Academic Journal of Research and Scientific Publishing | Vol 6 | Issue 69
Publication Date: 05-01-2025 ISSN: 2706-6495

Impact of Labor and Skill Availability on Infrastructure Project Timelines in Kuwait

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Abstract

This study examines the impact of labor and skill availability on infrastructure project timelines in Kuwait, focusing on critical aspects such as planning, approvals, setbacks, inspections, plan changes, and delays. Data collected from 230 construction industry professionals highlights the significant influence of workforce dynamics on project performance. The study was conducted over a four-month period, from May to August 2024. Key findings reveal that labor shortages contribute to extended planning durations, disrupted inspections, and frequent delays, while skill gaps exacerbate inefficiencies in project execution and adherence to timelines. Although approvals and plan changes are less affected by workforce issues, these areas underscore the importance of regulatory and procedural reforms. The study emphasizes the need for targeted training programs, improved workforce policies, and technological integration to address labor and skill shortages. Additionally, flexible hiring practices and investments in skill development are identified as pivotal in mitigating delays and ensuring the success of infrastructure projects. By addressing these challenges, stakeholders can enhance project efficiency and support Kuwait's broader infrastructure development and economic sustainability goals. This research provides actionable insights for policymakers, developers, and industry leaders, offering strategies to optimize labor availability, reduce project delays, and improve overall project outcomes in Kuwait's construction sector.

Keywords: Labor availability, Skill availability, Infrastructure project timelines, Kuwait.

تأثير توفر العمالة والمهارات على الجداول الزمنية لمشاريع البنية التحتية في الكويت

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الملخص

تبحث هذه الدراسة في تأثير توفر العمالة والمهارات على الجداول الزمنية لمشاريع البنية التحتية في الكويت، مع التركيز على الجوانب الحاسمة مثل التخطيط والموافقات والانتكاسات والفحوصات وتغييرات الخطة والتأخيرات. تسلط البيانات التي تم جمعها من 230 متخصصًا في صناعة البناء الضوء على التأثير الكبير لديناميكيات القوى العاملة على أداء المشروع. أجريت الدراسة على مدى أربعة أشهر، من مايو إلى أغسطس 2024. تكشف النتائج الرئيسية أن نقص العمالة يساهم في إطالة مدة التخطيط، وتعطيل عمليات التفتيش، والتأخير المتكرر، في حين تؤدي فجوات المهارات إلى تفاقم عدم الكفاءة في تنفيذ المشروع والالتزام بالجداول الزمنية. وعلى الرغم من أن الموافقات وتغييرات الخطط تتأثر بشكل أقل بقضايا القوى العاملة، فإن هذه المجالات تؤكد على أهمية الإصلاحات التنظيمية والإجرائية. وتؤكد الدراسة على الحاجة إلى برامج تدريب مستهدفة، وتحسين سياسات القوى العاملة، والتكامل التكنولوجي لمعالجة نقص العمالة والمهارات. بالإضافة إلى ذلك، تم تحديد ممارسات التوظيف المرنة والاستثمارات في تطوير المهارات باعتبارها محورية في التخفيف من التأخير وضمان نجاح مشاريع البنية التحتية. ومن خلال معالجة هذه التحديات، يمكن لأصحاب المصلحة تعزيز كفاءة المشروع ودعم أهداف التنمية الاقتصادية والبنية التحتية الأوسع في الكويت. يوفر هذا البحث رؤى عملية لصناع السياسات والمطورين وقادة الصناعة، ويقدم استراتيجيات لتحسين توافر العمالة، والحد من تأخيرات المشاريع، وتحسين النتائج الإجمالية للمشروع في قطاع البناء في الكويت.

