MANAGING DESIGN-PHASE SCOPE CREEP USING PROJECT MANAGEMENT STRATEGIES TO SOLVE ARCHITECTURE AND CIVIL ENGINEERING PROBLEMS

Bode Thomas Adeyemi

Department of Business Administration, Hutton School of Business, The University of the Cumberlands, Williamsburg, Kentucky, United States of America

Zeyad B. Ragab Amhana

Department of Leadership Studies, Hutton School of Business, University of the Cumberlands, Williamsburg, Kentucky, United States of America

A R T I C L E I N F O.	**Abstract**
	This study investigated the management of design-phase scope creep in architecture and civil engineering projects through the application of project management strategies to solve their project encountered problems. Various concepts pertaining to design-phase scope creep, project management strategies, and architecture and engineering problems were analyzed. The research has underscored the critical importance of effectively managing design-phase scope creep for ensuring project success. It has delineated the risks associated with scope creep and emphasized the pivotal role of robust project management strategies in mitigating these risks and maintaining alignment with project scope. Specifically, the study advocates for establishing a clear definition of project scope, identifying objectives, deliverables, and requirements, and implementing rigorous project management practices such as scope validation, change control, and stakeholder communication. By adhering to these strategies, project teams can proactively address scope creep, thereby enhancing project success and delivering value to stakeholders. The study concludes that managing design-phase scope creep is essential, as effective management of it averts unforeseen disruption of the project timelines, budgets, and objectives. Also, effective project management is crucial for mitigating these risks and ensuring alignment with project scope. Among the recommendations provided is the necessity for project managers to ensure clear documentation of project scope and objectives from the project's outset to mitigate design-phase scope creep effectively in architecture and civil engineering projects.

Introduction

In architecture and civil engineering projects, managing design-phase scope creep is paramount for ensuring project success. Scope creep, the gradual expansion of project objectives beyond their initial boundaries, can significantly impact timelines, budgets, and ultimately, the project's ability to deliver on its intended outcomes. Employing effective project management strategies becomes imperative in mitigating the risks associated with scope creep and maintaining project alignment with its defined scope. At the outset of any architectural or civil engineering endeavor, establishing a clear definition of project scope is fundamental (Heldman & Heldman, 2019). This involves articulating the project's objectives, deliverables, and requirements with precision and clarity. By delineating the boundaries of the project at its inception, stakeholders can align their expectations and efforts towards achieving the agreed-upon goals.

Project scope encompasses the entirety of what the project aims to accomplish, including the specific tasks, functionalities, and outcomes to be delivered. It serves as a guiding framework that outlines the project's boundaries, constraints, and objectives. Without a well-defined scope, projects risk succumbing to scope creep, as changes and additions to project requirements emerge over time, leading to scope ambiguity and project drift. A project objective may include designing an innovative structure or developing crucial infrastructure. Project objectives serve as guiding beacons, defining the purpose and intended outcomes of the project. Articulating project objectives provides clarity and direction, aligning stakeholders towards shared goals.

Alongside project objectives, identifying deliverables is essential. Deliverables encompass the tangible outputs or products that the project is expected to produce. In architecture and civil engineering projects, deliverables may include architectural designs, engineering drawings, feasibility studies, or construction plans. By defining deliverables at the beginning of the project, teams set measurable milestones and benchmarks, facilitating progress tracking and stakeholder communication.

Furthermore, outlining project requirements is critical for project success. These requirements encompass the specific criteria, functionalities, and standards that must be met for the project to fulfill its objectives. Project requirements may encompass technical specifications, regulatory compliance, environmental considerations, and stakeholder preferences. By clarifying requirements upfront, project teams ensure alignment with stakeholder expectations and regulatory frameworks, minimizing the risk of scope creep and project deviations (Project Management Institute, 2017).

In addressing design-phase scope creep, project management strategies play a pivotal role. Robust scope validation processes, rigorous change control mechanisms, and proactive stakeholder communication are essential in maintaining alignment with project scope. By adhering to these strategies, project teams can identify and address scope changes promptly, mitigating the impact on project timelines and budgets. Managing design-phase scope creep in architecture and civil engineering projects requires a comprehensive understanding of project objectives, deliverables, and requirements. By defining these elements at the beginning of the project and employing effective project management strategies, teams can proactively address scope creep, ensuring project success and delivering value to stakeholders.

