MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3992-3998

Agile Practices in PSU: Case study of BMRCL, Bengaluru

Devananda VS[1], Pradeep Kumar[2]
[1]Executive Engineer- Coordination, Planning & Design, BMRCL, email: devanandavs@gmail.com
[2]Chief Engineer- Coordination, Planning & Design, BMRCL, email: pradeep.nirmalite@yahoo.com

Abstract
As rapid urbanization in India demands more efficient public transportation, traditional project management models in public infrastructure are facing significant issues and trouble. The Architectural and Engineering Design (AED) division of the Bangalore Metro Rail Corporation Limited (BMRCL) historically relied on a Waterfall-based model, which often resulted in communication bottlenecks, delayed approvals, and fragmented assignment pursuing. This study evaluates the real-time implementation and impact of Agile-inspired practices within BMRCL's AED division to address the limitations of centralized, sequential workflows. Using a mixed-methods case study design, researchers collected quantitative data from surveys of professionals and qualitative insights through semi-structured interviews with key stakeholders, including senior management and lead architects. The intervention included the introduction of daily stand-up meetings, weekly reviews, and a cloud based work management system for real-time task tracking. Results indicate a significant positive shift in operational efficiency, with 59% of respondents reporting improved delivery times. Statistical analysis confirmed strong correlations between Agile adoption and increased accountability and coordination ($r > 0.82$). Qualitative themes revealed that while transition challenges such as initial resistance and meeting overruns existed, the shift empowered middle management and reduced reliance on high-ranking officials for routine approvals. The study demonstrates that Agile practices can be successfully adapted to infrastructure projects to enhance transparency and responsiveness without compromising regulatory compliance. Recommendations include scaling these practices organization-wide and implementing automated systems.

Keywords: Agile Methodology, Waterfall Methodology, BMRCL, Architectural and Engineering Design (AED), Scrum, Kanban, Public Sector Innovation.

1. INTRODUCTION

The office of the design/AED firm is an extension of the construction team. The office will cease to exist if there is no construction happening and it so happens that the method of project management followed by the execution team would be followed by the AED team a conventional method of waterfall method of project management would be inadvertently followed as they are trained in the traditional / conventional management method which is predictive in nature (D. Gao, 2024).An AED firm is partly or to be precise a bit more ignorant about approaches or change management that are been made as they stick to their old guns (Sujan, S.F., 2020) and move along without thinking of the new techniques which are way ahead. An AED firm always follows the construction cycle and requirements than on the management principles, (C. Eden et al.,.2005) this is mainly into a sequence of execution which is pre decided, if there are any short falls during the event of execution the sequence goes haywire and most of the time they need to visit the AED firm for the change order and have to appraise them the needs and requirements. This was not plausible in the ever-growing infrastructure world and they had to naturally move to a better method to mitigate the delay in the execution side. The hardship faced with manpower of site going idle and the machinery being not in use caused a time and cost delay (B. Flyvbjerg, 2014).

Here at this point, another methodology in software industry called as Agile methodology, atype of management that was seen as a beacon of hope toplan for research into the AED firm.Having been formed initially to serve software development, Agile approaches have now been introduced to gain massive momentum with applications in many organizations in the architectural (AEC), engineering, and construction fields(R Owen et al., 2016). Agile has flexibility (D.K.Rigby, et al., 2016) and repeatability as compared to a more inflexible, document-oriented project management system characterized by the Waterfall model in an AEC context (Al-Kurdi, N., & Al-Tahat, M. D., 2013). Constant improvement, sensitivity to change and increased collaboration promoted in the Agile framework are paramount to large-scale infrastructure projects. (E. Pikas et al., 2017).

The paper is a case study about the real practice of Agile in AED of BMRCL (Streule, T. et al., 2016). In January 2025, BMRCL-Planning and Design department implemented Agile practice as ameans of addressing its long-running problems of delayed communication, inability to clearly describe tasks and delays in the provision of design to benefit it as a whole but also being part of the solution to its multiple problems since then. For this, amid the daily stand-up meetings, regular weekly reviews, and a work management plan based on digital cloud tools (Denning, S., 2018), it has been represented by a practice of Agile. The study looks into the way in which these Agile practices have revolutionized day-to-day processes, enhanced cross-functional integration, and impacted on stakeholder satisfaction within day-to-day operations of a live, perpetual project.

Background Study: BMRCL (BMRCL AED Division, 2025). had a lot of hindrances in the effective way of addressing the needs and requirements of execution team wherein, the design details changed and were ever dynamic details changed overnight some of the constraints would be with respect to the working conditions (constraints like utilities, nala and land availability). These constraints cannot be addressed with the existing design in place as theshifting would not happen in a day so the execution team was on their toes to change the design to suit the site conditions.

In order to overcome such unforeseen events and constraints a new system of dynamic work culture had to be implemented. Also, large scale infrastructure projects need lots of coordination at inter departmental level. The technical people concerned are the Architect, Engineers, Field Engineers and Detailed Design Consultants who are the input providers whose contribution to the work is paramount for execution at the site. They need to have a good understanding of the work and effective among themselves for the needed communication and coordination if any of this is foregone or lacking the requirement of the execution team goes torpid (Choudhury, T., & Patel, S., 2022).

The flow of work or details required would usually start during the initial design itself. The AED team to DDC would work and provide the details as needed by the execution team. As stated above the requirements were always wavering due to an umpteen number of reasons. They would have a priority chart which would not be in line set by the in-house design team of BMRCL. The team here would not be aware of the plans of the site team only when the initial set of GFC are released they make a check and understand what is more paramount as per the needs of the contractor also. The transition during this period is time consuming, we need to be abreast of the happenings. The details are mismatched as the team of execution and designers are not on the same page. This must be addressed effectively.