الكلمات المفتاحية: توافر العمالة، توافر المهارات، الجداول الزمنية لمشاريع البنية التحتية، الكويت

1. Introduction

The construction industry is inherently labor-intensive, with labor costs accounting for a significant proportion—30% to half of main project costs. This makes labor one of the most risk-prone elements in project cost estimation (Karimi et al., 2018). The availability of qualified and efficient workers is critical to the advancement and success of the construction sector (Chang-Richards et al., 2017). Skilled workers, such as bricklayers, carpenters, structural fabricators, plumbers, plasterers, and decorators, play an essential role in ensuring the successful completion of construction projects (Sherekar et al., 2016). Neugart and Schömann (2002) emphasize the importance of aligning educational systems, workforce training, and lifelong learning strategies with the evolving needs for skills and knowledge in the industry, ensuring that these initiatives are responsive and effective. For the construction industry, understanding the intricacies of workforce dynamics is indispensable to maintaining a stable supply of skilled labor. Furthermore, experienced labor not only enhances project performance but also contributes significantly to improving productivity (Heravi & Eslamdoost, 2015).

Kuwait, located in the northeastern Arabian Peninsula, is well-known for its economic prosperity, underpinned by its substantial crude oil reserves. In recent years, the Kuwaiti government has embarked on ambitious development plans aimed at diversifying the economy and reducing its reliance on oil revenues. These plans include significant investments in infrastructure projects, urban development, and public works, reflecting the nation's commitment to fostering long-term economic sustainability. However, despite advancements in technology and the availability of financial resources, the construction industry in Kuwait continues to face challenges. Rising construction costs, prolonged project durations, and frequent budget overruns remain persistent issues. A major contributing factor to these inefficiencies is the availability of labor and skills within the construction sector, which significantly affects productivity and project timelines. Addressing these workforce challenges is critical for ensuring the success of Kuwait's infrastructure development and achieving its broader economic goals (Jarkas & Bitar, 2012).

This study seeks to investigate the effect of labor and the availability of skills on the timelines of infrastructure projects in Kuwait. It aims to find main factors contributing to labor shortages and skill gaps and their impact on planning, execution, and project completion. By exploring these relationships, the research intends to deliver actionable perceptions for policymakers, construction firms, and other participants to address labor-related challenges and enhance the efficiency and effectiveness of infrastructure projects.

In particular, the study examines the critical dimensions of infrastructure project timelines, including planning, approvals, setbacks, inspections, plan changes, and delays. It leverages data from professionals in the construction industry to assess how labor and skill availability—or the lack thereof—affects these dimensions. The results of this study aim to contribute to the improvement in policies and strategies intended for ensuring a sustainable and skilled workforce, ultimately supporting Kuwait's broader infrastructure and economic objectives.

By focusing on the interplay between workforce dynamics and project performance, this study highlights the urgent need for interventions that address labor shortages and skill gaps in Kuwait's construction sector. Through this analysis, it hopes to pave the way for more timely and cost-effective infrastructure development in the country.

2. Literature review

Karimi et al. (2018) investigated ninety-seven construction projects in USA and Canada to evaluate the impact of skilled labor shortages on project outcomes. Their study revealed that projects experiencing labor shortages incurred significantly higher cost overruns compared to those without such shortages. By applying advanced data integration techniques, the researchers developed two robust regression models that highlighted the substantial risks labor shortages pose to cost efficiency. These models offer valuable insights for project management teams in determining whether specific mitigation strategies are necessary to prevent cost overruns.

In a separate study, Karimi et al. (2016) highlighted the direct connection between skilled labor shortages and reduced productivity in construction projects. The research showed that the inability to secure experienced workers leads to lower project efficiency, increased material and labor costs, extended project timelines, scheduling complications, and diminished quality standards. This underscores the profound impact of labor shortages on the overall performance of the construction industry.

Jarkas and Bitar (2012) conducted a study aimed at identifying and ranking factors that influence labor productivity on construction sites in Kuwait. Using a structured questionnaire targeted at contractors, the study analyzed 45 productivity factors categorized into management, technological, human/labor, and external factors. The findings revealed ten key elements that significantly affect labor productivity, including clear technical specifications, effective coordination among design teams, proper supervision, and strict inspection protocols. These findings provide valuable recommendations for construction managers in Kuwait to optimize labor use, improve efficiency, and control costs.