Concept of Design Phase Scope Creep

The term "design phase scope creep" describes the progressive enlargement or modification of project specifications, goals, or deliverables while the project is still in the design phase. According to the Project Management Institute (2017), design phase scope creep occurs when changes are made to the initial scope without proper evaluation of their impact on the project's timeline, budget, or resources. The project's success can be greatly impacted by scope creep during the design phase, which can result in delays, cost overruns, and lower stakeholder satisfaction. As noted by Kerzner (2017), one common cause of design phase scope creep is inadequate planning and requirement gathering at the outset of the

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project. Stakeholders may submit modifications or new ideas during the design phase of a project if the requirements are not well-defined or documented, which could result in scope expansion. Additionally, as new requirements arise over time, scope creep may be exacerbated by changing market conditions or stakeholder needs.

Moreover, Wysocki (2011) mentioned that a lack of effective communication and stakeholder management can exacerbate design phase scope creep. Project team members, stakeholders, and clients may not communicate well enough, which could lead to miscommunication or conflicting expectations that alter the project's scope. Furthermore, scope creep during the design phase may remain uncontrolled due to inadequate change control procedures or a failure to enforce scope limitations. Tech developments or new design fads that appear after the project has started can also contribute to scope creep in the design stage. Schwalbe (2015) mentioned that as new technologies become available or design preferences evolve, stakeholders may seek to incorporate these changes into the project, resulting in scope expansion. Furthermore, it may be difficult to keep track of modifications and uphold scope integrity during the design phase if project documentation is out-of-date or incomplete.

Project managers must stress the significance of comprehensive requirement collection and scope definition at the project's inception in order to reduce scope creep during the design phase. Clearly defining the goals, deliverables, and bounds of a project can assist avoid scope creep by giving the evaluation of suggested modifications a benchmark. Furthermore, scope creep may be recognised and addressed early in the design phase by putting in place strong change control procedures and routinely discussing project scope with stakeholders. Due of its detrimental effects on schedules, finances, and stakeholder satisfaction, scope creep during the design process presents serious obstacles to project success. Through the resolution of underlying issues including insufficient planning, communication, and change control, project managers can lessen the effects of scope creep in the design stage and raise the probability of project success.

Concept of Project Management

The planning and arranging of an organization's resources to advance a particular assignment, occasion, or responsibility towards fulfilment is known as project management. A one-time project rather than a continuous endeavour is usually the focus of project management, and the resources controlled include both human and financial capital. According to Schwalbe (2015), project management is "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. It is notable that project management is the process of leading the work of a team to achieve all project goals within the given constraints. Majeed, Mahmood, Som and Munir (2022) simply defined project management as the planning, organizing, staffing, coordinating and handling resources.

Engineering projects, which usually consist of a complicated collection of parts that must be finished and combined in a specific way in order to produce a working product, are sometimes closely related to project management, (Huda, 2016). According to Radujkovic and Sjekavica (2017) project management is the planning, organization, monitoring and control of all aspects of project, with motivation of all included to achieve project goals on safe manner, within agreed schedule, budget and performance criteria. Final deliverables in project management are subject to time and money constraints. As stated by Thomas and Amhana (2024) one of the essential dimensions in management of project is the strategic utilization of time and resources, essential for achieving project objectives within allocated budgets and timeframes. This is due to the fact these components of project management are very essential for the project success.

Furthermore, Project Management Institute in Malaysia (PMI) as cited in Alias, Baharum and Idris (2012) defined project management as the art of directing and coordinating human and material resources throughout the life of a project by using management techniques to achieve predetermined

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objectives of scope, cost, time, and quality and participation satisfaction. Marnewick and Marnewick (2022) mentioned that project management are the knowledge, skills, tools and techniques need to be applied by the project manager to achieve specific project objectives. Project management encompasses both one-time and continuous activities, with resources such as people, money, technology, and intellectual property being managed. Manjo (2021) opined that project management is the art of planning, organising, directing and controlling resources for a relatively short-term objective that has been earlier established to complete specific goals.

