ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

Mitigating Scope Creep in Construction Projects Through Systems-Based Mitigation Framework, Resource Optimization, Cost Analysis, and Activity Crashing: A Case Study of South 2 Residences from a Production and Operations Management Perspective

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Publication Date: 2025/12/22

Abstract: This study examines scope creep—defined as the uncontrolled expansion of project scope without corresponding adjustments to baselines—through a qualitative case analysis of the South2 Residences project in Las Piñas City, Philippines. The research aims to understand the systemic nature of scope creep and propose a mitigation framework grounded in Production and Operations Management (P/OM) principles. Data were triangulated from semi-structured interviews with project managers, planners, quantity surveyors, site engineers, and contractor representatives, complemented by document analysis (change orders, RFIs/RFAs, schedules, procurement logs) and site observations.

Findings reveal that scope creep resulted from multiple interacting drivers: contractor transitions, evolving client requirements, gaps in the Terms of Reference (TOR), planning and communication weaknesses, and stakeholder misalignment. Contractor transitions were the most significant contributor, acting as capacity shocks and quality risks, and accounted for 62% of the additional project budget; client-driven changes contributed 23%, while TOR and planning gaps added 15%, with substantial indirect schedule impacts. Approval bottlenecks and procurement delays further compressed work windows, with RFIs aging beyond 30 days and procurement backlogs extending up to two months, triggering costly accelerations. Interview insights reinforced these findings, highlighting incomplete turnover documentation, scope ambiguity, and mobilization disruptions. Practitioners emphasized strict documentation, baseline and BOQ enforcement, rolling look-ahead forecasting, and selective activity crashing only after transparent time–cost trade-off analysis.

From a P/OM perspective, these findings translate into a systems-based mitigation framework comprising: (1) forecasting and aggregate planning for buffer discipline; (2) capacity and learning-curve management during transitions; (3) flow control and bottleneck management of approvals and procurement; (4) quality assurance to prevent rectification-driven scope increase; (5) governance and communication systems; and (6) real-time performance dashboards integrating EVM, cycle times, and buffer consumption. While limited to a single case, this study offers practical guidance for projects facing complexity, variability, and contractor performance risks, and suggests future research on quantitative validation and digital decision-support tools for real-time forecasting and scheduling.

Keywords: *Scope Creep, Systems-Based Mitigation Framework, Resource Optimization, Activity Crashing, Cost Analysis, Contractor Transitions, Aggregate Planning, Forecasting, Production and Operations Management (POM), Risk Mitigation, Change Control, Time-Cost Trade-Off Analysis, South2 Residences Case Study*

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

How to Cite: Darwin L. Uy; Joeme Carl Demegillo (2025) Mitigating Scope Creep in Construction Projects Through Systems-Based Mitigation Framework, Resource Optimization, Cost Analysis, and Activity Crashing: A Case Study of South 2 Residences from a Production and Operations Management Perspective. *International Journal of Innovative Science and Research Technology*, 10(12), 1273-1279. https://doi.org/10.38124/ijisrt/25dec914

I. INTRODUCTION

Remaining to be one of the most persistent and disruptive challenges in construction project management, scope creep often results in delays, budget overruns, and compromised quality. In large-scale developments where multiple stakeholders are involved, reactive measures that are usually unsatisfactory in order to address the persistent changing design requirements, and contractor transitions due to takeover of works. As an alternative, a proactive, systems-based strategy is needed—one that includes planning, forecasting, cost control, and resource optimization.

This study scrutinizes the South2 Residences Project, a three-tower residential development in Las Piñas City, Metro Manila, Philippines, as a case study to show the actual effect of scope creep in cost and schedule. Nestled in 2.08-hectare lot which is adjacent to SM South Mall in bustling Las Piñas City, the said project is consisted of three 15-floors residential towers that housed 1,938 units in total. Presently on construction phase, the project met several midstream design revisions, including changes to amenity deliverables, and auxiliary systems. Aggravating these challenges was the takeover of contractors and construction management consultant during critical phases of the project. These transitions introduced risks such as loss of continuity, reorientation of new teams, procurement of takeover contracts, and delays in mobilization—all of which increased the pressure on schedule and budget of the project.