2. Methodology

We used a Mixed methods case study approach on the collection of data. Wherein Quantitative and Qualitative methods were used for the entire data collection.

The Quantitative method: The quantitative method approach was selected in this research study in order to determine the effects of Agile in the AED division Planning and Design department of BMRCL. It made possible gathering of well-organized responses of a wide variety of employees, producers, creators and controllers. This approach (by asking predetermined questions and having predetermined answers) enabled to analytically objectively assess the improvement of coordination activities, the time of response, and its level of satisfaction. (Teddlie, C., & Tashakkori, A., 2009)

Qualitative Research Approach: The qualitative methodology has been adopted in this research along with the quantitative tools that will acquire the detailed feedback of the main stakeholders at BMRCL. The interviews of senior managers of the company, team-leads and field-engineers were held in semi-structured format to comprehend their views on Agile implementations, pains encountered, and the readiness of the organization to change. (Argyris, C., & Schön, D. A., 2022) This method has been adopted as the way to collect more subtle opinions that might not be presented

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3992-3998

in surveys and give the audience a context in which quantitative findings can be supported and enhanced. (Kothari, C. R., 2004)

Survey Questionnaires : An orderly 10 questions survey was sent out to 20 members of BMRCL of various positions in Planning and Design department. There were questions arranged to measure the experience of respondents with the Agile practices, such as the daily stand-up, meetings, and the work tracking tool, which was shared on Google. They were five different groups of respondents to the survey:

- Designers (Architects, Structural, MEP), Field Engineers
- Stakeholders
- Higher Management

Perceptions of improvement of communication, accountability, coordination and time efficiency were measured using Likert scales, multiple choice, and yes/no format.

Interviews: Particular attention was paid to 6 chosen participants who occupied the leading or strategic position in Agile implementation and took part in semi-structured interviews. Interview questions were open-ended, they included:

- Primary impressions of Agile implementation
- The achieved changes in workflow competence
- Effect on teamwork and problem solving
- Confrontation and challenges during the changeover
- Suggestions for future improvements

Sampling Technique

In this study, the purposive sampling method was applied and incorporated in a non-probability sampling in which the included individuals are chosen on the basis of their significance to the target of study (Etikan, I., Musa, S. A., & Alkassim, R. S., 2016). Within the domain of BMRCL, respondents were specifically selected among agencies which took specific part in the implementation of Agile strategy.The sample selected those who have direct experiences in the design planning and coordination, execution and review of tasks. These members have been chosen due to their engagement in the daily stand-up meetings, drawing review periods, and tools provided on the digital platform Centre for (Digital Governance, IIM Indore. (2025)). such as the Google work management plan. This was done so as to make sure that the insights would be gotten by those who were most interested in and conversant with the Agile transition therefore making it more valid and contextually relevant.

The sampling method harnessed the attention of informed stakeholders to create targeted insight into the operational impact of Agile on various roles in the division of AED. It focused on an informed audience like the designers, field engineers, section heads, and the authorities above.

Data Analysis Techniques

Quantitative Data: Descriptive statistics (correlational analysis, Pearson Corelation, Chi-Square Test, T-Test) was used to compile and analyze survey responses (Neuman, W. L., 2014). The information was sorted according to job position and the number of years of work experience to detect trends in Agile implementation and performance.**Qualitative Data**: The coded interviews were thematically analyzed in the transcripts (Denzin, N. K., & Lincoln, Y. S. 2011). The mention of better coordination and shorter feedback loops, increased visibility of tasks, and the condition of empowered staff were repeatedly talked about. Such challenges as resistance to change and training needs were also classified.

Validity and Reliability

In a bid to obtain internal validity, the questions in the survey and the interview guide were vetted by industry experts and pilot-tested. Reliability was achieved by consistency in administration of the survey and the structure of the interview. Cross-examination of survey results with interviewing increased the strength of results. (Bryman, A. 2016)

Ethical Considerations

- All participants signed an informed consent.
- Participation was without any kind of coercion and the guarantee of confidentiality was ensured.
- This data was kept under security and applied only towards academic research.

Limitations of the Methodology

- Although the sample size is adequate to provide qualitative interpretation, it might restrict the generalization to other people.
- The case study is narrow and it cannot pick all the external factors that define the Agile adoption.
- The results are based on a comparatively short implementation time (January 2025 and beyond); it could not be captured in the long term.

Irrespective of those weaknesses, the research design by (Creswell, J. W., 2014) gave a good starting point in evaluating the performance of the Agile practices in the AED in a practical field of public infrastructure. (Boukendour, S., & Hughes, W., 2014)

Data analysis and interpretation based on Architect, Engineers and Field

This section presents the visual analysis of responses collected from 17 participants namely Data of Architect, Engineers and Field Engineers on the implementation effectiveness survey.

