DOI: 10.53469/jpce.2025.07(06).02

Transnational Analysis of Construction Cost Escalation Drivers: A Structural Equation Modeling Approach Across GCC, OECD and ASEAN Contexts

Sreedurga Madhu[1], Aparna Muthu[2]

[1]Associate Professor (Principal Author), School of Property, Construction and Project Management, RMIT University, Australia.

[2]School of Property, Construction and Project Management, RMIT University, Australia.

Abstract: ***This research examines cost overruns in the construction industry by comparing Bahrain Strategic Road Master Plan (SRMP) with the construction sector of Australia and Malaysia. Key causes include inaccurate estimates, design changes, execution delays and economic fluctuations. The study highlights the role of risk management, stakeholder engagement, and advanced technologies such as Building Information Modeling (BIM) in mitigating cost overruns. Through a comprehensive analysis, the research provides insights into practices for improving cost estimation and project execution across the three regions, contributing to construction sustainability and economic growth.***

Keywords: cost overrun, project management, risk assessment, infrastructure development, construction industry.

1. Introduction

Like most countries, the construction industry in Bahrain is a vital contributor to economic growth and plays a pivotal role in advancing the country's development agenda (Faridi et al.2006). With the implementation of the Strategic Roads Master Plan, which encompasses numerous large - scale infrastructure projects, the sector is at the forefront of transforming Bahrain's economic landscape. In Bahrain, most infrastructure projects are financed through a combination of private - sector investments and government funding, including contributions from the Gulf Cooperation Council (GCC), (Zaidan et al., 2019). These projects involve expanding transport networks, upgrading utilities, and enhancing public amenities, all of which are critical for driving social and economic prosperity. However, the increased scale and complexity of these initiatives have highlighted the need for efficient project management practices (Eriksson et al.2017).

In Australia and Malaysia, similar challenges are faced in the construction sector. In Australia, ambitious timelines and substantial investment requirements underscore the importance of delivering projects on time and within budget (Lyneis et al.2007). Effective project management is crucial to ensure development goals are met and to foster investor confidence, essential for the continued growth of the construction sector (Chaudhary et al.2019). In Malaysia, inadequate planning and poor site management have been identified as significant contributors to cost overruns, further complicating project execution. The construction industry is capital - intensive and heavily reliant on resources. Although, budgeting and planning are conducted, fiscal dynamics often lead to project costs exceeding the original estimates. Despite the importance of diligent project management, cost overruns have become a significant challenge across Bahrain, Australia, and Malaysia (Samarghandi et al.2016). These overruns can be attributed to various factors, including inaccurate cost estimation, unforeseen project delays, fluctuating material costs, and inefficient resource allocation. Such challenges can have severe implications, leading to budget strain, compromised project quality, and even the potential failure of critical infrastructure initiatives (Rahman et al.2013).

This research is significant as it provides a comparative analysis that can inform policymakers, construction managers, and investors about best practises for reducing cost overruns, ensuring project sustainability, and economic growth in infrastructure development. This study aims to analyze cost overrun factors in Bahrain's SRMP, drawing comparisons with Australia and Malaysia to develop insights for improving cost control and efficiency in large infrastructure projects.

2. Objectives

This research aims to assess the key factors affecting project cost overruns under the Strategic Roads Master Plan of the Kingdom of Bahrain, while drawing insights from the experiences of Australia and Malaysia to inform a more comprehensive understanding of the issue. The Strategic Roads Master Plan (SRMP) of Bahrain is a significant national infrastructure initiative aimed at fostering sustainable development and ensuring long - term economic growth, aligning with Bahrain's Economic Vision 2030. This research will explore key projects within this framework and examine the reasons behind frequent construction cost overruns. By delving into these major road projects, we aim to understand the challenges and complexities involved in their various phases of execution and how to overcome them. Similarly, the construction industries in Australia and Malaysia face their own unique challenges. In Australia, Doloi (2013) highlighted the factors such as Labor shortages, regulatory complexities, and rising material costs contribute to frequent cost overruns. The emphasis on sustainable practices and innovative technologies also adds layers of complexity to project management.

In Malaysia, the construction sector grapples with issues like inadequate planning and client - driven changes Tiew et al. (2022), similar to those observed in Bahrain. Additionally, the need for skilled labour and effective project management is critical in both countries to navigate the intricacies of large - scale infrastructure projects. By comparing these three contexts—Bahrain, Australia, and Malaysia—this research aims to identify common challenges and best practices, ultimately providing insights to enhance project execution and minimize cost overruns across different regions.