Concept of Project Management Strategies

The term "project management strategies" describes the methodical techniques and procedures used to efficiently plan, carry out, oversee, and manage a project's lifecycle. These methods involve the application of diverse tools, techniques, and procedures to guarantee the effective completion of activities, proper resource allocation, risk mitigation, and timely achievement of objectives. Thomas and Amhana (2024) mentioned that project management strategies are the application of time management, cost minimization, scrutinising methodologies, effective use of resources, risk mitigation, and stakeholder communication to execute a project. The major objective of effective project management techniques is to enable the successful completion of projects by upholding consistency with expectations from stakeholders, controlling dependencies, and encouraging teamwork. Ebirim et al. (2024) posited that project management strategies are crucial for ensuring the successful execution of … projects.

Furthermore, A variety of techniques are included in project management strategies with the goal of effectively organising, carrying out, and finishing projects within limitations like time, money, and resources. Hassan, Ojeniyi and Razalli (2015) mentioned that project management strategies are strategies used in achieving project objectives. A project's success may be successfully attributed to the strategies' successful implementation. The Agile approach is a frequently utilised strategy that prioritises cooperation, iterative development, and adaptability in the face of change.

Concept of Architecture Problems

Architectural problems are the difficulties, limitations, and reoccurring concerns that architects face when designing and carrying out different projects. These issues can take many different forms, such as financial limitations, budgetary restrictions, legal obligations, environmental concerns, and customer preferences, among others. These intricate barriers cut across the domains of socioeconomics, technology, culture, and the environment. Najari, Barth and Sonntag (2015) mentioned that any architectural project contains several problems. Even if every project is different, they all share a characteristic that is defined by reoccurring problems that seem inevitable, regardless of the particulars of the project or its size.

Some issues are common to many architectural endeavours, even though architects work on a wide variety of projects and in a variety of circumstances. Architects may improve their capacity to produce creative, practical, and aesthetically beautiful designs that satisfy stakeholders and clients by identifying and resolving these reoccurring problems. The discipline of architecture is well known for its capacity to combine creativity and utility, profoundly influencing the built world. But beneath the spectacular structures and expansive plans are a plethora of difficulties that architects have to overcome. These difficulties, which are frequently called "architecture problems," cover a wide range of problems that come up during the planning and building phases.

The understanding that every project offers a distinct set of circumstances, presenting both potential and challenges, is at the core of architectural difficulties. As stated by architectural historian Kostof (1995) cited in Harvey (2020), "Every project an architect undertakes is unique; each one is an original creation, a response to particular needs, constraints, and aspirations". Architects must approach every project with a fresh perspective due to the inherent uniqueness of each one, which highlights the

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complexity of architectural practice and the challenges that come with it. Some examples of these challenges are budget constraints, regulatory requirements, environmental concerns, and client expectations. As noted by architectural theorist Alexander (1979) cited in Carmona (2021), "The problems of architecture do not change; they are always present, always demanding to be solved". This insight emphasises how persistent architecture challenges are and how never-ending the search for solutions is.

The conflict between practical limits and design objectives is one of the main issues facing architecture. It is the goal of architects to produce creative, imaginative designs that capture their imagination and vision. But they also have to deal with real-world issues like building codes, location limitations, and financial restrictions. The architect must carefully negotiate and use innovative problem-solving to balance these conflicting demands. The issue of environmental responsibility and sustainability in architecture is another common one. In a time when worries about resource depletion and climate change are growing, architects are under pressure to create structures that minimise their negative effects on the environment and encourage sustainability. In order to lower energy consumption and carbon emissions, this calls for the integration of energy-efficient technologies, the use of renewable materials, and the adoption of passive design techniques.

Moreover, social and cultural factors are frequently taken into account in addition to the technical components of design and construction while solving challenges in architecture. In order to create spaces that are practical, inclusive, and culturally sensitive, architects must balance the interests of many stakeholders, attend to community needs, and protect cultural heritage. Architects use a variety of instruments, approaches, and procedures to solve challenges in their field and come up with creative solutions. This could entail interdisciplinary cooperation, collaborative design methods, and the incorporation of cutting-edge technology like parametric design and building information modelling (BIM).