Table 1: Summary of Responses

Question	Improved (a)	Slightly Improved(b)	Same as Earlier(c)	Reduced (d)
Efficiency in delivery time	10	6	1	0
Sense of responsibility	9	6	2	0
Coordination with team below	8	7	2	0
Coordination with higher management	8	7	2	0
Coordination with colleagues	8	7	2	0
Coordination with other departments	8	6	3	0
Coordination with field engineers	9	6	2	0
Would you implement this if promoted?	Yes: 17	No: 0	-	-
Helped in getting early feedback?	Yes: 15	No: 2	-	-
Overall efficiency rating	Highly satisfied: 3	Satisfied: 13	Same as earlier: 1	No improvement: 0

Figure 1 shows the distribution of responses across key questions regarding coordination, efficiency, and adoption of the new arrangement. The results show that the majority of participants observed improvements in all surveyed areas, with no participant reporting reduced performance. Table 1.1 and 1.2 below summarizes the key insights derived from the survey.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3992-3998

Table 2: Key Insights

Category		Metric	Improved	Slightly Improved	Same as earlier
Operational		Delivery Time	59% (10)	35% (6)	6% (1)
Culture		Responsibility & Ownership	53% (9)	35% (6)	12% (2)
Coordination		With Team Below	47% (8)	41% (7)	12% (2)
		With Higher Management	47% (8)	41% (7)	12% (2)
		With Colleagues	47% (8)	41% (7)	12% (2)
		With Other Departments	47% (8)	35% (6)	18% (3)
		With Field Engineers	53% (9)	35% (6)	12% (2)

Table 3: Key Insights

Metric	Result	Comments
Adoption Intent	100% (17/17)	All participants willing to implement if promoted.
Feedback Loop	88% (15/17)	Agreed the method helped in getting early feedback.
Overall Satisfaction	94% Positive	3 Highly Satisfied, 13 Satisfied, 1 Same as earlier.

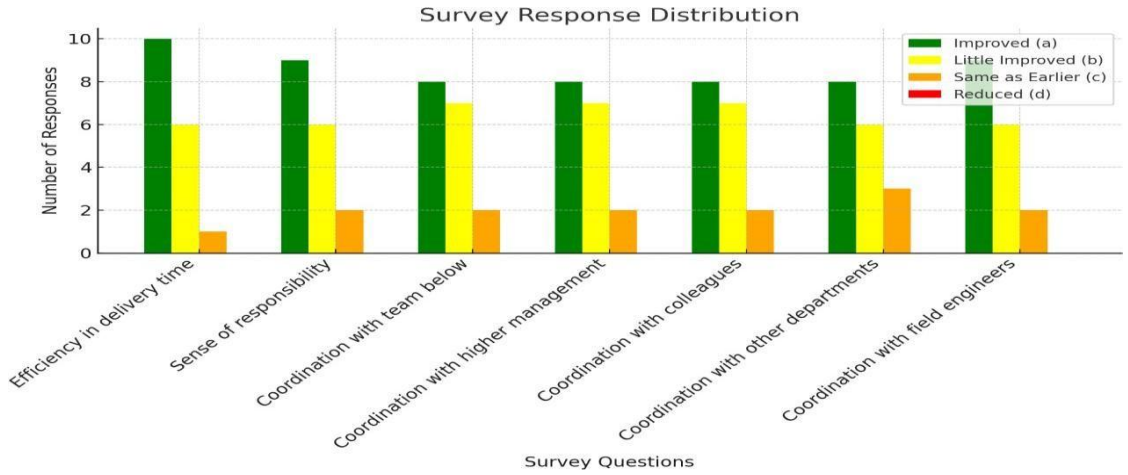

Figure 1. Survey Response Distribution

The survey results reflect a strong positive reception of the newly implemented process within the organization. When assessing the impact on efficiency in delivery time, 10 out of 17 respondents reported a significant improvement, while 6 noted a slight improvement. Only one respondent felt that the process maintained the status quo, and importantly, none of the participants reported any decline in efficiency. This indicates that the implementation has effectively streamlined the delivery pipeline, reducing delays and enhancing operational throughput. Given the diversity in roles and experience levels among the respondents—from Chief Engineers to Assistant Engineers—the results suggest that the benefits of this system are felt across the hierarchy, regardless of seniority.A notable outcome is the improvement in team dynamics and communication, both vertically and horizontally. Coordination with subordinates improved for 8 participants, while 7 reported slight improvements. Similarly, interactions with higher management and peers saw consistent positive feedback. In the case of inter-departmental collaboration, while most responses were positive, 3 individuals felt there was no significant change. This points to a minor gap in cross-departmental integration, which could be an area for future focus. Nevertheless, the overarching trend shows enhanced collaboration and reduced friction in team workflows, which are essential for efficient project execution.The sense of responsibility and ownership among employees also increased, as indicated by over 50% of respondents selecting "Improved." This shift is critical for the success of any organizational change because it drives accountability and fosters a proactive working culture. The ability to detect and act on issues early was another key highlight of the survey. About 88% of respondents agreed that the new method helped in gathering early feedback and observations, enabling timely interventions and course corrections. This is especially valuable in project-driven environments where early detection of errors can prevent larger operational setbacks.

Another critical insight is the unanimous willingness of the respondents to adopt this process if they are promoted to higher roles. This demonstrates not only acceptance but also endorsement of the system at a leadership level. The participants see this process as scalable and beneficial for long-term organizational growth. Furthermore, the data suggest that the process promotes leadership readiness and a mindset oriented toward continuous improvement, which bodes well for future managerial transitions.Finally, the overall satisfaction ratings solidify the success of the implementation. With 3 respondents marking "Highly Satisfied" and 13 selecting "Satisfied," the general sentiment is overwhelmingly positive. Only one individual felt the arrangement was "Same as earlier," and no participants reported "No improvement." This comprehensive acceptance across all surveyed metrics—efficiency, responsibility, coordination, feedback management, and satisfaction—indicates that the process has met its intended goals. For long-term impact, minor adjustments could be made to further strengthen inter-departmental collaboration, but the current system can be confidently considered a best practice model for wider deployment within the organization.