One significant factor contributing to cost overruns in Bahrain's Strategic Roads Master Plan is the lack of cost risk assessment.

Abusafiya et al. (2017) identified various risks that influence the success of infrastructure projects, including project uniqueness, complexity, and the dynamic nature of construction activities. These risks frequently lead to cost overruns, delays, and compromised project quality. Many contracts related to Bahrain's SRMP have faced similar challenges, resulting in substantial underestimations. Discrepancies between estimates provided by the Ministry of Works and actual tender figures have been considerable during the tendering process. Furthermore, Flyvbjerg et al. (2003) noted that optimism bias and strategic misrepresentation are prevalent factors contributing to cost underestimations. In Australia, the construction industry similarly struggles with cost overruns due to inadequate risk assessment and data management. Factors such as labour shortages and fluctuating material prices exacerbate these issues, leading to financial inefficiencies. Effective data management is crucial in enhancing the cost - effectiveness of contracts, ensuring timely and budget - friendly delivery.

In Malaysia, challenges mirror those in Bahrain and Australia, with inadequate data collection impacting project management. Yu et al. (2020) highlighted that a primary obstacle to managing contracts effectively in Malaysia is the lack of data tools illustrating economic impacts. This data deficiency undermines planning and risk management, resulting in delays and increased costs. Al Siyabi et al. (2021) noted that cost overruns across the construction industries of Bahrain, Australia, and Malaysia pose significant challenges to maintaining projects within budget and on schedule. Dutta and Bose (2015) emphasized that enhanced data collection and analysis could provide valuable insights, enabling stakeholders to implement more effective cost control measures and optimize resource allocation. Furthermore, Arif and Aldosary (2023) asserted that a greater emphasis on data - driven strategies, data analytics, open data initiatives, and the deployment of IoT sensors for real - time data collection is vital for achieving sustainable growth in infrastructure projects across all three countries. By addressing these issues, the construction industries in Bahrain, Australia, and Malaysia can improve productivity and enhance their economic contributions.

According to Scott (1999), "a change order is a charge for work not included in a contract's scope of work. " Within Bahrain's Strategic Road Master Plan (SRMP), many contracts register change order requests immediately upon being awarded. These variations often arise from the relocation of existing services and utility diversions. Additionally, stakeholders—including the Ministry of Works, service providers, or funding bodies from Saudi Arabia, Kuwait, or the UAE—frequently request modifications that exceed the original project scope, leading to project expansions without corresponding budget increases. Shrestha et al. (2019) noted that construction contract costs can increase by 5% to 10% of the original contract price, highlighting the necessity for careful management of changes and clear communication among stakeholders to ensure project objectives are met without compromising financial constraints.

In Australia, similar issues arise, with change orders frequently resulting from regulatory changes and stakeholder demands. Amini et al. (2023) identified inadequate project planning as a primary cause of cost overruns in both Australia and Malaysia. Key issues include insufficient scope definition, lack of detailed project schedules, and unrealistic budgeting. In Malaysia, frequent design changes, additional work, and price fluctuations exacerbate these challenges, particularly in projects associated with the SRMP.

Hassan (2023) emphasized that addressing cost overruns requires a multifaceted approach that includes enhanced planning, realistic budgeting, effective risk management, and the adoption of advanced project management tools. Othman et al. (2021) noted that integrating modern technologies—such as Building Information Modeling (BIM) and data analytics—can optimize resource allocation, improve decision - making, and mitigate risks in project execution across all three regions. By cultivating a culture of transparency, accountability, and proactive planning, Bahrain, Australia, and Malaysia can effectively address these challenges, ensuring the successful completion of infrastructure projects within budget and on schedule.

3. Materials and Methods

Data was analyzed using statistical techniques such as frequency analysis and comparative evaluation to identify the key causes of cost overruns across the three regions. Coy (2019) stated that both qualitative and quantitative research methodologies are essential for a comprehensive understanding of complex phenomena**.** This study utilized quantitative methods to rigorously analyse numerical data, allowing for precise testing of hypotheses and exploration of relationships among the various factors influencing the construction cost overrun.

