	Impact on the business fiscal matter (cashflow and investments)	RD 5
	Impact on how the project is insured (insurances have to be extended/enhanced to meet the new law)	RD 6
	Legislative changes in licensing and consents can lead to disruption in supply chain, logistics and pooling of resources	RD 7
Empty rows		
<i>Quality management disruptions</i>	Cause additional approvals, shop drawings, method statements	QMD 1
	Cause additional scope requirements, new design guidelines/specifications	QMD 2
	Impact on business codes and construction methodology clarity	QMD 3
	Impact on licensing and consents	QMD 4
	Impact in working with the concerned authorities (obtaining NOCs, policies, procedures, approvals, . . .)	QMD 5
	Legislative changes in bankruptcy or Insolvency laws can impact the contractor's enterprise and its contracts	QMD 6
	Impact on the adherence to health, environment and safety standards in workplace	QMD 7
	Cause productivity and procurement issues	QMD 8
	Impact on change management procedures	QMD 9

Table 2. Cont.

Themes	Implications	Code
Empty rows		
<i>Legal</i>	Impact on dispute resolution, where any surge/change in disputes in Federal Arbitration Law have an impact on the dispute resolution method used in the construction industry	L 1
	Impact on arbitration (changes to laws, at times may lead to controversy, with different groups arguing for or against the proposed changes)	L 2
	Impact on liability under local law (whether the liability is excluded or restricted under local law have an impact on the clauses used in the construction contracts)	L 3
	Legislative changes in employment laws impacting labor-related regulations for public and private sectors have an impact on construction whether it is related to diversity and/or types of standard form of employment contracts provided for the employees	L 4
	Impact on contractual protections, where any change on forms of construction contracts (Red Book, Yellow Book, and Silver Book) have an impact on the construction and the projects	L 5
	Impact on the contractual levels of flexibility as failure to plan for and meet changes in the law and regulatory requirements indicates that a project fail to meet its core requirements	L 6
Empty rows		
<i>Positive</i>	Positive impact on sustainability	P 1
	Help in ensuring that the final product is in-line with international codes (fire codes and safety of the end users. . .) and updated researches	P 2
	Impact on socioeconomic burden and benefit (job creations, pollution, noise management, . . .)	P 3

When legislative changes trigger change orders in construction projects, it often results in cost overruns for the overall construction program. This is due to various factors, such as the need for additional resources requirements, including new specialized workforce, training, new material specifications and equipment. Taxes and fees may also be impacted by legislative changes, further adding to the cost overruns. Additionally, administrative rules, such as new permits and additional mandated inspections, can cause delays and increase projects' costs. Logistics and shipments may also be affected, leading to delays in material delivery and causing resources to be expended beyond the planned timeframe. Furthermore, failure to adhere to the new changes may result in penalties, adding to the overall cost overrun. Another consequence of legislative changes is missing business opportunities, as the budget variance may exceed the baseline budget due to changes in the law during the execution period. Delays in the approval of variation claims may further worsen the cost overruns in construction programs caused by legislative changes. These various factors collectively contribute to the increased costs in construction programs, resulting in the need for careful management and mitigation strategies to minimize the impact of legislative changes on program budgets.

Change orders triggered by legislative changes can result in time overruns in construction programs, where these delays can be caused by various factors, including delays in the execution of project tasks and completion of the interrelated projects within the programs. When legislative changes require modifications to existing designs or specifications, additional scope requirements may arise, resulting in further delays. Procurement processes may also be delayed due to changes in legislation, which can impact the availability of resources and materials needed for the construction program. Obtaining the necessary permits and No Objection Certificates (NOCs) from the relevant authorities may also experience delays due to legislative changes, which can further impact the project's timeline

within the program. Additionally, if there are changes in the number of working hours per day, as per the country's laws and regulations, it can have a direct impact on productivity, since productivity in construction programs is often dependent on the number of working hours per day. It is crucial for construction managers and teams to be aware of and adapt to legislative changes to mitigate the risk of time overruns in construction programs.