The Results

Statistical Analysis and Interpretation

Correlation Analysis: We computed the Pearson correlation matrix to understand the relationships between different survey variables. The correlation between Efficiency in Delivery Time and Responsibility is 0.88, indicating a strong positive linear relationship. Similarly, high correlations exist between efficiency, team coordination, and field coordination (all above 0.82), suggesting that improvements in efficiency are closely linked with better coordination and higher responsibility across the team.

Pearson Correlation Formula:

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{(x_i - \bar{x})^2}\sqrt{(y_i - \bar{y})^2}}$$

Where:

- x_i, y_i = observed values
- $\bar{x}$, $\bar{y}$ = means of variables

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3992-3998

2. Chi-Square Test of Independence

A Chi-square test was performed between Efficiency Improvement and Overall Satisfaction to check for dependency between these factors. The test yielded:

- Chi-square statistic = 19.35
- p-value = 0.00067
- Degrees of Freedom = 4

Since the **p-value < 0.05**, we **reject the null hypothesis** and conclude that **there is a statistically significant association between efficiency improvement and overall satisfaction**.

Chi-Square Formula:

$$\chi^2 = \frac{\sum(O_i - E_i)^2}{E_i}$$

Where:

- O_i = Observed frequency
- E_i = Expected frequency

3. Independent T-Test

We conducted a T-test to compare the Efficiency scores between participants who said 'Yes' to early feedback (n=15) and those who said 'No' (n=2). The results are:

- T-statistic = -2.26
- p-value = 0.24

Since the **p-value > 0.05**, there is **no significant difference in efficiency ratings between the two groups**. However, this could be due to the small sample size in the 'No' group (only 2 participants).

T-Test Formula:

$$t = \frac{X_1 - X_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where:

- X_1, X_2 = group means
- s_1^2, s_2^2 = group variances
- n_1, n_2 = group sizes

Full Cross-Table Analysis Report

We present pairwise cross-tabulations and chi-square test results between all relevant survey variables.

Cross-Table Analysis Summary

We performed pairwise cross-tabulations and chi-square tests across all variables to identify associations.

Key Observations from Cross-Table Analysis

- High correlations and significant chi-square statistics were found between efficiency and all coordination-related variables.
- The p-values are well below 0.05 for all the listed pairs, confirming statistically significant relationships.
- The results suggest that improving one aspect (like efficiency) is likely to have a cascading positive effect on responsibility and coordination, reinforcing the system-wide improvement hypothesis.

Chi-square Statistics Heatmap

The following heatmap visualizes the chi-square statistics across all variable pairs:

Summary of Findings

- There is strong correlation between efficiency, responsibility, and coordination factors, indicating that improvements in one area likely lead to improvements in others.
- The Chi-square test confirms that overall satisfaction is significantly related to efficiency improvement.
- The T-test did not find a significant difference in efficiency based on early feedback perception, possibly due to the unbalanced group sizes.
- These findings statistically validate the positive survey trends, highlighting that the new implementation has led to systemic improvements in operations and satisfaction.

Data analysis and interpretation based on Higher Management Response:

Here's an analysis of the feedback provided by Executive Director regarding the new project monitoring and governance practices:

Table 2: Sample Results

Variable Pair	Chi-square	p-value	Degrees of Freedom	Interpretation
Efficiency vs Responsibility	20.31	0.00043	4	Strong significant association. As efficiency improves, responsibility perception also improves.
Efficiency vs Coordination with Team Below	17.61	0.00147	4	Significant association. Efficiency gains are linked to better team coordination.
Efficiency vs Coordination with Higher Management	17.61	0.00147	4	Similar to above; improvements in efficiency correlate with smoother management coordination.
Efficiency vs Coordination with Colleagues	17.61	0.00147	4	Shows strong alignment between peer coordination and efficiency.
Efficiency vs Coordination with Other Departments	14.73	0.00528	4	Moderately significant. Cross-departmental coordination is related to efficiency but less strongly than within-team coordination.

Overview of the Response

The feedback from the higher management reflects a strong endorsement of the new structured management practices introduced in January 2025. The Executive Director has extensive execution experience (34 years) and represents a critical stakeholder perspective for BMRCL's design and

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3992-3998

planning operations.