A survey was conducted in the Bahracollin construction industry to analyse the top twelve factors contributing to construction cost overruns. This primary research aimed to gather insights directly from industry professionals and stakeholders. Additionally, secondary data was sourced from past publications regarding construction cost overruns in Australia and Malaysia, providing a comparative framework for analysis. By examining these two countries, known for their significant challenges with cost overruns, we aim to draw meaningful comparisons that illustrate the similarities and differences in the factors influencing cost overruns in Bahrain versus those in Australia and Malaysia. This comparative study will highlight the specific causes of cost

overruns in Bahrain, offering valuable insights into how these factors vary across different cultural and economic contexts. Ultimately, the findings will contribute to a deeper understanding of the construction landscape in Bahrain and inform strategies for mitigating cost overruns based on successful practices observed in Australia and Malaysia.

Data Overview: The case of Bahrain

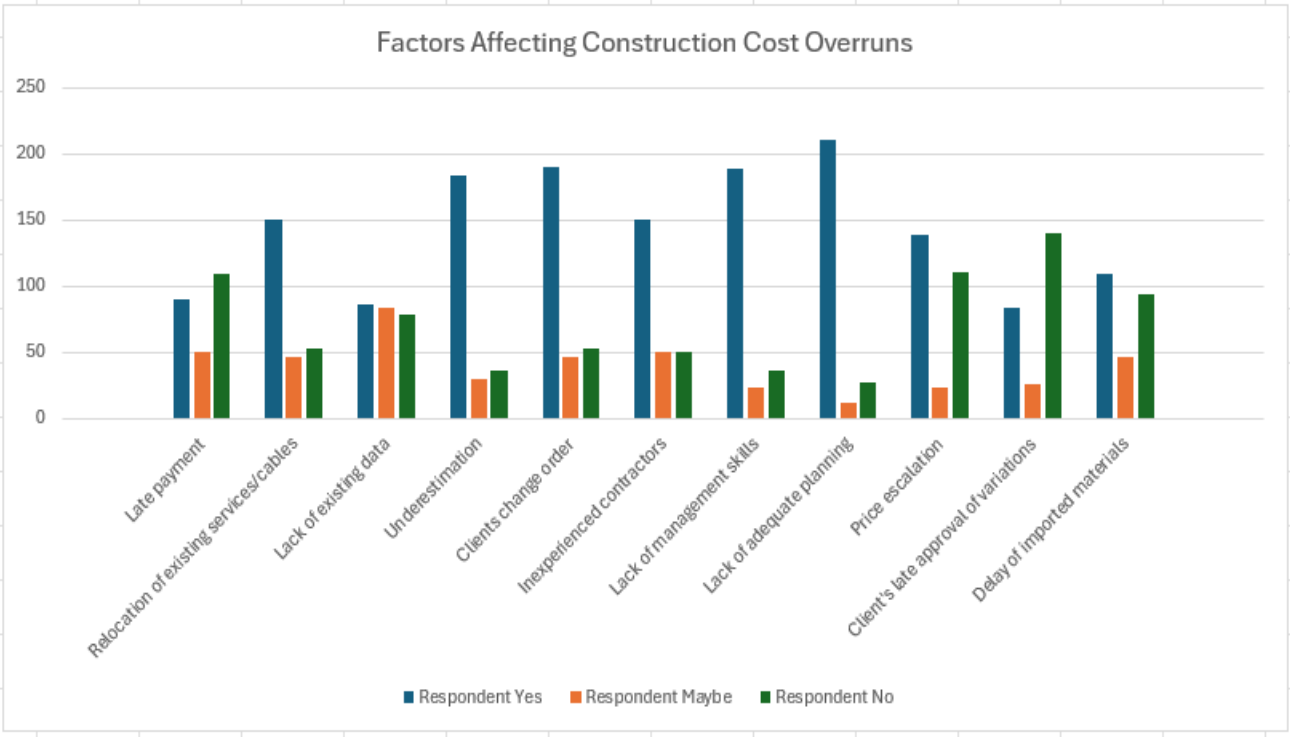
The survey included responses from 250 participants across various roles in construction (Quantity Surveyors, Project Managers, Engineers, Contractors, Clients). The participants rated several factors affecting cost overruns.