Change orders initiated due to legislative changes can result in disruptions to resources in construction programs. These disruptions can manifest in various ways, including impacts on the availability and allocation of resources. New requirements for specialized workforces, training, material specifications, and equipment may arise due to legislative changes, which can affect the availability and allocation of resources in the project. Additionally, delays in releasing resources to other projects in the program may occur as a result of these changes. The supply chain and logistics may also experience pressure and disruption, as procurement arrangements may need to be adjusted to comply with new legislative requirements. The fiscal matters of the business, such as cash flow and investments, may also be impacted by legislative changes, which can affect the overall financial planning of the project. Furthermore, changes in licensing and consents as per the new laws can result in disruptions to the supply chain, logistics, and pooling of resources. Additionally, insurance arrangements may need to be extended or enhanced to comply with the new legislation, further impacting the overall construction program. It is essential for construction project managers to closely monitor and address any resource disruptions caused by legislative changes, to ensure smooth project execution and mitigate potential delays.

Change orders triggered by legislative changes can result in disruptions to quality management in construction programs. These disruptions can be evident in various ways, such as the need for additional approvals, shop drawings, and method statements. Legislative changes may also result in additional scope requirements and new design guidelines or specifications, which can impact the overall quality management of the construction program. Business codes and construction methodologies may also be impacted, leading to a lack of clarity in program execution. Licensing and consents may also be affected by legislative changes, which can result in delays and challenges in obtaining necessary approvals, policies, procedures and NOCs from concerned authorities. Changes in bankruptcy or insolvency laws can also impact the contractor's enterprise and its contracts, further affecting the quality management of the projects and the overall program. Adherence to health, environment, and safety standards in the workplace may also be impacted by legislative changes, leading to potential risks and challenges. Productivity and procurement issues may arise due to changes in legislation, affecting the overall quality of program outcomes. Additionally, change management procedures may need to be adjusted to comply with new legislative requirements. It is crucial for construction managers to proactively manage and address these disruptions to quality management caused by legislative changes, to ensure that program objectives are achieved effectively and efficiently.

Change orders initiated due to legislative changes can have legal implications on construction programs. These implications can affect various aspects of the construction program, including dispute resolution, arbitration, liability under local law, labor regulations, contractual protections, and contractual flexibility. Changes in laws related to dispute resolution, such as amendments to Federal Arbitration Law, can impact the method used for resolving disputes in the construction industry. Legislative changes may also affect arbitration, with different groups arguing for or against proposed changes, leading to controversy. Liability under local law, including whether liability is excluded or restricted, can impact the clauses used in construction contracts. Changes in employment laws, particularly those related to labor regulations for the public and private sectors, can impact construction programs in terms of diversity and types of standard employment contracts provided to employees. Changes in the forms of construction contracts, such as Red Book, Yellow Book and Silver Book, can also have an impact on the contractual protections afforded to parties involved in the project. Failure to plan for and meet changes in the law and regulatory

requirements can result in a lack of contractual flexibility, potentially leading to the project failing to meet its core requirements. It is essential for construction managers to stay abreast of legislative changes and proactively address any legal implications to ensure compliance and successful program outcomes.

Despite the fact that legislative changes have many implications on construction program management, they can have some positive impacts on construction projects and the overall construction programs. These impacts can be seen in various aspects, including sustainability, compliance with international codes, and socioeconomic benefits. Legislative changes that introduce tax incentives for certain businesses, particularly in highly demanded or government-backed sectors such as clean energy, can encourage investors to invest more in those sectors, resulting in positive impacts on sustainability. Compliance with international codes, such as fire codes and safety regulations, can be ensured through legislative changes, leading to safer and more efficient end products. Legislative changes can also have a positive impact on socioeconomic factors, such as job creation, pollution management, and noise control. For instance, changes in laws related to construction projects can result in the creation of more job opportunities, while also addressing issues related to pollution and noise management. Overall, change orders resulting from legislative changes can contribute to positive impacts on construction projects and programs by aligning them with international standards, promoting sustainability, and addressing socioeconomic concerns.