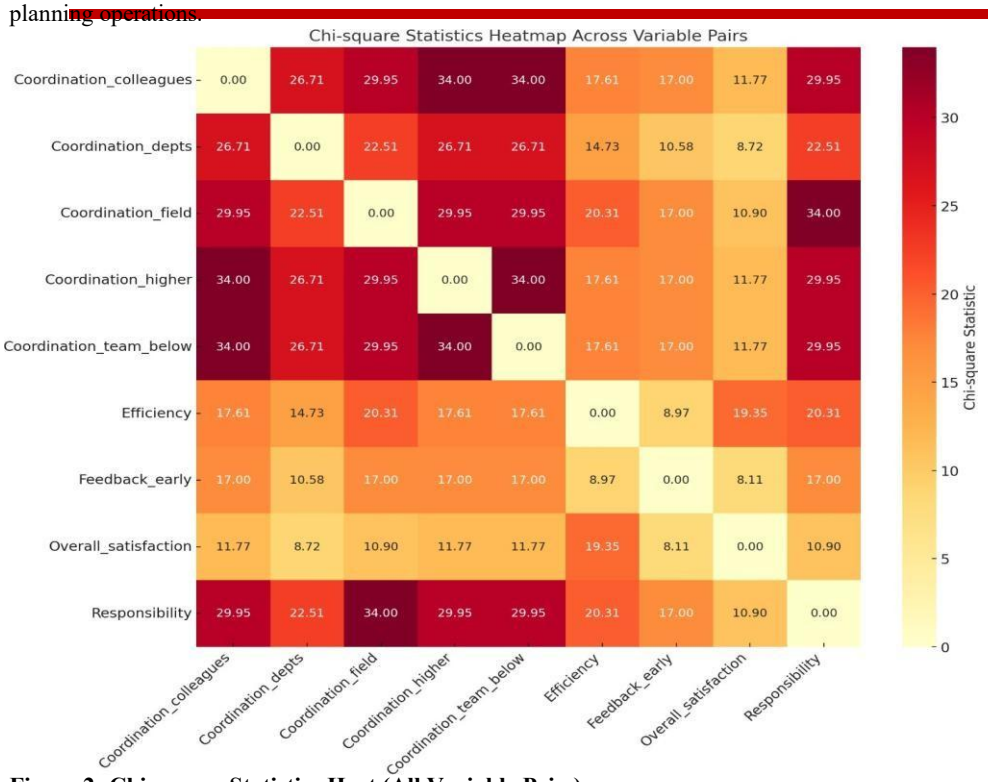

Figure 2: Chi-square Statistics Heat (All Variable Pairs)

Interpretation of Findings: The Executive Director's responses suggest that the new management system has delivered measurable improvements in transparency, accountability, and project monitoring. The daily stand-ups, Google Work

Table 3: Key Observations from Responses

Survey Area	Response	Interpretation
Overall Team Communication & Coordination	Yes, significantly	Indicates substantial improvement since January 2025 in communication flow and alignment within teams.
Visibility of Ongoing Design Activities	Yes	The system provides transparency without the need for micromanagement or follow-ups.
Accountability via Google Work Management Plan	Yes	Confirms that task ownership and deliverable tracking have improved.
Daily Stand-up Meetings for Issue Resolution	To some extent	Shows partial success; daily meetings help but may require further optimization for faster resolution.
Weekly Review Effectiveness	Yes	Weekly reviews are helping to track progress and identify gaps across departments.
Reduction in Dependency on Individuals	No	Highlights that certain roles (e.g., Chief Engineer, Deputy Chief, AE) remain critical points in task control, suggesting a need for more process decentralization.
Reduction in Senior Escalations	Yes	There is a decrease in escalations, indicating better handling of issues at operational levels.
Interdepartmental Collaboration	Slightly	Minor improvements seen, but further efforts are needed to enhance collaboration between Architecture, MEP, Systems, etc.
Support for Institutionalizing Practices	Yes	Strong endorsement for rolling out these practices across all design and planning divisions.
Overall Assessment	Highly effective	Marks the system as highly impactful for project monitoring and governance.

Management Plan, and weekly reviews have collectively streamlined operations and reduced the burden on senior management for routine escalations. The practices seem to have enabled proactive issue handling, fostering a culture of ownership among mid-level managers and engineers.

However, some limitations remain:

- Individual dependency persists in task management. The fact that there is no reduction in dependency on specific roles indicates that the system may not yet have matured into a fully process-driven model. More work is required to decentralize decision-making and build redundancy in responsibilities.
- Interdepartmental collaboration has seen only slight improvement. This could be due to silos still existing between disciplines like architecture, structural engineering, and MEP services. Integrated coordination platforms or cross-functional task forces could help break these barriers.
- The partial effectiveness of daily stand-up meetings in resolving design issues suggests that either the format, frequency, or follow-up mechanisms need refinement.

Data analysis and interpretation based on Stakeholder's Quantitative data Response:

Here's the analysis of the feedback from General Manager, regarding the project monitoring and governance practices:

Overview of the Response: The feedback a senior stakeholder with 19 years of design experience, provides valuable insights into how the current management practices are impacting day-to-day operations at the mid-senior leadership level. The responses indicate an overall positive perception of the system but also highlight certain limitations.

Analysis and Interpretation of Findings: The stakeholder's feedback indicates that the structured design management practices have effectively transformed the operational workflow. The system has simplified task management, making it easier to track responsibilities and monitor progress in real-time. The use of the Google Work Management Plan (GWM Plan) appears to be fully adopted by the General Manager level, demonstrating success in the digital transition for project management. One of the most significant outcomes is the improved coordination between departments, reported as "significant." This suggests that the Review of Works meetings and collaborative platforms are breaking down departmental silos, which is critical for integrated project delivery in design-heavy projects like metro systems. Additionally, the stakeholder notes better client communication, which indirectly validates the internal process improvements. A crucial positive insight is the reduction in escalations to senior management. This implies that middle management and functional heads are now empowered to resolve issues independently, leading to faster decision-making and better resource management.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3992-3998

Analysis and Interpretation of Qualitative Interview Data: Here is a qualitative analysis report based on the interview data provided from six respondents regarding the shift from traditional (Waterfall) methods to more agile-inspired practices in an Architectural Engineering Design (AED) environment.