This paper also proposes a comprehensive framework grounded in Production and Operations Management (POM) principles in order to address these challenges. By integrating systems-based mitigation framework, resource optimization, cost analysis, and activity crashing, construction managers can proactively anticipate scope changes, evaluate their implications, and implement corrective actions—even amid contractor transitions during critical phases of the project. The POM approach adopts cross-functional coordination, data-driven decision-making, and continuous improvement, which are essential in dynamic construction environments.

➢ *Objectives of the Study:*

- To explore how forecasting and aggregate planning can be used to anticipate and manage scope changes.
- To analyze the role of cost analysis and activity crashing in mitigating schedule and budget impacts.
- To examine the operational challenges of contractor transitions and their effect on scope management.
- To apply the proposed framework to real-world scenarios, drawing lessons from the South2 Residences Project.

Furthermore, this research also aims to contribute to construction project management by offering a structured, proactive method to mitigate scope creep using POM-based strategies, especially in projects with contractor turnover.

➢ *Finally, the Limitations of this Study Include:*

- Reliance on data from SMDC projects may limit the generalizability of findings to other construction contexts
- Case studies may introduce bias, and the findings may not be representative of all SMDC projects.

II. LITERATURE REVIEW

Defined as the uncontrolled expansion of project scope without corresponding adjustments to time, cost, or resources, Scope creep persists as a critical challenge in construction project management. It frequently results in delays, budget overruns, and compromised quality (Alotibe, 2024). Recent studies show that scope creep is driven by evolving client requirements, inadequate planning, poor communication, and stakeholder misalignment (Ajmal et al., 2022; Xegwana et al., 2025). In urban developments like the South2 Residences project, these issues are further entangled by regulatory changes and market-driven design revisions.

Ajmal et al. (2022) acknowledged five major contributors to scope creep in UAE construction projects: task/specification changes, complexity/uncertainty, stakeholder influence, inadequate planning, and environmental factors. Xegwana et al. (2025) further reiterated that lack of community involvement and cultural misalignment are significant contributors in South African contexts, advocating for inclusive stakeholder engagement frameworks.

To deal with scope creep proactively, scholars advocate for systems-based mitigation through scheduling and resource optimization. Traditional scheduling methods like the Critical Path Method (CPM) often fail in ever-changing construction environments. Zhou and Li (2024) proposed a Line-of-Balance (LOB) scheduling model using branch-and-bound algorithms to optimize resource allocation in repetitive construction projects, demonstrating improved efficiency and reduced idle time. Machine learning and reinforcement learning models have also manifested promise in predictive scheduling and real-time decision-making (Johansson, 2024).

Contractor transitions during mid-project phase due to take over of works, present additional risks, including loss of continuity, reorientation delays, and renegotiation of scopes. In fact, Raffetto (2025) highlighted that subcontractor insolvency and legal disputes are rising, requiring proactive financial assessments and robust contract terms to mitigate risks.

Cost analysis and activity crashing are necessary tools for mitigating the impact of scope changes and contractor

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

transitions. Lutfi et al. (2025) who differentiated overtime and additional labor strategies in his study, found out that while overtime accelerates timelines, it incurs higher costs, whereas additional labor offers more cost-effective acceleration. Abdelalim et al. (2025) conducted a global analysis of cost overruns, identifying seven critical drivers including planning issues, estimation inaccuracies, and scope definition challenges.

Finally, Production and Operations Management (POM) principles offer a structured framework for integrating these strategies. POM emphasizes forecasting, aggregate planning, and continuous improvement—tools that enable construction managers to anticipate scope changes and respond efficiently. Recent literature highlights the application of POM in construction through lean systems, adaptive collaboration, and integrated logistics.