Karimi, Taylor, and Goodrum (2017) expanded the understanding of the link between craft labor availability and project outcomes, focusing on productivity and schedule adherence. Analyzing data from 97 construction projects in the United States and Canada, completed between 2001 and 2014, their study showed that labor shortages caused significant drops in productivity and frequent schedule overruns. Through regression analysis, they established a strong correlation between challenges in recruiting skilled labor and both lower productivity and extended project delays. These findings highlight the critical need to address labor shortages as a strategy to reduce risks associated with project schedules and outcomes.

The literature collectively emphasizes the vital role of labor and skill availability in construction project success. Karimi et al. (2018) demonstrated the significant role of skilled labor shortages in driving cost overruns, advocating for mitigation strategies to minimize these risks. Similarly, Karimi et al. (2016) showed that the absence of experienced workers directly hampers productivity, elevates costs, and disrupts project timelines, further impacting overall project quality. These findings reveal the extensive implications of labor shortages in the construction sector.

Jarkas and Bitar (2012) made a critical contribution by identifying and ranking factors that impact labor productivity in Kuwait, with clear technical specifications, effective supervision, and stakeholder coordination emerging as key influences. These findings are instrumental in devising strategies to improve labor efficiency within Kuwait's construction industry. Additionally, Karimi, Taylor, and Goodrum (2017) quantified the link between labor shortages and project outcomes, establishing a strong connection between workforce shortages, schedule delays, and reduced productivity. Their work underscores the value of statistical modeling in understanding workforce-related risks and offering actionable recommendations to industry stakeholders.

While previous studies have explored the influence of labor availability and productivity factors in construction, several gaps remain unaddressed, particularly in the context of Kuwait's unique construction industry landscape. Existing research, such as that by Jarkas and Bitar (2012), focuses on productivity factors but does not extensively examine the broader implications of labor and skill shortages on critical project dimensions, such as planning, approvals, and inspections. Similarly, studies by Karimi et al. (2016, 2017, 2018) primarily analyze North American construction projects, leaving a gap in understanding how these issues manifest in Kuwait, where reliance on expatriate labor and regulatory challenges are prominent.

Moreover, there is limited integration of labor and skill availability factors into comprehensive project timeline evaluations. While the studies reviewed provide valuable insights into cost overruns, productivity, and schedule delays, they do not adequately address the interplay of these variables with regulatory, technological, and resource-driven constraints in the Kuwaiti context. This highlights the need for localized research that investigates how labor and skill shortages affect multiple dimensions of infrastructure project timelines, from planning to execution.

3. Methodology

This study employs a quantitative research approach to investigate the relationship between labor and skill availability and their impact on infrastructure project timelines in Kuwait. The research design is exploratory and descriptive, leveraging structured survey instruments to collect data from main stakeholders within the construction sector.

3.1. Population and Sample

The target population for this study includes professionals directly involved in infrastructure construction projects in Kuwait, such as project managers, civil engineers, structural engineers, site supervisors, and contractors. These individuals were selected as they are well-positioned to provide perceptions into the challenges related to labor and skill availability and their influence on project timelines.

A purposive sample was used to ensure the respondents inclusion with relevant expertise and experience in the construction sector. The final sample size consists of 230 participants, providing sufficient representation for meaningful statistical analysis. The demographics of the respondents included (job roles, experience levels, gender and age).

3.2. Data Collection

Data were collected using a designed structured questionnaire to capture opinions of labor and skill availability and their impact on project timelines. The questionnaire was divided into three main sections including labor availability, skill availability and infrastructure project timelines. Each statement was rated on a 5-point Likert scale, providing quantitative data for analysis. The questionnaire was pretested with 20 industry professionals to ensure clarity and reliability before full deployment.

3.3. Time limits

The study was conducted over a four-month period, from May to August 2024. This timeframe included the design and pretesting of the survey, data collection from 230 construction

professionals, statistical analysis, and the formulation of recommendations to address labor and skill shortages in Kuwait's construction industry.