Concept of Civil Engineering Problems

Problems in civil engineering include a wide range of difficulties that practitioners in the field deal with on a daily basis. Tougwa (2020) mentioned that one of the major problems faced in civil engineering is that of sustainability in construction. The field of civil engineering is essential in forming the physical framework that supports contemporary society. The job of civil engineers is to plan, create, and manage the built environment to suit community demands, from buildings and water systems to highways and bridges.

Nonetheless, there are difficulties in the subject of civil engineering. These difficulties, which are frequently referred to as civil engineering problems, cover a broad range of problems that engineers run into when working on infrastructure projects. The understanding that the built environment is susceptible to a variety of forces and restrictions, both natural and man-made, is at the heart of the idea of civil engineering challenges. As noted by civil engineer Maillart, (1950) cited in Rinke (2023) "The engineer's problem is to achieve the maximum of stability and the minimum of material". The twin goals of civil engineering—ensuring structural integrity and maximising resource utilization—are summed up in this statement.

Ensuring the safety and resilience of infrastructure in the face of environmental conditions and natural disasters is a ubiquitous topic in civil engineering. In constructing infrastructure that can survive possible threats, engineers have to take flooding, hurricanes, seismic activity, and other risks into account. To improve the resilience of built structures, this calls for the use of cutting-edge modelling tools, risk assessment procedures, and creative structural design solutions. The sustainable management of resources and the environment is a major issue in civil engineering. In light of mounting worries about resource depletion, climate change, and environmental degradation, civil engineers are facing mounting pressure to create infrastructure with the least amount of ecological imprint possible. To

lessen the influence on the environment and save natural resources, this entails incorporating green technologies, maximising energy efficiency, and promoting sustainable construction methods.

Furthermore, social, economic, and political variables are frequently taken into account in civil engineering difficulties in addition to technical ones. Engineers have to manage conflicting priorities and goals while navigating stakeholder interests, legal obligations, and financial limits. To guarantee the effective completion of infrastructure projects, this calls for interdisciplinary teamwork, good communication, and stakeholder participation. Engineers use a variety of instruments, approaches, and best practices to solve challenges in civil engineering and come up with creative solutions.

Process of setting boundaries and communicating them to stakeholders

There are numerous processes involved in project management when establishing limits and informing stakeholders about them. These processes include:

Defining the Project's Scope: Defining the project scope, including goals, deliverables, and restrictions, is the first stage in establishing limits. This involves identifying the project's purpose, desired outcomes, and any limitations that may impact its execution (Kerzner, 2017).

Identifying Key Stakeholders: Determine who will be impacted by the project and who the sponsors, team members, clients, and outside partners are. Understanding stakeholder needs and expectations is crucial for defining project boundaries effectively (Pinto & Slevin, 1988).

Developing Project Documentation: To clearly define project boundaries and expectations, provide thorough project documentation, such as work breakdown structures, scope statements, and project charters. Throughout the course of the project, stakeholders can refer to these materials.

Communicating Boundaries: Communicate project boundaries to stakeholders in an efficient manner by using a variety of communication methods and channels. This could involve regular progress reports, stakeholder workshops, and project kickoff meetings. Ensure that communication is clear, concise, and tailored to the needs of different stakeholder groups (Schwalbe, 2015).

Facilitating Stakeholder Engagement: Promote transparent communication and feedback channels to resolve any queries or worries stakeholders may have about project boundaries. Encourage commitment and alignment by actively including stakeholders in conversations regarding expectations, limitations, and scope.

Monitoring and Enforcing Boundaries: Keep an eye on the project's development and evaluate any modifications or departures from the initial plan. To avoid scope creep and keep the project focused, be sure to enforce project boundaries strictly. Address any scope changes or requests for additional work through formal change management processes (Kerzner, 2017).

Providing Regular Updates: Throughout the course of the project, keep in constant contact with the stakeholders, giving them updates on the state of the work, its milestones, and any modifications to its bounds. Remain informed and involved with stakeholders to guarantee comprehension and reduce miscommunication.