In summary, legislative changes often trigger change orders in construction projects, leading to cost, time, resource, quality management, and legal implications for construction programs. These changes necessitate additional resources, training, and adjustments to comply with new regulations, resulting in cost overruns, delays, and disruptions to resource allocation, quality management, and legal compliance. Despite these challenges, legislative changes can also have positive impacts on construction programs, promoting sustainability, compliance with international standards, and socioeconomic benefits such as job creation and pollution management. To navigate these complexities, construction managers must implement careful management and mitigation strategies to minimize the negative impacts and leverage the positive opportunities presented by legislative changes.

### 3.1.2. Mitigation Strategies

Additionally, the interviews also yielded a total of 19 mitigation strategies to effectively manage change orders resulting from legislative changes, as detailed in Table 3.

First, conducting a comprehensive risk analysis and maintaining a register of potential risks can aid in identifying and addressing them proactively. Additionally, ensuring that the organization has a mature and proper structure in place enables efficient handling of change orders. Subcontracting certain works can also be considered a measure to minimize the impact of law changes on the parent organization. Creating a healthy job environment for workers in compliance with laws and regulations, including timely payment of overtime wages as required, can enhance efficiency and productivity. Moreover, for confidential projects, procuring the necessary manpower in adherence to laws and regulations ahead of time is recommended. Being aware of the procedure time ahead for obtaining construction NOCs and staying updated with changing requirements can prevent unexpected surprises during execution. Meticulous adherence to safety standards can prevent lost time injuries (LTIs) and promote a safe working environment. Moreover, regular maintenance of construction equipment and obtaining the required certifications as per laws and regulations is crucial to ensure compliance and smooth operations. Furthermore, implementing awareness programs with sufficient lead time for the construction industry to understand changes in laws and regulations and develop appropriate plans can minimize the impact of change orders. Additionally, providing adequate notice prior to the implementation of new legislation is essential for effective preparation. Also, implementing new legislation from the start of new contracts can streamline compliance. Consideration can also be given to compensating or waiving charges for contractors working on government contracts to



alleviate financial burdens. Seeking professional help, such as consulting with attorneys or legal professionals, when in doubt, can provide expert guidance on adapting to changes in the law. The government can also play a role in supporting the local construction industry by controlling the prices of construction materials through subsidies or fee waivers. It is important to ensure that updates or changes to laws are implemented in a way that promotes growth and minimizes burdens on the construction industry, which is a significant contributor to the economy and society. Establishing a reliable agency set-up with efficient procurement and permit processes can mitigate the risk of unexpected adverse regulatory decisions. Streamlining procurement procedures or providing ease in implementation can further expedite compliance. Involving all stakeholders in decision-making processes through public surveys, social media polls, etc., can foster transparency and result in optimum outcomes within a reasonable timeframe prior to full implementation of new laws. Finally, timely approval of cost impacts of changes in laws by clients is crucial to prevent negative effects on the contractor's cash flow.

In summary, conducting comprehensive risk analysis and maintaining a risk register help proactively identify and address potential issues. Additionally, establishing a mature organizational structure facilitates efficient handling of change orders, while subcontracting certain works can mitigate impacts on the parent organization. Ensuring compliance with labor laws, procuring necessary manpower, and staying updated on procedural requirements can further minimize disruptions. Adherence to safety standards and equipment maintenance ensure smooth operations, while early notice and implementation in new contract can streamline compliance from the very beginning. Government support through material price controls is also crucial. Transparent decision-making involving stakeholders expedites outcomes, and timely client approval of cost impacts preserves contractor cash flow. This collaborative approach will ensure a smoother transition when faced with legislative changes.