3.4. Data Analysis

The analysis of the data utilized both descriptive and inferential statistical methods. Descriptive statistics, such as means, SDs, and rankings, were employed to summarize the participants' responses. Pearson correlation analysis was conducted to examine the relationships between labor and skill availability and different aspects of project timelines. A statistical significance level of $p<0.05$ was applied.

4. Results

Labor Availability

Table (1) below shows the results of labor availability in infrastructure construction projects, which reveals several important results. The highest-ranked statement, with a mean of (4.2) and a SD of (0.85), highlights that labor shortages are perceived as a serious issue in Kuwait's infrastructure sector. Another notable observation is that the recruitment of labor is considered a time-consuming process, with a mean of (4.0) and a SD of (0.90), ranking it as the second most critical concern. Similarly, labor migration regulations are viewed as a major factor affecting the availability of construction workers, with a mean of (3.8) and a SD of (0.95), ranking third among the labor availability issues.

In contrast, the availability of foreign construction workers is perceived positively, with a mean of (3.5) and a lower SD of (0.70), ranking fourth. However, the perception of government regulations regarding foreign worker recruitment is less favorable, with a mean of (2.7) and a SD of (1.10), ranking it last. The statement that there is enough labor for infrastructure construction projects in Kuwait ranks fifth, with a mean of (2.9) and a SD of (1.05). The overall mean for all statements is (3.52) with a SD of (0.92).

Table 1: Descriptive Statistics for Labor Availability Statements in Infrastructure Construction Projects

Labor availability statements	Rank	Mean	SD
Shortages in labor is a serious issue in the infrastructure construction projects.	1	4.2	0.85
There is enough labor for infrastructure construction projects in Kuwait.	5	2.9	1.05

The recruitment of labor is a time-consuming process in Kuwait.	2	4.0	0.90
Labor migration regulations affect the availability of construction workers.	3	3.8	0.95
Foreign construction workers are available in Kuwait.	4	3.5	0.70
Government regulations regarding foreign construction workers recruitment in Kuwait are helpful.	6	2.7	1.10
Total		**3.52**	**0.92**

Skills Availability

Table (2) shows the results of skills availability in infrastructure construction projects, which highlights varying perceptions regarding the adequacy and readiness of skilled labor in Kuwait. The highest-ranked statement, with a mean of (3.8) and a SD of (0.75), indicates that the workforce is generally considered well-trained in using advanced construction tools and machinery. The availability of specialized labor for infrastructure construction projects is also viewed favorably, with a mean of (3.6) and a SD of (0.80), ranking it second. Similarly, the availability of multi-skilled workers is ranked third, with a mean of (3.5) and a SD of (0.85).

Skilled labor availability aligning with the demand for large-scale infrastructure projects ranks fourth, with a mean of (3.4) and a SD of (0.90). Advanced technical expertise among local construction workers is ranked fifth, with a mean of (3.0) and a SD of (0.95). On the other hand, the ease of hiring certified construction workers is viewed less favorably, ranking sixth with a mean of (2.8) and a SD of (1.10). Similarly, the availability of workers with adequate knowledge of modern building standards and codes ranks lowest, with a mean of (2.9) and a SD of (1.05). The overall mean for all statements is (3.28), with a SD of (0.91).

Table 2: Descriptive Statistics for Skills Availability Statements in Infrastructure Construction Projects

Skills availability statements	**Rank**	**Mean**	**SD**
There are specialized labor for infrastructure construction projects in Kuwait.	2	3.6	0.80
Certified construction workers are easy to hire.	6	2.8	1.10
Advanced technical expertise is available among local construction workers.	5	3.0	0.95

Multi-skilled workers are available in infrastructure construction projects in Kuwait.	3	3.5	0.85
Skilled labor availability aligns with the demand for large-scale infrastructure projects.	4	3.4	0.90
The workforce is well-trained in using advanced construction tools and machinery.	1	3.8	0.75
The labor market provides workers with adequate knowledge of modern building standards and codes.	7	2.9	1.05
Total		**3.28**	**0.91**

Infrastructure Project Timelines

Table (3) shows the results of infrastructure project timelines that highlights critical factors influencing the planning and execution of construction projects in Kuwait. Regarding Planning, the highest-ranked statement indicates that project timelines are generally achievable, with a mean of (3.9) and a SD of (0.75). Comprehensive planning also received positive feedback, ranking second with a mean of (3.7) and a SD of (0.80), reinforcing the importance of well-structured planning processes. However, accurate forecasting of resources and manpower, though crucial, ranked lowest among planning-related factors, with a mean of (3.4) and a SD of (0.85), signaling room for improvement in this area. The overall mean for Planning is (3.63).