Frequency Analysis

Factors	Yes (Count)	Maybe (Count)	No (Count)	Yes (%)	Maybe (%)	No (%)
Late payment	90	51	109	36%	20.40%	43.60%
Relocation of existing services/cables	150	47	53	60%	18.80%	21.20%
Lack of existing data	87	84	79	34.80%	33.60%	31.60%
Underestimation	184	30	36	73.60%	12%	14.40%
Clients change order	190	47	53	76%	18.80%	21.20%
Inexperienced contractors	150	50	50	60%	20%	20%
Lack of management skills	189	24	37	75.60%	9.60%	14.80%
Lack of adequate planning	211	12	27	84.40%	4.80%	10.80%
Price escalation	139	24	111	55.60%	9.60%	44.40%
Client's late approval of variations	84	26	140	33.60%	10.40%	56%
Delay of imported materials	109	47	94	43.60%	18.80%	37.60%

4. Findings and Discussions

In Bahrain, a striking 84.4% of respondents pointed to inadequate planning as the leading cause of cost overruns in construction projects. This underscores the critical need for thorough project preparation to ensure that resources are allocated efficiently, and timelines are adhered to. Additionally, 76% of participants recognized that client - driven change orders significantly impact project budgets, highlighting the importance of effective communication and well - defined project scopes to manage expectations and minimize disruptions. The issue is further exacerbated by the frequent underestimation of project costs, identified by 73.6% of respondents, which can lead to financial strain and project delays. Furthermore, the necessity for skilled management is evident, with 75.6% acknowledging its role in navigating the complexities of construction projects. These findings collectively suggest that Bahrain's construction sector requires a multifaceted approach to address these challenges. Enhancing planning processes, fostering clear communication between stakeholders, and investing in the development of management skills are essential steps toward improving project outcomes and reducing the occurrence of cost overruns. By focusing on these areas, the industry can achieve greater efficiency and success in future projects.



In Australia, research by Shah (2016) emphasizes that planning and scheduling are the most critical factors affecting construction cost overruns. This aligns with findings from Bahrain, but it places a stronger emphasis on the importance of construction methodologies and effective monitoring feedback. Shah's focus on management - related factors indicates that while planning is essential, the techniques employed, and ongoing project evaluations are equally crucial for mitigating cost overruns. The Australian perspective suggests a more integrated approach to management,

highlighting the need for continuous feedback loops to identify and address issues before they escalate. By implementing these strategies, stakeholders can enhance project performance and reduce the likelihood of financial discrepancies. This proactive management framework not only promotes efficiency but also fosters a culture of accountability and responsiveness within the construction industry. Ultimately, integrating robust planning with effective monitoring and feedback mechanisms can significantly improve project outcomes, ensuring that projects remain on time and within budget, thereby contributing to overall industry sustainability and growth.

In Malaysia, the findings Shah (2016) also resonates with those from Bahrain, emphasizing a lack of appropriate planning as a major factor contributing to cost overruns. Poor site management emerged as the second critical issue, indicating that execution problems can significantly impact overall costs. Additionally, financial shortcomings on the client's part and delays in payments for completed works were noted, suggesting that economic factors play a vital role in the construction sector.

This introduces a different dimension to the discussion, as financial stability and timely payments are essential for project continuity, aspects that may not have been as strongly emphasized in the cases of Bahrain and Australia. The reliance on consistent cash flow highlights the need for stronger financial management practices among clients to ensure that projects proceed smoothly. Addressing these financial challenges, alongside improving planning and site management, is crucial for enhancing the efficiency and effectiveness of the construction industry in Malaysia, ultimately leading to better project outcomes and sustainability. By recognizing the interplay between financial health and project execution, stakeholders can develop more comprehensive strategies to mitigate cost overruns.

5. Comparative Analysis

Comparative insights reveal several commonalities and differences among the three countries. All three identify inadequate planning as a significant factor in cost overruns, suggesting a universal need for enhanced project preparation and management skills. This highlights the importance of investing in training and development across the construction industry. Both Bahrain and Australia recognize the influence of client - driven changes, indicating that effective communication and scope definition are critical factors that need to be addressed globally.

However, Australia's focus on construction techniques and feedback mechanisms presents a more nuanced understanding of project management compared to Bahrain and Malaysia. Relying solely on planning may overlook the need for adaptive management strategies. Additionally, Malaysia's emphasis on financial issues introduces an external economic dimension that is less prominent in the other two countries. This suggests that while project management is crucial, external financial stability and timely payments are equally important, which may not be adequately addressed in Bahrain and Australia's frameworks.

