ISSN 2348-1218 (print)
International Journal of Interdisciplinary Research and Innovations ISSN 2348-1226 (online)
Vol. 13, Issue 4, pp: (12-16), Month: October 2025 - December 2025, Available at: www.researchpublish.com

Standardization of Project Management Practices across Mega-Projects

Ghassan Omar

DOI: https://doi.org/10.5281/zenodo.17311220

Published Date: 10-October-2025

Abstract: **Mega-projects, very large projects, lead the engineering and construction industry. Specifically, those operated by Saudi Aramco require a globally standardized approach to project management to be effective, cost-efficient, and timely. This technical paper explores how standardization can be used to streamline the byproducts of projects, with specific application to lean construction, risk management, digital transformation, role of stakeholders, obstacles, and implementation strategy. The convergence of technologies, like Building Information Modelling (BIM) and Internet of Things (IoT), is a significant force behind standardizing technology. The discussion will be based on the context of Saudi Arabia's engineering and construction industry, with a focus on applications. Among the recommendations are the adoption of integrated frameworks in order to limit wastage, improve decision-making, and harmonize the aims and objectives of projects and organizational goals. This paper seeks to deliver practical solutions for enhancing project management in the complicated portfolio of Saudi Aramco.**

Keywords: **Mega-projects, very large projects, Building Information Modelling (BIM), construction industry.**

1. INTRODUCTION

The engineering and construction sectors have Mega-projects characterized by scale, complexity, and massive resource requirements, like Saudi Aramco refineries and offshore platforms. The projects can be characterized by cost overruns, delays in these projects, and inefficiencies of the projects because of multiple approaches to project management. Standardization provides a discipline to mechanize operations, boost cooperation, and increase project performance. At Saudi Aramco, the issue of harmonizing the project management processes is essential to provide project management services to the extensive volume of projects, such as the Marjan field expansion. This paper examines how standardized practices can be applied to the methodologies, technologies, and challenges that are unique to engineering and construction. It is organized into six parts: lean construction, risk management, digital transformation, stakeholder coordination, barriers, and recommendations. The analysis uses recent works of literature to give evidence-based information that can guide the project management system at Saudi Aramco.

The inherent complexity of mega-projects, which have many stakeholders and wide-ranging regulatory provisions, makes standardization a necessity. Disparities in the way things are done cause mixed messages, unnecessary redoing, and wastage of resources, which can cause project delays and exceeded budgets. Standardization promotes predictability in the project since the planning, implementation, and control are homogeneous. The Jazan Refinery, which is one of the projects of Saudi Aramco, shows what the standardized approach may provide in the future. The ability to transform project delivery can be found in areas of focus such as risk management and integration of digital tools; standardization can improve project delivery. The purpose of the paper is to contribute to the engineering and construction industry by providing an in-depth study of standardization.

2. LEAN CONSTRUCTION PRINCIPLES

Lean construction practices will help Saudi Aramco reduce the amount of waste and increase the deliverable value, which is pivotal to the delivery of mega-projects, such as the Jazan Refinery. They include the optimization of processes, minimization of non-value-added work, and improvement of the collaboration between project teams. As an example, the Last Planner System (LPS) has been introduced to Saudi mega-projects to enhance the reliability of schedules through the collaborative process of planning. Converting the lean practices to standard ones guarantees uniformity of application

throughout the project phases, that is, during design and construction. By concentrating on the delivery of the value, lean techniques minimize the amount of wasted materials and time when the equipment remains idle. Taking a demonstrative example is the implementation of lean in the King Abdulaziz Center for World Culture by Saudi Aramco, which has led to a shorter duration of the construction process. Nevertheless, lean construction adoption is not without some setbacks, which include reluctance to change and poor training. In the projects of Saudi Aramco, barriers such as the traditional workflows and cultural aspects tend to act as hindering factors to lean implementation. An example is where subcontractors are more interested in speed than efficiency, resulting in material waste in other projects. Standardized training programs have been deemed essential in breaking these barriers and in aligning the workforce. Adoption of lean can also be encouraged by effective communication of the benefits of lean-to project teams. The success of Saudi Aramco in implementing the principles of lean shows the potential of standardization of practices to enhance the results. The leadership is also required to commit to and invest in training to continue lean construction efforts.