Implementation of a change control process to handle any proposed changes to a project's scope

Effective management of proposed modifications to a project's scope in project management depends on the adoption of a change control process. Project settings will always change as a result of changing needs, stakeholder choices, or unanticipated events. Therefore, in order to assess, authorise, and implement changes with the least amount of disturbance and preservation of project goals, a structured change control procedure is required, which include:

Establishing Change Control Procedures: To initiate a change control process, it is necessary to set up precise protocols for submitting, examining, and approving modifications to the project scope. These

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procedures should outline the roles and responsibilities of project stakeholders, define the documentation required for change requests, and specify the process for evaluating the impact of proposed changes (PMBOK Guide, 2017).

Documenting Change Requests: It is recommended that project stakeholders utilise standardised forms or templates to document change requests, which should include comprehensive details on the proposed modification, its justification, and any possible effects it may have on the project's resources, schedule, budget, and scope. Clear documentation ensures transparency and facilitates informed decision-making during the change control process (Kerzner, 2017).

Change Evaluation and Impact Analysis: Changes that are suggested should be methodically assessed by project managers and pertinent stakeholders to determine how they might affect the goals and limitations of the project. To ascertain the effects of the modification on scope, schedule, cost, quality, and other project characteristics, impact analysis must be carried out. Stakeholders should consider factors such as feasibility, risk, and alignment with project goals when evaluating change requests (Schwalbe, 2015).

Change Approval and Authorization: Change control boards or other designated authorities should examine and approve change proposals after the impact analysis is finished, according to predetermined standards. Any approved modifications should have official authorization prior to implementation, and approval decisions ought to be recorded. Effective change authorization ensures that only validated changes are incorporated into the project scope, minimizing the risk of scope creep and project delays (PMBOK Guide, 2017).

Communicating Changes: After the impact study is completed, change proposals should be reviewed and approved by change control boards or other designated authorities in accordance with established guidelines. Before being put into effect, any accepted changes must have formal authorization, and the decisions made regarding approval must be documented. Additionally, project managers should update project documentation, such as the project management plan and work breakdown structure, to reflect approved changes accurately (Kerzner, 2017).

Monitoring and Controlling Changes: Project managers need to keep an eye on and oversee modifications throughout the project lifetime to make sure they are carried out as authorised and don't negatively impact the project's performance. This entails monitoring the implementation of changes, evaluating how they affect project parameters, and responding appropriately when deviations from the plan occur. By actively managing changes, project managers can mitigate risks, maintain project alignment, and optimize project outcomes (Schwalbe, 2015). Project outcome optimization is very vital for attainment of project success. This is why Thomas and Amhana (2024) opined that it is crucial for project managers and all personnel concerned with project execution to continuously evaluate and optimize resource utilization to prevent bottlenecks and unnecessary expenses.

Regular monitoring of a project's progress

A crucial component of project management is ongoing progress monitoring, which guarantees that the project stays on course, achieves its goals, and benefits stakeholders. To monitor a project's progress, the following are involved:

Defining the work scope: The team members need to specify the scope of work before they can start monitoring. A formal agreement outlining all of the team members' goals for the project's realisation is called the scope of work. It is a summary of the targeted deliverables, due dates, and particular tasks. Clarifying a project plan and ensuring that they and their clients agree on the quantity and type of planned project activities are the primary goals of the scope of work. However, a well-developed work scope can also serve as a project progress monitoring tool.

Set Regular Monitoring Intervals: It can be difficult to strike a decent balance between excessive and insufficient monitoring, particularly for inexperienced project managers. A monitoring plan specifies when and how the status of the project will be evaluated. It includes details such as monitoring frequency, responsible parties, data collection methods, and reporting mechanisms.

Decide on your project progress tracking method: Project managers must frequently assess how their actual progress compares to the project schedule. The team member can use qualitative and quantitative techniques to track development. When using quantitative project tracking techniques, quantifiable metrics like cost, time, and milestones are examined.

Identify Deviations and Risks: Project managers can spot plan variations and any hazards early on thanks to monitoring. Delays, overspending, a lack of resources, problems with quality, or adjustments to stakeholder expectations are a few examples. Proactive problem-solving is made possible by the timely notice of deviations, which also stops minor problems from becoming larger ones.

Take Corrective Actions: Project managers are required to respond quickly to address deviations or hazards. This could entail shifting the project's scope, reallocating resources, modifying the budget, modifying schedules, and putting risk mitigation techniques into practice.