In conclusion, understanding the factors contributing to cost overruns in Bahrain, Australia, and Malaysia reveals both common challenges and unique contexts. By recognizing the importance of planning, management skills, and external financial factors, stakeholders can implement targeted strategies to mitigate risks and improve project outcomes. Collaborative efforts across these regions to share best practices could further enhance the effectiveness of construction management and reduce the incidence of cost overruns in the future

Table 1: Comparative analysis table

Aspect	Bahrain	Australia	Malaysia
Inadequate Planning	Significant factor in cost overruns	Significant factor in cost overruns	Significant factor in cost overruns
Need for Enhanced Skills	Investment in training and development needed	Investment in training and development needed	Investment in training and development needed
Client - Driven Changes	Recognized influence; need for effective communication	Recognized influence; need for effective communication	Recognized influence; need for effective communication
Focus on Construction Techniques	Less emphasis on adaptive management strategies	Emphasis on construction techniques and feedback mechanisms	Less emphasis on adaptive management strategies
Financial Issues	Less prominent in discussions	Less prominent in discussions	Emphasis on financial stability and timely payments
External Economic Dimension	Not heavily addressed	Not heavily addressed	Critical for project management
Common Challenges	Planning and management skills	Planning and management skills	Planning and management skills
Unique Contexts	Focus on communication and scope definition	Focus on adaptive management	Focus on financial stability
Collaborative Efforts	Sharing best practices recommended	Sharing best practices recommended	Sharing best practices recommended

6. Recommendations

To address the challenges of cost overruns in the construction sectors of Bahrain, Australia, and Malaysia, a multifaceted approach is essential. First, enhanced cost risk assessments should be conducted during the planning phase of projects, as this will help identify potential risks and develop effective mitigation strategies. This aligns with the findings from all three countries, emphasizing the need for thorough project preparation. Additionally, investing in robust data management systems will facilitate reliable data collection

and analysis, enhancing transparency and supporting informed decision - making. The adoption of advanced technologies, such as Building Information Modeling (BIM) and Internet of Things (IoT) sensors, should be prioritized to optimize resource allocation and provide real - time insights. Australia's focus on effective monitoring and feedback mechanisms can be integrated into Bahrain and Malaysia's frameworks, enhancing project management practices. Clear communication protocols among stakeholders are vital to minimize the impact of client - driven changes on budgets, ensuring alignment on project objectives.

Realistic budgeting and thorough planning are critical components. Conducting detailed project planning that includes clear scope definitions and achievable budgets will help avoid unrealistic expectations. Regularly reviewing and adjusting project schedules to accommodate potential changes is necessary for maintaining project integrity. Malaysia's emphasis on financial stability underscores the importance of ensuring that clients have the necessary resources and timely payments, which should be a focus across all three countries. Training and capacity building for project managers and stakeholders on advanced project management tools will enhance their ability to manage risks and control costs effectively. Finally, establishing mechanisms for continuous feedback and improvement throughout the project lifecycle is essential. Regular assessments of project performance and incorporating lessons learned into future planning will foster a culture of ongoing enhancement across the construction sectors in Bahrain, Australia, and Malaysia.

7. Conclusion

This study highlights that cost overruns in construction projects are a universal challenge across Bahrain, Australia and Malaysia. Common causes include inadequate planning, risk management, and external economic factors. By integrating advanced project management strategies and leveraging technology such as BIM, stakeholders can enhance cost control and project efficiency. Future research should explore the impact of specific policy interventions on mitigating cost overruns in different national contexts.

References

[1] Flyvbjerg, B., Holm, M. K. S., & Buhl, S. L., 2003. How common and how large are cost overruns in transport infrastructure projects?

[2] Faridi, A. S. and El-Sayegh, S. M., 2006. Significant factors causing delay in the UAE construction industry. *Construction management and economics*, *24* (11), pp.1167 - 1176.

[3] Zaidan, E., Al - Saidi, M. and Hammad, S. H., 2019. Sustainable development in the Arab world–is the Gulf Cooperation Council (GCC) region fit for the challenge?. *Development in Practice*, *29* (5), pp.670 - 681.

[4] Eriksson, P. E., Larsson, J. and Pesämaa, O., 2017. Managing complex projects in the infrastructure sector—A structural equation model for flexibility - focused project management. *International journal of project management*, *35* (8), pp.1512 - 1523.

[5] Lyneis, J. M. and Ford, D. N., 2007. System dynamics applied to project management: a survey, assessment, and directions for future research. *System Dynamics Review: The Journal of the System Dynamics Society*, *23* (2-3), pp.157 - 189.