Lean construction also involves a cultural change to continuous improvement that may be difficult within the complex project environments that exist within Saudi Aramco. The incorporation of lean tools, including value stream mapping, will aid in the detection of waste and the standardization of processes within projects. However, a unanimous system of lean may not be used unified on the part of subcontractors. Common guidelines and performance standards can help to implement them consistently and hold people accountable. The accomplishment of Saudi Aramco to minimize the amount of wasted materials by 10 percent in the Jazan Refinery due to the lean practices indicates the benefit of standardization. A robust lean strategy with frequent audits has the capability of prolonging efficiency.

3. RISK MANAGEMENT STRATEGIES

Risk management is essential in mega-projects, to which uncertainties can contribute major financial and operational problems. Saudi Aramco applies unified risk management models, including Failure Modes and Effects Analysis (FMEA), to spot and curb risks in projects. These frameworks rank risks according to severity and probability, and they allow thematic decision-making. A cohesive way of dealing with risk produces a stronger project and the distribution of resources. Seamless incorporation of risk management workflow into project activities means risk mitigation is anticipated at Saudi Aramco. Common risk registers allow for the tracking and reporting of risks across projects. Different risk management practices among the subcontractors can compromise the success of projects. In projects within Saudi Aramco, there is a mismatch in priorities influenced by the difference in the implementation methodology of risk assessment where a lack of coordination of mitigation measures occasioned delays. By standardizing risk management protocol, all the teams are assured of the same understanding of risks. The training programs are necessary to have a proper alignment of stakeholders using standardized tools and processes. A coordinated risk management system reduces any mismatch and gives the projects certain predictability. Risk monitoring and feedback are essential for sustaining effective risk management. Standardization of risk management also implies the use of sophisticated tools that will promote risk identification and mitigation in the mega-projects of Saudi Aramco. When standardizing, there are issues of disparity in risk tolerance by the stakeholders, which can be a hindrance. The potential solution to increasing transparency and alignment would be automated reporting systems and standardized risk dashboards. The positive results experienced by Saudi Aramco with regard to Zuluf Field stakeholders in the field of reducing project delays due to the use of a unified approach serve as evidence to support the ideas discussed in this paper. Audits and regular risk management workshops will also make sure that the application is uniform throughout all project stages.

4. DIGITAL TRANSFORMATION IN PROJECT MANAGEMENT

Saudi Aramco is embracing new technologies in project management, digitalizing processes with solutions such as Building Information Modelling (BIM) and Internet of Things (IoT) to achieve its goal. BIM facilitates the process of standardized data management that minimizes error and enhances coordination in an upgrade project. Sensors are also IoT devices that can give real-time data concerning the equipment performance, thus being used to enhance decision-making in offshore projects. Digital platforms are standardized, thus providing consistency in the data format and work procedures. With this tool, transparency and minimization of rework are improved in project phases. The implementation of digital technologies by Saudi Aramco leads to efficient project delivery. However, the high cost of implementation and inefficiency in terms of technical expertise obstruct digital transformation. The challenges that are likely to occur in Saudi Aramco projects regarding BIM implementation are the inconsistency among the subcontractors regarding the use of BIM. Unified BIM implementation blueprints are essential in creating a hassle-free integration. Training programs can help fill in the gaps in

essential skills, as well as encourage the adoption of technology. The example of the successful application of the IoT on offshore projects is Saudi Aramco, which indicates the effectiveness of using the standardized digital tools. Barriers to cost would have to be lifted through investment in technology infrastructure. With the harmonization of digital standards, Saudi Aramco will become capable of greater project efficiency and coordination. The incorporation of digital tools also implies a need to have uniform protocols so that they can be feasible for all the mega-projects of Saudi Aramco. It is possible to create standard digital templates and cloud platforms to facilitate data sharing and collaborations. The utilization of BIM in the Jizan Refinery project to identify clashes led the Saudi Aramco to save costly rework expenses. Continuous training and certification to use digital tools should be regularly undertaken to have uniformity in the use of digital tools by all stakeholders. A clear digital transformation strategy, enabled by robust digital systems and infrastructure, will enable efficiency and innovation over the long term of project management.