In the context of Approvals, the data reveals significant challenges. Respondents strongly agreed that delays in obtaining government approvals significantly affect project timelines, with this statement ranking highest. Additionally, regulatory requirements are perceived as time-consuming, with a mean of (3.8) and a SD of (0.90). In contrast, the perception of smooth and fast approval processes was notably less favorable, receiving the lowest score. The overall mean for this dimension is (3.5).

Setbacks are another prominent issue affecting project timelines. Financial setbacks were ranked as the most disruptive factor, with a mean of (4.0) and a SD of (0.95), highlighting the critical role of funding stability in project success. Labor availability setbacks also emerged as a significant issue, underscoring the importance of a reliable labor supply in maintaining project schedules. Unforeseen events, while slightly less impactful, still pose considerable challenges. The overall mean for this dimension is (3.8).

The findings for Inspections indicate that these processes are crucial for maintaining project timelines. The most highly ranked statement emphasizes the importance of timely inspections in ensuring schedule adherence. However, delays in inspections are recognized as a critical factor, with a mean of (3.7) and a SD of (0.85). Regular inspections, while necessary, are viewed as slightly less impactful, with a mean of (3.4) and a SD of (0.90). The overall mean for Inspections is (3.67).

Regarding Plan Changes, frequent changes in project plans are identified as having a significant impact on timelines, with a mean of (3.8) and a SD of (0.90). Flexible accommodation of such changes is viewed more favorably. The overall mean for this dimension is (3.7).

Finally, Delays are shown to be significantly influenced by coordination issues, material procurement problems, and labor shortages. Coordination issues ranked as the most critical factor, followed closely by material procurement challenges and labor shortages. The overall mean for Delays is (3.9).

Table 3: Descriptive Statistics for Infrastructure Project Timelines Dimensions in Kuwait

Infrastructure Project Timelines statements		**Rank**	**Mean**	**SD**
Planning	There is a comprehensive planning in in the infrastructure construction projects in Kuwait.	2	3.7	0.80
	Project timelines are realistic.	3	3.5	0.90
	Project timelines can be achieved.	1	3.9	0.75
	There is accurate forecasting of resources and manpower during planning ensures adherence to project timelines.	4	3.4	0.85
Total			**3.63**	**0.83**
Approvals	Approval processes for infrastructure construction projects in Kuwait are smooth and fast.	3	2.6	1.05
	Regulatory requirements for infrastructure construction projects in Kuwait are often time-consuming.	2	3.8	0.90
	Delays in obtaining government approvals significantly affect project timelines.	1	4.1	0.85
Total			**3.5**	**0.93**

Setbacks	Financial setbacks often disrupt project timelines in infrastructure construction projects in Kuwait.	1	4.0	0.95
	Labor availability setbacks often disrupt project timelines in infrastructure construction projects in Kuwait.	2	3.8	0.85
	Unforeseen events often disrupt project timelines in infrastructure construction projects in Kuwait.	3	3.6	0.90
Total			**3.8**	**0.90**
Inspections	Inspection processes are critical factors in maintaining project timelines in infrastructure construction projects in Kuwait.	1	3.9	0.80
	Delays in inspection are critical factors in maintaining project timelines in infrastructure construction projects in Kuwait.	2	3.7	0.85
	Regular inspections are conducted on time and do not disrupt project timelines in infrastructure construction projects in Kuwait.	3	3.4	0.90
Total			**3.67**	**0.85**
Plan Changes	Changes in the plan are accommodated in a flexible way in infrastructure construction projects in Kuwait.	2	3.6	0.85
	Frequent changes in project plans significantly affect project timelines in infrastructure construction projects in Kuwait.	1	3.8	0.90
Total			**3.7**	**0.88**
Delays	Coordination issues between stakeholders is one of the major causes of delays in project timelines in infrastructure construction projects in Kuwait.	1	4.0	0.95
	Material procurement issues is one of the major causes of delays in project timelines in infrastructure construction projects in Kuwait.	2	3.9	0.90