[6] Chaudhary, K. and DakshinaMurthy, R. A., 2019. Sustainable Project Management and Sustainable Development Goals: Connecting the Dots. *PROJECT MANAGEMENT IN THE EMERGING WORLD OF DISRUPTION*, p.85.

[7] Samarghandi, H., Mousavi, S., Taabayan, P., Mir Hashemi, A. and Willoughby, K., 2016. Studying the Reasons for Delay and Cost Overrun in Construction Projects: The Case of Iran.

[8] Rahman, I. A., Memon, A. H., Karim, A. T. A. and Tarmizi, A., 2013. Significant factors causing cost overruns in large construction projects in Malaysia. *Journal of Applied sciences*, *13* (2), pp.286 - 293.

[9] Hassan, A., 2023. Mitigating Cost Overruns: Effective Strategies in Construction Management.

[10] Othman, A. A. E. and Alamoudy, F. O., 2021. Optimising building performance through integrating risk management and building information modelling during the design process. *Journal of Engineering, Design and Technology*, *19* (6), pp.1233 - 1267.

[11] Amini, S., Rezvani, A., Tabassi, M. and Malek Sadati, S. S., 2023. Causes of cost overruns in building construction projects in Asian countries; Iran as a case study. *Engineering, Construction and Architectural Management*, *30* (7), pp.2739 - 2766.

[12] Al Siyabi, H. N. and Khaleel, O., 2021. Cost overrun in construction projects in Oman: Case study. *Journal of Student Research*.

[13] Yu, T., Liang, X. and Wang, Y., 2020. Factors affecting the utilization of big data in construction projects. *Journal of construction engineering and management*, *146* (5), p.04020032.

[14] Dutta, D. and Bose, I., 2015. Managing a big data project: the case of ramco cements limited. *International Journal of Production Economics*, *165*, pp.293 - 306.

[15] Hasan, R., Suliman, S. M. and Malki, Y. A., 2014. An investigation into the delays in road projects in Bahrain. *International Journal of Research in Engineering and Science*, *2* (2), pp.38 - 47.

[16] Doloi, H., 2013. Cost overruns and failure in project management: Understanding the roles of key stakeholders in construction projects. *Journal of construction engineering and management*, *139* (3), pp.267 - 279.

[17] Abusafiya, H. A. and Suliman, S. M., 2017. Causes and effects of cost overrun on construction project in Bahrain: Part I (ranking of cost overrun factors and risk mapping). *Modern Applied Science*, *11* (7), p.20.

[18] Arif, M. and Aldosary, A. S., 2023. Urban spatial strategies of the Gulf Cooperation Council: A comparative analysis and lessons learned. Sustainability, 15 (18), p.13344.

[19] Abusafiya, H. A. and Suliman, S. A. M., 2017. Causes and effects of cost overrun on construction project in Bahrain: part 2 (PLS - SEM path modelling). *Modern Applied Science*, *11* (7), pp.28 - 37.

[20] Amini, S., Rezvani, A., Tabassi, M. and Malek Sadati, S. S., 2023. Causes of cost overruns in building construction projects in Asian countries; Iran as a case study. Engineering, Construction and Architectural Management, 30 (7), pp.2739 - 2766.
[21] Scott, R. D.1999. “Change order protection.” Reeves J. Plumb. Heat. Cool.79 (3): 38.
[22] Shrestha, P. P. and Maharjan, R., 2019. Effect of change orders on cost and schedule for small low - bid highway contracts. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *11* (4), p.04519025.
[23] Coy, M. J., 2019. Research methodologies: Increasing understanding of the world. *International Journal of Scientific and Research Publications*, *9* (1), pp.71 - 77.
[24] Mohajan, H. K., 2020. Quantitative research: A successful investigation in natural and social sciences. *Journal of Economic Development, Environment and People*, *9* (4), pp.50 - 79.
[25] Shah, R. K., 2016. An exploration of causes for delay and cost overrun in construction projects: A case study of Australia, Malaysia & Ghana. Journal of Advanced College of Engineering and Management, 2 (1), pp.41 - 55.
[26] Tiew, S. Y., Hashim, H. A. and Zolkafli, U. K. B., 2022. Performance barriers in relation with professional development of graduate architects in construction industry: A systematic literature review. Journal of Construction Business and Management, 5 (2), pp.29 - 43.