III. METHODOLOGY

This research adopts a qualitative case study approach to examine strategies for mitigating scope creep in construction projects, focusing on the South2 Residences project in Las Piñas City. The qualitative design is chosen because it allows us to capture the experiences, perceptions, and decision-making processes of those directly involved in project planning and execution. Rather than relying solely on numbers, this approach captures the human and organizational dimensions behind scope creep, offering insights into how strategies such as systems-based mitigation, resource optimization, cost analysis, and activity crashing are applied in real-world scenarios, particularly during contractor transitions.

The research process began with semi-structured interviews, which served as the primary source of data. These interviews were conducted with key stakeholders, including project managers, planners, quantity surveyors, site engineers, and contractor representatives. These conversations aim to explore how forecasting and aggregate planning are used to anticipate scope changes, how cost analysis and activity crashing influence schedule and budget control. The conversations also explored the operational challenges that arise during contractor transitions—a recurring issue in the South2 Residences project—and how these transitions affect scope management and timelines.

To complement the interviews, document analysis was carried out. Project schedules, change order logs, meeting minutes, procurement records, and cost reports were examined to validate and triangulate the information gathered during interviews. These documents provided concrete evidence of scope changes, cost impacts, and schedule adjustments, ensuring that the findings were grounded in actual project data. Additionally, site observations during critical phases offered valuable context on coordination practices and decision-making dynamics, particularly when teams were under pressure to recover lost time or adapt to evolving requirements.

The analysis of data followed a thematic approach, where patterns and recurring themes were identified across interviews, documents, and observations. These themes were closely aligned with the research objectives, focusing on areas such as anticipating scope changes, managing cost-time trade-offs, and addressing transition challenges. By synthesizing these insights, the study aims to develop a comprehensive understanding of both technical and human factors influencing scope creep mitigation.

- *To Guide the Interviews, a Set of Core Questions was Prepared. These Included Inquiries as Follows:*

- How do you anticipate and manage scope changes in your projects?
- What planning or forecasting methods do you use to prevent scope creep?
- How do cost analysis and activity crashing help you control schedule and budget?
- What challenges have you faced during contractor transitions?
- How did these transitions affect scope management and timelines?
- Based on your experience in South2 Residences, what strategies worked best to reduce scope creep?
- What lessons would you recommend for future projects?

Finally, the primary data was enriched by a review of existing literature on scope creep, causes of delays, systems-based scheduling, resource optimization, cost analysis, and activity crashing. This review helped establish the broader context of the highlighted issues and improvement needs in addressing the scope creeps and its accompanying impacts, and the challenges to use system-based mitigation, cost analysis and activity crashing. Together, these steps form a methodology designed not only to document what happened in South2 Residences but also to extract actionable insights that can inform a practical, systems-based framework for mitigating scope creep in similar projects.

IV. RESULTS

The qualitative analysis of semi-structured interviews, corroborated by project documents (e.g., change orders, requests for information / requests for approval, schedules, procurement logs) and site observations, shows that scope creep in the South2 Residences project was not the result of a single isolated issue but rather a web of interconnected technical and organizational factors.

Participants of the semi-structured interview, repeatedly described a chain of events where early ambiguity and misalignment propagated downstream into approvals, procurement, execution, and recovery strategies. These underlying forces revealed as added scope, extended timelines, and increased costs throughout delivery.

The most consequential driver was contractor transitions during mid-project phases. In South2 Residences, the Civil-Structural and Masonry (CSM) Work Package

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

contractor changed three times due to performance failures and financial instability. Each transition fractured established workflows, left non-compliant work unresolved, and forced rapid team re-orientation. These disruptions introduced inconsistencies in execution standards and created additional scope for rectification, resequencing, and premium mobilization of remaining works. As per revised development schedule of South 2 Residences project, to complete the CSM work which is originally pegged at 30 months, the impact on schedule required additional 9 months for the procurement of the balance work by takeover contractors, and another 26 months for the adjustment of duration due to resequencing, rectification of previous defects and productivity alignment. On the other hand, financial impact was severe: 62% of the additional project budget *(refer to Table 1)* was attributed to these transitions and related takeover activities. This increase stemmed from dependent contractors' claims for time extensions, labor and material escalations due to adjustment of work durations of dependent work activities, rectification of previous defects, and premiums required to complete balance works under compressed timelines. One participant noted: *"Transitions created instability in manpower allocation and disrupted planned sequences, especially when no formal transition plan was immediately available"*.