### 3.2. Questionnaire

Demographic information for the questionnaire respondents is summarized in Table 4. It is noticeable that the dominating gender of interviewees were males, with a percentage of 93%, while a minority of females accounted for 7%. The presence of female participants in the questionnaire compared to no females in the interviews is due to the expansion of sample size, from 11 to 30, which allowed for reaching two female participants from the construction industry. Furthermore, the largest category of respondents was contractors, with a percentage of 43%, followed by clients (30%), consultants/engineering (23%), and construction management firms (3%). This is also an expected outcome, since the contractors would be the most concerned part affected by impacts of change orders caused by legislative changes. In addition, 60% of the participants had an experience of more than 21 years in the construction industry, followed by 37% having an experience of 11 to 20 years, and only 3% having an experience less than 10 years. Furthermore, 57% of the participants were involved in construction programs that included more than 10 interrelated projects, while 23% of participants were responsible for construction programs having 5 to 10 interrelated projects, where 20% of the participants were responsible for less than 5 projects. Additionally, the majority of respondents represented large companies (73%) medium-sized companies (23%) and small companies (3%), while also being representative of the private sector (77%), government sector (20%) and semi-government sector (3%), further adding to the diversity of professionals from the construction industry and providing a comprehensive representation of the industry. Such demographical data also confirms that the sampling inclusion criterion was accurate in terms of the qualities of respondents, which provides relevance to the topic of this research.

**Table 3.** Mitigation strategies.

No.	Mitigation Strategies	Code
1	Applying proper risk analysis and register	S 1
2	Maturity and proper structure of the organization	S 2
3	Subcontracting the works reduces the impact of law changes on parent organization	S 3
4	The efficiency of the workers depends on the job environment, which shall be protected as per laws and regulations. Overtime shall be paid as per applied laws	S 4
5	In terms of confidential projects, its recommended to procure the required manpower as per laws and regulations on or before time	S 5
6	At the time of obtaining construction NOCs, one should be well aware of the procedure time ahead. Requirements often change as per laws, so the NOC coordinator shall be aware of it so that no one sees sudden surprises before execution	S 6
7	Safety standards shall be maintained meticulously so that there are no lost time injuries (LTIs)	S 7
8	Maintain construction equipment regularly, and required certifications shall be obtained as per laws and regulations	S 8
9	An awareness program has to be implanted by the authority with sufficient time to the construction industry to enable them to understand the changes in law and regulation and take appropriate action and develop proper plans to reduce the impact	S 9
10	Give enough notice prior to the implementation of the new legislation	S 10
11	Implement new legislation, if possible, from the start of new contracts	S 11
12	Compensate/waive the charges for the contractors who are working on government contracts. This results in more savings to the government as the contractor shall not include the administration costs of the new law in his claim	S 12
13	Seek professional help: when in doubt, always consult with an attorney or other legal professional to receive expert guidance on how to adapt your business to any changes in the law	S 13
14	The government may also control the price of construction materials. To facilitate the local construction industry, the government can fix the price levels and provide subsidies or waive the fees	S 14
15	The construction industry is a significant contributor to the economy and society. It is regulated by governments, and any updates or changes should be implemented in a way that supports growth rather than creating burdens	S 15
16	To mitigate the risk of unexpected and adverse regulatory decisions, authorities need to ensure a reliable agency set-up with efficient procurement and permit processes	S 16
17	Procurement procedures to be streamlined or ease to be provided, for timely implementation	S 17
18	Involvement of all stakeholders participating on different platforms (i.e., public survey, social media polls, etc.) in decision-making processes with a view of finding optimum results within reasonable time frame prior to full implementation of the new laws	S 18
19	Cost impacts of change of law should be approved by clients in time to not affect the contractor's cash flow	S 19

**Table 4.** Demographic characteristics (online survey).

Demographic Characteristic	Frequency	%
<i>Company size</i>		
Large	22	73%
Medium	7	23%
Small	1	3%
Empty rows		
<i>Type of company</i>		
Private	23	77%
Government	6	20%
Semi-government	1	3%
Empty rows		
<i>Experience in the construction Industry</i>		
More than 20 years	18	60%
11 to 20 years	11	37%
Less than 11 years	1	3%
Empty rows		
<i>Experience in program management (No. of projects within program)</i>		
More than 10 projects	17	57%
5 to 10 projects	7	23%
Less than 5 projects	6	20%
Empty rows		
<i>Role in the construction industry</i>		
Contractor	13	43%
Client	9	30%
Consultant/Engineering	7	23%
Construction management firm	1	3%
Empty rows		
<i>Education level</i>		
PhD	3	10%
Master	11	37%
Bachelor	16	53%
Empty rows		
<i>Age</i>		
Above 55	8	27%
45–55	13	43%
35–45	7	23%
25–35	2	7%
Empty rows		
<i>Gender</i>		
Male	28	93%
Female	2	7%