Table 4: Response Summary

Survey Area	Response	Interpretation
Improved Ability to Monitor and Assign Tasks	Yes	The system has enhanced task assignment and tracking capabilities.
Review of Works Improving Department Coordination	Yes, significantly	Reflects major gains in cross-department coordination through structured reviews.
Use of Google Work Management Plan	Frequently	Indicates a high adoption rate of the GWM Plan for tracking task progress.
Clarity on Task Ownership	Yes	The new process has improved visibility of individual responsibilities.
Reduction in Response Delays	Yes	Design teams are now responding faster, reducing bottlenecks.
Consistent Updates Received	Yes	The stakeholder is receiving updates regularly, improving project awareness.
Inter-functional Communication Improvement	Yes	Coordination across disciplines (Architecture, Structure, MEP) has improved.
Reduction in Escalations	Yes	Operational issues are being handled at the appropriate level, minimizing the need for senior intervention.
Recommendation to Continue/Expand Practice	Yes	The stakeholder strongly supports institutionalizing the practices.
Improvement in Client Response Time	Yes	Client-side responsiveness has also improved, indicating end-to-end system efficiency.

Table 5: Respondent Profiles

Designation	Experience (Design)	Experience (Execution)	Seniority Level
Section Engineer	4 years	2 years	Junior
Deputy General Manager (Arch-1)	35 years	Not disclosed	Senior-most
Chief Architect	30 years	23 years	Senior
Executive Engineer	4.5 years	Not disclosed	Mid-level
Deputy General Manager (Arch-3)	18 years	5 years	Senior
Executive Engineer	14 years	0 years	Mid-level

The mix of junior, mid-level, and senior professionals offers a comprehensive perspective across organizational hierarchy and experience levels.

Qualitative Analysis Report: Transition from Traditional to Agile-like Methods in AED Projects: This qualitative analysis explores the perceptions, experiences, and feedback of six professionals from various roles and levels of experience within the Architectural Engineering Design (AED) domain. The purpose was to understand the effectiveness, challenges, and potential of newly adopted methodologies, namely daily stand-up meetings, work reviews with retrospection, and a Google-based work management system, in contrast to the traditional waterfall model. A structured interview was conducted with six respondents — ranging from Section Engineers to Deputy General Managers and Chief Architects — who answered five open-ended questions. These questions covered their experience under the traditional model, the impact of new tools and practices, observed benefits, transition challenges, and suggestions for other organizations. Based on the responses, the analysis is organized under five key themes corresponding to the five interview questions.

Experience with Traditional Waterfall Model

The traditional Waterfall model was summed into a rigid, non-collaborative structure that frequently deviated work distribution and individual accountability. Without a mode for real-time tracking, key stakeholders like Chief Architects and Section Engineers often faced the task of lack of role clarity, which built up the confusion and coordination inefficiencies. This environment was further aggravated by limited communication; as noted by senior management, the absence of regular reviews forced teams into silos where tracking pending submissions became nearly impossible. Consequently, this lack of oversight led to an inequity in workload and inconsistent project updates. Ultimately, the Waterfall approach's inability to provide transparency or flexibility created a friction-heavy workflow that diminished both operational efficiency and team spirit.

- **Impact of New Tools and Methods:** While the impact of new tools and methods were warmly welcomed the transformative was perceived in a way that it gave way to more collaboration, visibility and accountability with the daily stand up meetings were consistently reported to be valuable for real time interactions in the eyes of the section engineer the issues would be with ease of immediate tracking and the peer to peer learning and motivation was more pronounced as described by the Chief engineer and moreover the timely work completion was also paramount.
- **Observed Benefits of the New System:** The transition to the new system yielded significant improvements across project delivery, communication, and overall team dynamics. By minimizing communication delays, the new framework enabled faster project execution and a notable reduction in rework, as cited by the Executive Engineer and Deputy General Managers. Beyond pure logistics, the shift fostered a psychological boost; the Section Engineer noted a transition from "confusion to control" through structured work planning and enhanced role clarity. This operational discipline was complemented by smoother cross-functional coordination and prioritized issue resolution with site teams. Ultimately, the ability to maintain precise records and monitor deadlines in real-time not only increased productivity but also instilled a sense of professional ownership and accountability that was previously absent.
- **Challenges in the Transition Phase:** Despite the clear long-term benefits, the transition to the new system introduced several initial adjustment challenges, primarily centered on adoption inertia and the demands of a more rigorous routine. For some, like the Section Engineer, shifting from traditional workflows to active digital tracking via worksheets required a significant change in daily habits. This was compounded by logistical pressures; the Chief Engineer noted that early daily meetings occasionally exceeded their intended duration due to over-detailed reporting, while the Executive Engineer and Deputy General Manager (Arch – 1) found it difficult to maintain consistent updates when urgent, high-priority tasks disrupted the new routine. However, these obstacles were largely viewed as temporary teething problems. As the teams acclimated, the initial friction of task-tracking pressure gave way to the more structured, long-term operational advantages the system was designed to provide.

Correlation Analysis

Correlation between Experience Level and Perception of Change

Insight: Mid-level professionals appeared to gain the most, while seniors found it either redundant or overlapping with current practices.

Correlation between Design/Execution Background and System Impact: A significant correlation emerged between a respondent's professional background and their perception of the system's impact, particularly among those with dual exposure to both design and field execution. For roles like the Section Engineer, Chief Architect, and Deputy General Manager (Arch – 3), the new system directly translated into superior scheduling, more efficient drawing delivery, and enhanced task visualization. This alignment was further validated by the Executive Engineer, who noted that the system facilitated faster decision-making and a marked reduction in rework—likely a result of better synchronization with real-time on-site requirements. Ultimately, professionals who operate at the intersection of design and execution were best positioned to witness the end-to-end project impact. This unique vantage point transformed them into key adopters and advocates, as they could clearly see how improved coordination at the design level directly mitigated friction in the field.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3982-3991

Table 6: Correlation between Experience Level and Perception of Change

Experience Level	Adaptability to Change	Observation
Junior (0–5 yrs)	Moderate to High	Found the system helpful but faced issues with task tracking (Section Engineer)
Mid-level (5–15)	High	Appreciated structure, transparency, better tracking (Dy. GM (Arch–3), Executive Engg.)
Senior (>15 yrs)	Mixed	Dy.GM(Arch–1) found it aligned with existing practices, chief architect demanded time focus

Table 7: Correlation between Role Hierarchy and Challenges Faced

Hierarchy	Common Challenges	Likely Cause
Junior	Updating worksheets, initial confusion	Unfamiliarity with task tracking tools
Mid-level	Time balancing between tasks	Conflict between routine planning & urgent tasks
Senior	Over-detailed meetings, low differentiation	Expectations of strategic planning over operational details

Insight: The pain points were operational for juniors, tactical for mid-level, and strategic for seniors.