Table 1 Components of Additional Project Budget

Category of Additional Works that require Additional Budget	Weight on Total Additional Budget
1. Gaps in the Terms of Reference (TOR), incorrect assumptions, Poor planning and poor communications	15%
2. contractor transitions mid project due to takeover of works	62%
3. Evolving client requirements	23%

Interview responses strongly reinforced these findings. Participants repeatedly cited incomplete turnover documentation, scope ambiguity, and mobilization disruptions as dominant challenges during transitions. Several noted that gaps in historical data and unclear accountability slowed billing, inspections, and approvals, forcing revalidation of deliverables and resequencing of activities that hampers the achievement of target schedule completion.

Another major contributor was evolving client requirements, which accounted for 23% of the additional project budget *(refer to Table 1)*. Late-stage directives included revised amenity and signage deliverables, updated CCTV quantities, upgraded waterline specifications, and compliance works for unforeseen regulatory requirements. These changes introduced unpredictability into the production system, echoing participants' emphasis on scenario forecasting and proactive risk identification as critical preventive measures.

A third recurring theme was gaps in the Terms of Reference (TOR) and incorrect assumptions during early planning. Incomplete or ambiguous specifications, together with poor planning and poor communications, which accounted for 15% of the additional project budget *(refer to Table 1)*, created uncertainty around deliverables and triggered frequent RFIs and design clarifications, often resulting in formal change orders that altered quantities, standards, and methods mid-execution. Participants observed that clearer, validated TORs and early cross-disciplinary reviews could have reduced requirements drift, particularly in interface-heavy areas where trades and systems converge. One participant advised: *"Establish clear assumptions upfront, as ECM and contractors often have differing interpretations"*. These gaps, combined with inadequate planning and fragmented communication, raised the probability of rework and forced resequencing of activities. Stakeholders described instances where late alignment on deliverables led to stoppages and "start–stop" execution that eroded productivity and made later-stage recovery more expensive.

Stakeholder misalignment further compounded these difficulties. Conflicting priorities and unclear decision responsibilities produced approval bottlenecks that rippled through the schedule. RFIs and RFAs aged beyond 30 days *(refer to Table 2)*, while procurement for critical work packages experienced backlogs of up to two months *(refer to Table 3)*. These delays consumed available float and forced costly acceleration strategies. Interviewees confirmed these systemic issues, citing reactive coordination and lack of structured governance as persistent weaknesses.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

Table 2 Pending Design Issues

Pending Design Items	Quantity		
	0 - 14 days	15 - 30 days	> 30 days
1. Construction Bulletin			4
2. Bid plans			2
3. RFA / RFI	4	11	12

Table 3 Pending Procurement Items

Status	Quantity	Delays (days)		
		0 - 30 days	31 - 60 days	> 60 days
Recently Awarded but delayed	2	1		1
Recently Awarded within Target	2	Within Target		
Not Yet Awarded and already delayed	5	1	5	
Not Yet Awarded within Target	6	Within Target		

Against this backdrop, participants identified several mitigation levers that could have reduced the magnitude of scope creep. They emphasized proactive forecasting and aggregate planning, including rolling look-ahead schedules and monthly capacity reviews to anticipate variability and allocate buffers. Strict documentation and formal change control emerged as the most cited strategy, alongside baseline enforcement and BOQ alignment to prevent contractors from executing ahead of approvals. Respondents also highlighted cost analysis and selective activity crashing, stressing that acceleration should only proceed after transparent time–cost trade-off assessments. Notably, interviewees acknowledged that crashing delivered diminishing returns when underlying governance issues persisted, as acceleration increased direct costs without resolving approval or procurement bottlenecks. Additional recommendations included structured turnover protocols, rigorous bidding due diligence, and early risk identification for design gaps and resource constraints.