### 3.2.1. Implications

The results of the RII values for the implications are shown in Table 5. The RII value ranged from 0.6467 to 0.8467, which confirms that all the concluded implications from phase 3 are of medium-high to high importance. Out of the 39 implications, 4 implications had RII values between 0.8000 and 0.8467, thus having high importance level, and the remaining 35 implications had RII values between 0.6467 and 0.7933, indicating a medium to high importance level. The CO 3 implication was ranked first in the cost overrun theme and third overall. The TO 5 implication was ranked first in the time overrun theme and fifth overall. RD 5 implication was ranked first in the resources disruptions theme and first overall as well. The QMD 1 implication was ranked first in the quality management disruptions theme and second overall. The L 2 implication was ranked first in the legal theme and sixth overall. Finally, the P 2 and P 1 implications were ranked first in the positive impacts theme and tenth overall.

**Table 5.** RII analysis of the implications.

	RII Value	Overall Ranking	Ranking by Category	Importance Level
<i>Cost overrun</i>				
CO 1	0.7800	10	3	M-H
CO 2	0.7867	6	2	M-H
CO 3	0.8067	3	1	H
CO 4	0.7600	19	4	M-H
CO 5	0.7467	26	6	M-H
CO 6	0.7467	26	6	M-H
CO 7	0.7133	35	8	M-H
CO 8	0.7533	21	5	M-H
Empty rows				
<i>Time overrun</i>				
TO 1	0.7667	17	4	M-H
TO 2	0.7533	21	5	M-H
TO 3	0.7733	14	2	M-H
TO 4	0.7133	35	6	M-H
TO 5	0.7933	5	1	M-H
TO 6	0.7733	14	2	M-H
Empty rows				
<i>Resources disruptions</i>				
RD 1	0.7467	26	5	M-H
RD 2	0.7467	26	5	M-H
RD 3	0.7333	30	7	M-H
RD 4	0.7867	6	3	M-H
RD 5	0.8467	1	1	H
RD 6	0.8000	4	2	H
RD 7	0.7533	21	4	M-H
Empty rows				
<i>Quality management disruptions</i>				
QMD 1	0.8133	2	1	H
QMD 2	0.7867	6	2	M-H
QMD 3	0.7333	30	5	M-H
QMD 4	0.7133	35	8	M-H
QMD 5	0.7667	17	3	M-H
QMD 6	0.7533	21	4	M-H
QMD 7	0.6467	39	9	M-H
QMD 8	0.7333	30	5	M-H
QMD 9	0.7200	33	7	M-H
Empty rows				
<i>Legal</i>				
L 1	0.7800	10	2	M-H
L 2	0.7867	6	1	M-H
L 3	0.7733	14	3	M-H
L 4	0.7600	19	4	M-H
L 5	0.7533	21	5	M-H
L 6	0.7200	33	6	M-H
Empty rows				
<i>Positive impact</i>				
P 1	0.7800	10	1	M-H
P 2	0.7800	10	1	M-H
P 3	0.6933	38	3	M-H

### 3.2.2. Mitigation Strategies

The results of RII values for the mitigation strategies are shown in Table 6. The RII values ranged from 0.6000 to 0.9467, which confirms that all the concluded mitigation strategies from phase 3 are of high to medium-high importance. Also, out of the 19 mitigation strategies, 17 had RII values between 0.8333 and 0.9467, which meant that they were of high importance level. Finally, the only two remaining mitigation strategies with RII values of

0.6000 and 0.7867 were highlighted as having a medium to high importance level. Overall, S 1 and S 7 were ranked first, while S 3 was ranked the last.