Key Findings

The transition to Agile-inspired methods has been a definitive success, earning unanimous internal support for significantly enhancing transparency, scheduling, and communication. While the shift initially met with minor, short-term process hurdles, these were superficial rather than structural, with mid-level professionals emerging as the group most positively impacted by the new workflow. To build on this momentum, the focus now shifts toward fine-tuning the engine through tighter project scoping, clearer role-based task definitions, and more efficient communication protocols.

.CONCLUSION, RECOMMENDATIONS AND FUTURE WORK

This study evaluated the real-time implementation of Agile practices within the AED function Planning and Design department of BMRCL. Faced with challenges of centralized decision-making, poor communication flow, and inefficiencies in tracking and resolving design issues, BMRCL introduced Agile practices in January 2025. These included daily stand-up meetings, weekly reviews, and a digital work management system via Google Sheets. The implementation aimed to decentralize task ownership, increase real-time visibility, and promote a culture of continuous feedback.

Based on survey and interview responses from over 20 participants, this research found that Agile practices significantly enhanced communication, accountability, and task tracking. The transition from a reactive, dependency-based system to a proactive and transparent coordination model improved both internal operations and field-level responsiveness. Agile created opportunities for mid-level staff to take greater ownership while enabling senior managers to focus on strategic oversight rather than daily follow-ups.

The qualitative analysis reveals a strong consensus among AED professionals that the shift from the traditional waterfall model to more agile-like processes has yielded significant positive outcomes. These include better coordination, improved confidence, quicker delivery, and better issue tracking. While initial resistance and challenges were noted — primarily around the learning curve and administrative updates — the overall transition has been positive and instructive. To sustain these improvements and support broader implementation, organizations should invest in structured role definitions, centralized work management tools, concise communication methods, and training for all team levels. The integration of modern agile practices into AED project management represents a cultural as well as procedural transformation, one that supports a more efficient and responsive project lifecycle.

The findings confirm that Agile, when customized to suit the operational realities of public infrastructure agencies, can lead to measurable efficiency gains in AED. BMRCL's implementation offers a replicable model for other organizations with similar workflows.

Recommendations:

Recommendation drawn based on the of field engineers, design data analysis: Drawing from the analysis of both design data and field engineer feedback, four strategic recommendations are proposed to solidify the project's success. First, given the overwhelmingly positive results, the organization should scale the implementation of these practices department-wide to standardize efficiency across all projects. To further bridge remaining silos, cross-functional workshops should be institutionalized, specifically targeting the minor coordination gaps identified during the transition phase. Furthermore, a system of continuous monitoring—utilizing regular feedback surveys—should be established to fine-tune the Agile processes based on evolving project demands. Finally, the organization should capitalize on its internal expertise by launching a mentorship program; by leveraging senior respondents who reported high satisfaction with the new system, the department can facilitate smoother onboarding for new joiners and foster a culture of peer-to-peer advocacy.

Recommendation drawn based on the data analysis of Higher Management Response: To move toward long-term sustainability, the organization must focus on institutionalizing and refining these practices into a mature operational standard. Supported by strong senior leadership, the first priority is to formalize and scale these methodologies across all design and planning departments, ensuring a unified approach to project delivery. To mitigate the risk of over-reliance on specific individuals, the framework should be reinforced by process automation and rigorous documentation, allowing for smoother role rotations and continuity. This structural stability should be matched by enhanced interdepartmental synergy, achieved through shared digital dashboards and joint review sessions that provide cross-discipline visibility. At the tactical level, daily stand-up meetings can be further optimized by integrating action trackers and issue-escalation frameworks to accelerate problem resolution. Finally, by maintaining a continuous feedback loop with senior management, the organization can remain agile, refining the system through periodic reviews to ensure it evolves alongside the complexities of large-scale infrastructure projects.

Recommendation drawn based on the data analysis of Stakeholders Response: Based on a comprehensive analysis of stakeholder responses, the path forward involves the formalization and expansion of these successful practices across all project verticals, including planning, execution, and procurement. To support this growth, the organization must fully leverage digital infrastructure by standardizing the use of the Google Work Management Plan across all departments to ensure uniform engagement. This digital integration should be coupled with the institutionalization of Review of Works and Weekly Coordination Meetings, ideally supported by visual dashboards for real-time tracking. To maintain high performance, the establishment of clear KPIs is essential to monitor response times, inter-departmental synergy, and escalation frequency on a quarterly basis. Finally, these internal efficiencies must be aligned with external communication strategies; by formalizing feedback loops with clients, the organization can ensure that improved internal agility translates directly into superior stakeholder management and project transparency.