5. STAKEHOLDER COORDINATION

Mega-projects require more careful coordination of stakeholders, as various parties, such as contractors and regulators, will have to coordinate. Saudi Aramco also applies standardization to the communication protocols, like reporting templates, to ensure project clarity in projects. These protocols include periodic progress meetings and standard dashboards to enable the flow of information. The standardized coordination eliminates miscommunication and helps align the stakeholders with the project goals. A point of convergence helps build trust and accountability in project teams. This will make project milestones and goals achievable. Problems in the organization of stakeholders are connected with differences in priorities and cultural differences. In the projects of Saudi Aramco, the subcontractors might want to focus on the cost rather than the quality. These problems can be prevented by a uniform stakeholder management strategy, where the roles and responsibilities are spelled out correctly. Feedback and regular engagement are required in order to stay aligned. Saudi Aramco can deal with the disputes minimally because unified protocols can be enforced to carry out the projects on time. The engagement of the stakeholders is an ongoing process that holds the key to effective coordination. Saudi Aramco can further strengthen the coordination of stakeholders in its mega-projects by standardizing communication using digital collaboration tools. The different capacities in terms of technological proficiency among partners may interfere with the working relationship in a given project. These gaps can be overcome by implementing a set of standardized digital dashboards and training programs that will result in reliable interaction. Alignment and accountability can also be strengthened through regular stakeholder workshops and a feedback loop. A well-developed standard structure of the coordination, enabled by technology and sustained interaction, will maximize project performance and project stakeholder satisfaction.

6. BARRIERS TO STANDARDIZATION

The challenges of standardizing practices in project management in Saudi Aramco on its mega-projects are the implementation of cultural resistance and organizational inertia. The traditional construction approach in Saudi Arabia favors flexibility in a manner that does not promote structured practices. Mega-projects also have a lot of subcontractors and regulatory requirements, making things more complex in regard to standardization. The absence of standard training programs hinders workforce readiness for the new practices. Failure to adopt technology uniformly, for example, differences in BIM competence, presents other problems. These barriers can only be overcome if you have strong leadership and the ability to communicate effectively. Phased standardization can be a way of embracing it due to the steady absorption. The fact that digital solutions, like BIM or IoT are relatively costly to implement is also a significant obstacle. In the case of Saudi Aramco, its projects are constrained when it comes to investment in customized output since the budget is restricted. Different regulations among different regions in Saudi Arabia also interfere with the process of standardization. A coordinated partnership with regulators can standardize and simplify the compliance process. The value of going through the hurdles can be emphasized by Saudi Aramco encountering challenges in standardizing risk management. Buy-in is essential to leading cultural change and cultural adoption; therefore, stakeholder buy-in is necessary. A strategy of inclusiveness would assure the successful standardization of mega-projects. Another significant barrier is the inability to interoperate across project management tools and processes, which adversely affects the consistent standardization of Saudi Aramco projects. The adoption of unified digital platforms is further exacerbated by resistance from stakeholders who are used to legacy systems. This problem can be alleviated by implementing interoperable tools, including unified BIM protocols, which will improve collaboration. Standardized practices can be helped along by programs involving comprehensive change management, workshops with stakeholders, and pilot projects. By mitigating interoperability and resistance risks using specific tactics, Saudi Aramco will be able to manage its mega-projects similarly.

7. RECOMMENDATIONS FOR IMPLEMENTATION

Saudi Aramco should establish a unified system of project management that incorporates the values of lean management, risk management, and digitalization to ensure its consistency. This organization requires preparing its standardized templates for planning, reporting, and risk assessment, but these templates should be geared towards mega-projects. There is a need to develop the capacity within the workforce through training programs and utilize the capacity within the workforce in one capacity. The adherence to standardized practices can be noticed as a result of regular audits. One of the factors of adoption and cultural change is the commitment of leadership. With the help of stakeholder management, unified practices can always be established. Saudi Aramco ought to develop open lines of communication with clearly defined objectives. Working with regulators enables compliance and can help with standardization. Standardized frameworks have to be tried on the pilot projects before implementing them on a large scale. The strategy can be enhanced with the help of the experience of practical projects and addressing problems. Such a plan is not rigid since it will be implemented in phases involving progressive adoption and lowered opposition. The prioritization of standardization will allow Saudi Aramco to become efficient and achieve the same results in the same project.