**Table 6.** RII analysis of the mitigation strategies.

Mitigation Strategies	RII Value	Overall Ranking	Importance Level
S 1	0.9467	1	H
S 2	0.8867	10	H
S 3	0.6000	19	M-H
S 4	0.8467	15	H
S 5	0.8400	16	H
S 6	0.9200	6	H
S 7	0.9467	1	H
S 8	0.8867	10	H
S 9	0.8733	12	H
S 10	0.9267	4	H
S 11	0.9200	6	H
S 12	0.7867	18	M-H
S 13	0.9267	4	H
S 14	0.8333	17	H
S 15	0.8533	14	H
S 16	0.9067	9	H
S 17	0.9200	6	H
S 18	0.8667	13	H
S 19	0.9333	3	H

#### 4. Conclusions

In conclusion, the literature review revealed a noticeable dearth of journal articles and studies exploring the ramifications of change orders at the program level within the construction sector during the construction phase. While the existing literature discusses the effects of change orders at the project level, often attributing them to legislative alterations, it fails to address the broader implications at the program level. Consequently, no literature, frameworks, or studies specifically addressing this issue were uncovered.

The findings of this study highlight the significant impacts of legislative changes on construction programs, particularly regarding cost overruns, delays, resource disruptions, quality management issues, and legal ramifications. Additionally, the research suggests that legislative changes may prompt various responses from construction programs, such as reallocating resources, providing additional training, acquiring new equipment, adjusting taxes and fees, delaying permits and inspections, disrupting logistics and material deliveries, and facing penalties for non-compliance. Furthermore, legislative changes can influence resource availability and allocation, disrupt quality management procedures, and entail legal consequences related to dispute resolution, liability, employment regulations, and contractual safeguards.

To mitigate the effects of legislative changes on construction programs, as indicated by the study's findings, proactive management and mitigation strategies are essential. Construction managers must stay informed about legislative alterations, plan and allocate resources accordingly, and ensure compliance with new requirements to achieve successful program outcomes. Proactive measures like thorough risk analysis, subcontracting, and fostering a positive work environment can help minimize the impact of legal changes on the construction industry. Adhering to safety standards, conducting regular maintenance, and obtaining necessary certifications are vital for compliance. Awareness campaigns, stakeholder engagement, and seeking professional assistance when necessary can streamline the process. Additionally, government support through subsidies and fee waivers can alleviate financial burdens. Timely approval of cost impacts and efficient procurement processes are also crucial. Moreover, it is important to implement updates or changes in laws in a manner that fosters growth and minimizes burdens on the construction industry, which significantly contributes to the economy and society.

Current research is identifying respondents that meet the inclusion criteria for sampling where it focused mainly on construction experts of managerial positions with various experience levels and qualifications, while it could have benefited additionally from the inclusion of construction engineers to obtain a better perspective on their perceptions of the impacts of change orders caused by legislative changes, which can be investigated further in future work. Furthermore, their conflicting priorities and availability to take part in the interviews and questionnaires, to which the six-week timeframe added an additional layer of complexity. It could have benefited additionally from the inclusion of construction engineers to obtain a better perspective on their perceptions of the impacts of change orders caused by legislative changes, which can be investigated further in future work.

The study offers actionable suggestions for addressing the consequences of legislative changes, such as proactive monitoring, adaptation, and adherence to evolving legal frameworks. Furthermore, it proposes establishing a structured approach for handling legislative shifts affecting construction projects, highlighting the pivotal role of regulatory authority figures in this process. By presenting empirical evidence on the repercussions of legislative alterations and offering pragmatic advice, the research contributes significantly to both academic discourse and practical application in the construction sector. It enhances comprehension of construction program management and furnishes valuable guidance for industry stakeholders. Ultimately, this study drives progress in the field and provides valuable insights for navigating the complexities brought about by legislative changes in construction programs.

A future study can be performed in order to propose a framework for the successful management of legislative changes that lead to change orders impacting construction programs by targeting the concerned parties in the construction industry, mainly regulatory authority representatives, as they are the main entity imposing legislative changes.

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