	Labor shortages is one of the major causes of delays in project timelines in infrastructure construction projects in Kuwait.	3	3.8	0.85
Total			**3.9**	**0.90**

Table (4) analysis reveals significant relationships between Labor Availability, Skill Availability, and several key dimensions of Infrastructure Project Timelines in Kuwait. Labor Availability was found to have a strong positive correlation with Planning. Additionally, Labor Availability demonstrated a significant positive relationship with Inspections, indicating that timely availability of labor plays a crucial role in ensuring inspections are conducted efficiently, thereby avoiding disruptions in project progress. Labor Availability was also strongly associated with minimizing Delays, further emphasizing its importance in mitigating interruptions and ensuring project completion within the planned timeframe. A moderate but significant correlation was observed between Labor Availability and Setbacks, suggesting that labor shortages contribute to unexpected disruptions, though to a lesser degree than other dimensions.

On the other hand, Labor Availability showed weak and non-significant relationships with Approvals and Plan Changes. This implies that the processes related to government approvals or adapting to changes in project plans may be less dependent on the availability of labor and are likely influenced by external regulatory or organizational factors.

Skill Availability, on the other hand, exhibited even stronger correlations with several key dimensions. The most notable relationship was with Planning, highlighting the critical role of skilled labor in enhancing planning efficiency and ensuring project timelines are realistic and achievable. A similarly strong relationship was observed with Inspections, underscoring the importance of skill availability in maintaining inspection schedules and avoiding delays caused by inefficiencies during this process. Additionally, Skill Availability showed a strong correlation with Delays, pointing to the significant role that a skilled workforce plays in minimizing interruptions and avoiding costly timeline overruns. A moderate yet significant correlation was also found with Setbacks, suggesting that while skill availability contributes to reducing setbacks, other factors may also play a role.

Similar to Labor Availability, Skill Availability exhibited weak and non-significant relationships with Approvals and Plan Changes. This suggests that these dimensions are less directly influenced by the availability of skills in the workforce, likely due to their dependence on procedural or regulatory factors.

Table 4: Correlation Between Labor and Skill Availability and Dimensions of Infrastructure Project Timelines (N = 230)

		Labor Availability	Skill Availability	Planning	Setbacks	Inspections	Delays
Labor Availability	**Pearson Correlation**	1	0.65**	0.65**	0.58**	0.62**	0.60**
	Sig.	.	0.00	0.00	0.00	0.00	0.00
	N	230	230	230	230	230	230
Skill Availability	**Pearson Correlation**	0.65**	1	0.72**	0.48*	0.70**	0.67**
	Sig.	0.00	.	0.00	0.03	0.00	0.00
	N	230	230	230	230	230	230
Planning	**Pearson Correlation**	0.65**	0.72**	1	0.58**	0.62**	0.60**
	Sig.	0.00	0.00	.	0.00	0.00	0.00
	N	230	230	230	230	230	230
Setbacks	**Pearson Correlation**	0.58**	0.48*	0.58**	1	0.61**	0.63**
	Sig.	0.00	0.03	0.00	.	0.00	0.00
	N	230	230	230	230	230	230
Inspections	**Pearson Correlation**	0.62**	0.70**	0.62**	0.61**	1	0.67**
	Sig.	0.00	0.00	0.00	0.00	.	0.00
	N	230	230	230	230	230	230
Delays	**Pearson Correlation**	0.60**	0.67**	0.60**	0.63**	0.67**	1
	Sig.	0.00	0.00	0.00	0.00	0.00	.
	N	230	230	230	230	230	230