Recommendations for Other AED Organizations: To ensure the successful adoption of Agile methodologies within traditional Architectural, Engineering, and Design (AED) environments, several systemic improvements are recommended. Interviewees, including the Section Engineer and Executive Engineers, emphasized that the foundation of a smooth transition lies in formalized organizational structures with clearly defined scopes and hierarchical charts. These structures must be supported by comprehensive, designation-specific role definitions that align tasks from junior staff to senior leadership, eliminating ambiguity in responsibility. Furthermore, operational efficiency can be significantly enhanced through centralized, digital task-tracking systems that provide all stakeholders with real-time access to project data.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3982-3991

Finally, to prevent "meeting fatigue," the Chief Architect suggested that communication protocols be refined to ensure meetings are strictly time-bound and outcome-oriented. Ultimately, the integration of structural clarity, centralized tracking, and disciplined communication serves as the essential framework for bridging the gap between traditional practices and modern Agile tools. (Boehm, B., & Turner, R. (2005))

Contributions to Practice and Knowledge

This research contributes to a growing body of literature on Agile in non-software contexts (Conforto, E et al -2016), particularly public-sector infrastructure. It demonstrates how Agile can be adapted in structured environments and integrated into existing design coordination systems without disrupting accountability. The findings serve as a practical guide for policymakers, consultants, and design managers in similar government or semi-government organizations.

Future Work

While this research focused on BMRCL's AED function, future studies could:

- Evaluate the long-term sustainability of Agile practices and their effect on project timelines.
- Compare Agile outcomes between different metro corporations (e.g., DMRC, CMRL) to develop a national framework.
- Explore Agile's impact on inter-agency collaboration involving utility providers, municipal bodies, and consultants.
- Investigate the cultural and leadership transformations necessary for successful Agile adoption at scale.

Overall, the successful implementation of Agile at BMRCL reflects the potential of adaptive project management frameworks in government infrastructure projects. With strategic support and contextual customization, Agile can evolve as a standard model for design management in Indian public infrastructure.

APPENDIX I - REFERENCES

1. Al-Kurdi, N., & Al-Tahat, M. D. (2013). Development and analysis of agile architectural project design. *Journal of Information, Intelligence and Knowledge*, *5*(4), 217.
2. Argyris, C., & Schön, D. A. (2022). Organizational learning in dynamic public environments. *Learning Organization Journal,* 29(4), 412–426. https://doi.org/10.1108/TLO-11-2021-0172
3. Bangalore Metro Rail Corporation Limited (BMRCL). (2024). Design Team Agile Transition Review Report. AED Division, BMRCL.
4. Bangalore Metro Rail Corporation Limited (BMRCL). (2025). Phase 2 and Phase 3 Corridor Integration Status Report. Retrieved from https://english.bmrc.co.in/
5. Bangalore Metro Rail Corporation Limited (BMRCL). (2023). Architectural and Engineering Design (AED) Reforms – Presentation to Managing Director. Internal Document.
6. Boehm, B., & Turner, R. (2005). Management challenges to implementing Agile processes in traditional development organizations. IEEE Software*, 22*(5), 30–39. https://doi.org/10.1109/MS.2005.129
7. Boukendour, S., & Hughes, W. (2014). Agile project management in the infrastructure sector: Lessons and recommendations. *Construction Management and Economics, 32*(6), 567–583. https://doi.org/10.1080/01446193.2014.8949
8. BMRCL AED Division. (2025). *Internal Technical Review Report: AED Coordination Issues and Process Improvements*. Bangalore Metro Rail Corporation Limited.
9. BMRCL Design Division. (2025). *Transition from Waterfall to Agile in AED: Internal Review Report*. Bangalore Metro Rail Corporation Limited.
10. Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.
11. B. Flyvbjerg, "What You Should Know About Megaprojects," *Project Management Journal*, 2014.
12. Centre for Digital Governance, IIM Indore. (2025). *Policy Brief: Scaling Agile Methods in Indian age Urban Projects*. Retrieved from https://cdg.iimidr.ac.in
13. C. Eden et al., *"The external and internal complexity IwOweof projects and the emerging practice of risk management*," Int. J. Project Management., vol. 23, no. 3, 2005.
14. *Choudhury, T., & Patel, S. (2022). Communication bottlenecks in design development: Lessons from large-scale transportation projects. Built Environment and Project Coordination Journal, 6(4), 76–90.*
15. Conforto, E. C., Salum, F., Amaral, D. C., da Silva, S. L., & de Almeida, L. F. M. (2016). Can Agile project management be adopted by industries other than software development? *Project Management Journal, 47*(3), 21–34. https://doi.org/10.1177/875697281604700303
16. Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.
17. Denning S, *The Age of Agile*, New York, NY: AMACOM, 2018.
18. D. K. Rigby et al., "Embracing Agile," *Harvard Business Review*, vol. 94, no. 5, 2016.
19. Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11
20. E. Pikas et al., "Design Management in Civil Engineering," *JEPPM*, 2017.
21. Gao, D. (2024). Exploring Issues in Architectural Engineering Design Management in the New Era. *The Frontiers of Society, Science and Technology*, *6*(5).
22. Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International.
23. Neuman, W. L. (2014). *Social research methods: Qualitative and quantitative approaches* (7th ed.). Pearson Education Limited.
24. R. Owen et al., "Is agile project management applicable to construction?" in *Proc. 14th IGLC*, 2006.
25. Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. SAGE Publications.
26. Streule T et al., "Implementation of Scrum in the Construction Industry," *Procedia Engineering*, vol. 164, 2016.
27. Sujan, S. F. (2020). *A Holistic and Systemic Model of Collaboration in the AED Industry*. The University of Liverpool (United Kingdom).