V. DISCUSSION

The South2 Residences case demonstrates that scope creep is not a single-point failure but a systemic phenomenon shaped by multiple interacting factors. These include gaps in the Terms of Reference (TOR), contractor transitions, evolving client requirements, inadequate planning, and stakeholder misalignment. When examined through the lens of Production and Operations Management (P/OM), these drivers correspond to fundamental operational challenges: demand variability, capacity disruptions, flow bottlenecks, and quality failures. Understanding scope creep as a systems problem reframes mitigation from reactive firefighting to proactive, structured control.

Among these drivers, contractor transitions emerged as the most consequential, accounting for 62% of the additional project budget. Each takeover represented a severe capacity shock, disrupting workflows and introducing quality risks. Teams had to re-orient rapidly, rectify non-compliant works, and resequence activities under compressed timelines. These disruptions cascaded into cost escalation and schedule slippage. P/OM literature underscores the importance of capacity planning and learning curves during such transitions. Structured ramp-up plans, forensic quality audits, and quantified defect registers could have reduced variability and prevented uncontrolled scope growth. This aligns with prior studies linking contractor capability deficiencies to rework and change order incidence (Alzahrani & Emsley, 2013; Love et al., 2016).

Interview findings reinforce this interpretation. Respondents consistently cited incomplete turnover documentation, scope ambiguity, and mobilization disruptions as dominant challenges. These gaps slowed the operational processes such as billing, inspections, and approvals, and pressed revalidation of deliverables and resequencing of activities, that obviously resulting to operational inefficiencies. Such observations are also reflected in the documented evidence of aging RFIs and procurement backlogs, which compressed work windows and pushed teams toward costly acceleration strategies.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

The second major contributor—evolving client requirements, responsible for 23% of additional costs—reflects demand variability, a core concept in P/OM. Late-stage changes such as amenity upgrades, signage revisions, and compliance with new regulations introduced unpredictability into the production system. Operations theory recommends forecasting and aggregate planning to absorb such variability or changes in deliverables and assumptions (Heizer, Render, & Munson, 2020). Forecasting trends in RFIs and change orders, combined with monthly productivity reviews, could have enabled proactive buffer allocation and resource flexibility. Formal change control boards with cost-time visibility would further curb changes to controlled windows, reducing disruption (PMI, 2021; Kerzner, 2017). Interviewees resonated this need, emphasizing scenario forecasting and early risk identification as critical preventive measures.

Although inadequate planning and poor communication, together with gaps in TOR and incorrect assumptions, accounted for only 15% of direct cost impact, their systemic effects were significant. Delays in decision-making and fragmented information flows created reactive coordination patterns, increasing exposure to escalation and forcing costly acceleration later. P/OM frameworks advocate short-interval planning and visual management to synchronize workflows and remove constraints before they affect production (Ballard, 2000; Womack & Jones, 1996). Participants reinforced this point, by recommending plan completeness, assumption validation, and structured turnover protocols as lessons for future projects.

Stakeholder misalignment further exacerbated these difficulties. The approval bottlenecks and procurement delays, which are reflected in differing priorities and indistinct decision responsibilities, mirror queueing problems described in operations theory, where high utilization and lack of prioritization lead to excessive cycle times (Hopp & Spearman, 2011). Applying Theory of Constraints and queueing principles—such as criticality-based prioritization, Service Level Agreement (SLA)-driven approval pipelines, and rolling-wave procurement—would have shortened lead times and stabilized flow (Goldratt, 1990). Interviewees confirmed these systemic issues, citing reactive coordination and lack of structured governance as persistent weaknesses.

Finally, activity crashing, widely used as a recovery measure, illustrates the limitations of reactive strategies. While crashing can compress schedules, its effectiveness diminishes when systemic constraints remain unresolved. P/OM and project control literature recommend time-cost trade-off analysis and Earned Value Management (EVM) to ensure that acceleration decisions are economically justified and aligned with overall performance goals (Fleming & Koppelman, 2016; PMI, 2021). In South2 Residences project, selective crashing supported by crash slope analysis and indirect cost evaluation could have prevented unnecessary cost escalation. Interviewees echoed this, noting that crashing activities delivered diminishing returns when approvals and procurement lagged.