5. Discussion

The results of this study give key insights into the interplay amongst labor and skill availability and their impact on infrastructure project timelines in Kuwait. The results highlight labor shortages as a significant issue affecting project performance, with notable consequences on planning, inspections, and delays. Specifically, the strong correlations between labor availability and these dimensions emphasize the importance of a sufficient and stable workforce in minimizing disruptions and ensuring project efficiency. Workforce diversity has been shown to play a vital role in addressing skilled labor shortages and enhancing decision-making processes, which are essential for project efficiency (Won, Hwang & Chng, 2021). The findings of this study align with prior research indicating that leveraging diverse skills and experiences can mitigate labor constraints and improve project timelines (Karimi et al., 2018; Won, Hwang & Chng, 2021).

Similarly, the significant relationships between skill availability and planning, inspections, and delays underscore the need for a skilled workforce to enhance project adherence to schedules and overall performance. Despite these positive associations, labor and skill availability showed weak and non-significant correlations with approvals and plan changes. This suggests that these dimensions are influenced more by external regulatory and procedural factors than by workforce dynamics as suggested also by Almamlook et al., (2020). These findings highlight an area where improvements in government policies and organizational processes could complement workforce-related strategies to further streamline project timelines.

Moreover, the significant correlations between setbacks and both labor and skill availability underscore the broader implications of workforce shortages. These shortages exacerbate financial instability and increase the likelihood of unforeseen disruptions, further emphasizing the need for comprehensive strategies that address both supply chain management and workforce readiness.

6. Conclusion

This research highlights the critical role of labor and skill availability in determining the success of infrastructure projects in Kuwait. The study confirms that shortages in labor and skills significantly impact planning, inspections, and project delays. However, the findings also reveal that dimensions like approvals and plan changes are less influenced by workforce factors, indicating the need for procedural and regulatory reforms alongside workforce strategies. Addressing labor and skill shortages is not only essential for enhancing project performance but also for achieving Kuwait's vision of sustainable infrastructure development. Enhancing workforce development and refining labor policies can help the construction industry reduce risks,

streamline project schedules, and play a more impactful role in the nation's economic advancement.

7. Limitations and Future Research

This study offers valuable findings; however, several limitations should be noted. Firstly, as the research is confined to Kuwait, the results may not be fully applicable to regions with varying economic and regulatory conditions. Secondly, the reliance on self-reported data introduces the potential for response bias, even with measures taken to ensure the survey's clarity and reliability. Future studies could overcome these limitations by conducting comparative analyses across different countries to examine how labor and skill availability affect construction projects within diverse cultural and regulatory environments. Additionally, investigating the role of technology and automation in mitigating labor shortages and enhancing project timelines would provide valuable insights for the construction industry.

8. Recommendations

To address the challenges posed by labor and skill shortages and their impact on infrastructure project timelines in Kuwait, several targeted strategies are proposed. First, enhancing workforce development through the establishment of comprehensive training programs that combine technical skills with practical applications is essential. These programs should focus on aligning the skills of workers with the demands of large-scale infrastructure projects. Additionally, introducing flexible hiring policies and improving labor migration regulations can facilitate the recruitment of foreign workers while ensuring compliance with modern building standards and codes.

The integration of advanced technologies, such as automated project management tools and predictive analytics, can help mitigate delays caused by labor shortages and improve planning efficiency. Furthermore, fostering collaboration among stakeholders, including government agencies, construction firms, and educational institutions, can streamline approval processes and improve regulatory frameworks. Investments in multi-skilled workforce development and public-private partnerships are also vital to addressing skill gaps and ensuring the availability of a diverse and competent labor force.

Lastly, establishing robust monitoring systems to assess labor market dynamics and skill availability will enable policymakers and industry leaders to respond proactively to emerging challenges. By implementing these strategies, Kuwait's construction sector can optimize project timelines, enhance productivity, and contribute to the nation's broader infrastructure development goals.

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Doi: https://doi.org/10.52132/Ajrsp.e.2025.69.3