Communicate Progress: Communicating project progress to stakeholders, such as team members, clients, sponsors, and other pertinent parties, is another aspect of routine monitoring. Open communication fosters trust, informs stakeholders, and enables prompt decision-making and feedback.

Document Lessons Learned: Project teams should record best practices and lessons gained during the monitoring process. Future projects may benefit greatly from this information, which can facilitate knowledge sharing and ongoing organisational progress.

Effective communication with stakeholders about project progress

Effective stakeholder communication is critical to project management because it manages expectations, promotes transparency, and keeps stakeholders informed about the status of the project. The following are how to effectively communicate with stakeholders about a project's progress:

Establish a Clear Communication Channels: The establishment of unambiguous and easily available channels for information transmission is the cornerstone of successful stakeholder communication. The preferred communication methods of stakeholders should be determined by project managers, who should also make sure that information is communicated consistently and promptly. This might entail regular project status meetings, email updates, progress reports, and utilization of collaborative platforms for real-time updates and discussions (Project Management Institute, 2017).

Tailor Communication to Stakeholder Needs: Project managers need to adapt their communication strategy to the different interests and information needs of stakeholders. Project updates may need to differ in terms of frequency and depth of detail depending on the various stakeholder groups. For instance, executive stakeholders might prefer concise, high-level summaries, whereas technical stakeholders may require in-depth technical reports (Kerzner, 2017).

Provide Regular Updates: Maintaining timely and consistent communication is essential to updating stakeholders on the status of the project. Project managers ought to provide frequent reports regarding completed work, milestones reached, and any obstacles or deviances encountered. This routine communication not only keeps stakeholders engaged but also affords them opportunities to offer feedback and address concerns promptly, thereby mitigating potential risks (Schwalbe, 2015).

Highlight Achievements and Milestones: Honouring project successes and benchmarks acts as a spark to keep stakeholders engaged and motivated. Project managers should acknowledge team members' contributions and stakeholders' support while communicating progress in an affirmative and grateful manner. This positive reinforcement fosters a sense of accomplishment and momentum, invigorating

stakeholder commitment to the project's success (Kerzner, 2017).

Address the Challenges and Risks: Managing stakeholder expectations and fostering trust need open discussion about risks and problems. In order to give stakeholders a realistic view of the project's state, project managers should be open and honest about any risks or barriers that could hamper the project's progress. Moreover, actively engaging stakeholders in discussions about potential solutions or mitigation strategies demonstrates accountability and reinforces stakeholder confidence in the project's management (Project Management Institute, 2017).

Seek Stakeholder Feedback: Feedback from stakeholders is a joint effort that is necessary for effective communication. Project managers ought to provide channels for interested parties to provide feedback, ask questions, and express concerns about the status of the project. Encouraging stakeholder feedback not only demonstrates respect for their perspectives but also enables project managers to address issues proactively, thereby fostering a culture of openness and collaboration (Schwalbe, 2015).

Conclusion

Managing design-phase scope creep in architecture and civil engineering projects is crucial, as it disrupts timelines, budgets, and objectives. Effective project management is essential to mitigate these risks and maintain alignment with project scope. Establishing a clear definition of project scope involves precise articulation of objectives, deliverables, and requirements, ensuring stakeholders focus on agreed-upon goals. Project scope serves as a guiding framework, preventing ambiguity. Robust project management strategies, including scope validation and stakeholder communication, are vital for addressing scope creep promptly. Adhering to these strategies minimizes the impact of scope changes on timelines and budgets. Understanding project objectives, deliverables, and requirements is key to managing design-phase scope creep effectively, ensuring project success and stakeholder satisfaction.

Recommendations

1. Project managers should ensure clear documentation of project scope and objectives from the outset to mitigate design-phase scope creep in architecture and civil engineering projects.

2. Architects and civil engineers should regularly communicate with stakeholders to understand evolving requirements and address potential scope changes promptly during the design phase.

3. Implement robust change control mechanisms, led by project managers, to evaluate and approve proposed scope changes, ensuring alignment with project objectives and minimizing disruptions in architecture and civil engineering projects.

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