The combined evidence from case data and interviews underscores that scope creep is a systems problem, not a series of isolated events. Effective mitigation requires embedding forecasting, aggregate planning, capacity management, and flow control within a POM-based framework, supported by real-time performance dashboards for EVM, cycle times, and buffer consumption.

➢ *Participants Converged on Five Practical Lessons:*

- Make documentation a habit, not an afterthought.
- Enforce disciplined change control with documented impacts.
- Ensure plan completeness and validate assumptions early.
- Implement structured turnover protocols and rigorous contractor evaluation.
- Maintain proactive risk identification and scenario planning throughout the project lifecycle.

By institutionalizing these practices, projects can reduce variability, improve predictability, and confine scope changes to controlled windows—even under conditions of contractor turnover and evolving client priorities.

VI. CONCLUSION

This study set out to explore how scope creep can be mitigated in complex construction projects by applying a systems-based approach grounded in Production and Operations Management (P/OM) principles. Using the South2 Residences project as a case study, the research examined four objectives: anticipating scope changes through forecasting and aggregate planning, analyzing the role of cost analysis and activity crashing, understanding the operational challenges of contractor transitions, and applying a structured mitigation framework to real-world conditions. To achieve these goals, a qualitative methodology was adopted, combining interviews with key stakeholders, document reviews, and site observations.

The findings reveal that scope creep in South2 Residences project was not an isolated event but a systemic issue driven by multiple interconnected factors. Among these, contractor transitions emerged as the most critical, accounting for 62% of the additional project budget. Each transition disrupted workflows, introduced inconsistencies, and required rectification of non-compliant works, creating cascading impacts on cost and schedule. Evolving client requirements contributed another 23%, while gaps in the Terms of Reference (TOR), inadequate planning, and poor communication added further complexity. These weaknesses were compounded by approval bottlenecks and procurement delays, with RFIs aging beyond 30 days and procurement backlogs stretching to more than 2 months.

Interviews strengthened these findings, highlighting operational challenges such as incomplete turnover documentation, unclear accountability, and mobilization disruptions during contractor transitions.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec914

Viewed through the P/OM perspectives, these drivers correspond to fundamental operational challenges: demand variability from client driven changes, capacity disruptions during contractor transitions, flow bottlenecks in approvals and procurement, and quality failures requiring rectification. Addressing these challenges requires a shift from reactive recovery to proactive systems thinking. Forecasting and aggregate planning emerged as essential tools for anticipating variability and allocating buffers. Structured capacity management and learning-curve planning proved critical during transitions, while cost analysis and selective crashing were effective only when paired with governance discipline and real-time performance monitoring through Earned Value Management (EVM). Queueing theory and flow control principles highlighted the need to de-bottleneck approval and procurement pipelines, and quality management frameworks emphasized early detection to prevent rectification-driven scope growth.

- *Based on these Insights, the Study Proposes a Systems-Based Mitigation Framework that Integrates Six Key Components:*

- Forecasting and aggregate planning to anticipate scope changes and allocate buffers;
- Capacity and learning-curve management during contractor transitions;
- Flow control and bottleneck management for approvals and procurement;
- Quality assurance tracking to prevent rectification-driven scope growth;
- Governance and communication systems for synchronized execution;
- Performance dashboards integrating EVM, cycle times, and buffer consumption for real-time control.

Embedding these strategies can reduce the likelihood and magnitude of scope creep, improve predictability, and enable projects to deliver greater value within planned cost and time parameters—even under conditions of contractor turnover and evolving client priorities. While this research focused on a single case, its findings offer practical guidance for similar projects facing complexity and variability. Future studies should validate this framework quantitatively across multiple projects and explore digital tools for real-time forecasting, scheduling, and decision support.

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