8. CONCLUSION

Standardization of practice in project management is essential with the mega-projects in the country, especially with regard to time wastage, mis-utilization of resources, and the ultimate fulfillment of the projects within the targeted timelines in the engineering and construction industry. The integration of the ideas of lean construction, efficient risk management practices, and digital technologies, including BIM and IoT, will enable Saudi Aramco to achieve consistent execution outcomes across its extensive spectrum, and that is what can be found in the success of various projects. All this, together with proper training and commitment exhibited by leaders, should be used in order to overcome such challenges as cultural resistance, high costs of implementation, and poor coordination among stakeholders. Uniform procedures not only represent a highly efficient approach in that they rationalize the processes but also act as a way of establishing co-working and integrating all the aspects of the endeavor with the organizational objectives. The incorporation of technologies and stakeholder engagement policies confirms the transformative quality of standardization. By adopting the identified strategies, Saudi Aramco will be capable of becoming one of the best examples in terms of handling mega-projects, and this will contribute to the sustainability of the construction industry in Saudi Arabia.

REFERENCES

[1] Allouzi, M. A., & Al Jaafreh, M. B. (2023). Enhancing project efficiency: A comprehensive analysis of lean construction management implementation in Saudi megaprojects. *Elm və İnnovativ Texnologiyalar Jurnalı Nömrə*, *27*, 39-77. https://www.researchgate.net/publication/390110086

[2] Alotaibi, S., Martinez-Vazquez, P., & Baniotopoulos, C. (2025). Factors Causing Waste in Construction of Mega-Projects: Case Studies from Saudi Arabia. *Sustainability*, *17*(9), 4011. https://doi.org/10.3390/su17094011

[3] Jawad, S., & Ledwith, A. (2021). Analyzing enablers and barriers to successfully project control system implementation in petroleum and chemical projects. *International Journal of Energy Sector Management*, *15*(4), 789-819. https://doi.org/10.1108/IJESM-08-2019-0004

[4] Raed, L., Mahdi, I., Ibrahim, H. M. H., Tolba, E. R., & Ebid, A. M. (2025). Innovative BWM–TOPSIS-based approach to determine the optimum delivery method for offshore projects. *Scientific Reports*, *15*(1), 13340. https://www.nature.com/articles/s41598-025-95710-7

[5] Durrani, O., & Zeeshan, Q. (2023). An Assessment of Risks in Oil and Gas Construction Projects in Pakistan: A Quantitative Approach Using Failure Modes and Effects Analysis. *J. Eng. Manag. Syst. Eng*, *2*(3), 180-195. https://library.acadlore.com/JEMSE/2023/2/3/JEMSE_02.03_05.pdf

[6] Alasmari, E., Martinez-Vazquez, P., & Baniotopoulos, C. (2023). An analysis of the qualitative impacts of building information modelling (BIM) on life cycle cost (LCC): a qualitative case study of the KSA. *Buildings*, *13*(8), 2071. https://doi.org/10.3390/buildings13082071

[7] Jaafreh, A. B., & Al Jaafreh, E. M. B. (2021). Adaption of construction management modelling system through the use of internet of things (IOT). *European Scientific Journal ESJ*, *17*(29), 263-263. https://doi.org/10.19044/esj.2021.v17n29p263

[8] Alotaibi, S., Martinez-Vazquez, P., & Baniotopoulos, C. (2024). Mega-projects in construction: barriers in the implementation of circular economy concepts in the kingdom of Saudi Arabia. *Buildings*, *14*(5), 1298. https://doi.org/10.3390/buildings14051298

[9] Abdelalim, A. M., Shawky, K., Salem, M., Alnaser, A. A., & Sherif, A. (2025). Digital transformation of BIM execution plans for effective BIM implementation in mega construction projects. *Annals of Civil Engineering and Management*, *2*(1), 1-15. https://www.researchgate.net/profile/Ahmed-Abdelalim-2/publication/389070693_Digital_Transformation_of_BIM_Execution_Plans_for_Effective_BIM_Implementation_in_Mega_Construction_Projects_Research_Article_Corresponding_Author_Citation/links/67b4239c207c0c20fa8c7d40/Digital-Transformation-of-BIM-Execution-Plans-for-Effective-BIM-Implementation-in-Mega-Construction-Projects-Research-Article-Corresponding-Author-Citation.pdf