Tailoring PDCA to Improve Construction's Productivity

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Abstract

Construction needs a unified productivity method. This paper asserts one. Standardisation increases a country's GDP and a company's profit. Shewhart's Plan-Do-Check-Act (PDCA) was created for the manufacturing industry. It has been helpful for construction contractors as a starting point. Still, it contains misalignments and blind spots, making it suboptimal —i.e., not readily adaptable to the custom installation and rehabilitation industry. This paper examines the limitations of the model and proposes a potential solution that builds upon Shewhart's model. First, we describe the realities that for-profit construction organisations face, and then we expand and tailor the PDCA approach to address those issues. In summary, completed tasks comprise a finished project. Each project requires dozens of physical installation activities. As an improvement, a repetitive set of management activities that support trade professionals' on-site tasks, done on time, will ultimately deliver quality, cost, and schedule. This paper examines potential variations in project inputs and projected results. This approach applies to both new construction and rehabilitation projects and can be utilised as a diagnostic tool in post-project reviews to facilitate continuous improvement.

Keywords (Times New Roman 12)

Construction Planning, Project Scheduling, Work Logistics, Procurement, Task Execution, Increasing Productivity

1. Introduction (Times New Roman 12)

The original quality and productivity framework, Plan-Do-Check-Act (PDCA) from Shewhart, and promoted by Deming, was tailored to manufacturing issues (Koiesar 1994). PDCA does not readily address construction issues such as information gathering and site dynamics; however, it is helpful. PDCA contains other misalignments and blind spots, making it suboptimal for this industry. Construction needs a unified productivity method. This paper asserts one.

PDCA is illustrated as a cycle because it is a repeatable process that produces thousands (or more) identical products. Wei (2022) asserts it is a "hierarchical loop,". Contrastingly, this paper argues that project tasks proceed linearly because they are unique and discontinuous from project to project. This is not controversial in construction. CPM and GANTT are based on a linear transformation of an input's value-seeking throughput speed and project-compliant output. However, each typically ignores the achievement of critical prerequisites before the activity starts (Koskela 2000). Of course, some activities generally resemble previous projects' installations, but how does a project manager or site supervisor determine the demarcation line —i.e., which tasks can be repeated from prior experience and which should be tailored to the project to deliver safety, quality, cost, and schedule? Relying only on previous experience invites disaster in a single-digit % net profit business (RMA 2025). This paper tailored this production methodology for constructing or rehabilitating vertical and horizontal structures. The researcher examines the limitations of the PDCA model and proposes refinements to enhance construction thinking. First, we describe the realities for-profit construction organisations face, and then we expand and tailor PDCA to address those issues.

Construction contracting is volatile, uncertain, complex and ambiguous (VUCA) (Bennis and Nanus 1986). This evolved sector includes fragmentation, dysfunction and perverse incentives (Stevens and Smolders 2023). There is a critical need to use a proven system to improve outcomes. Womack and Jones (2003) have found that "delayering" operations to bring workers closer to management is the only antidote. Those insensitive to workers' installation needs will inadvertently lead to diminished safety, quality, timeliness, and cost. Notably, the site operations generate approximately100% of the revenue, 90% of the costs, and 80% of the risks. Successful construction projects are completed on time, within the estimate, and meet quality requirements. Productivity is a key factor that determines the success or failure of a project, influencing both project quality and business earnings (Lai, 2022). An organised, sequential and timely adherence to a firm's management practices provides disproportionately positive outcomes, i.e.

a rise of 1% in compliance with enabling tasks increases overhead/direct cost efficiency by 2% (Stevens and Smolders 2023)

2. Settings and Methods

The original quality and productivity framework, Plan-Do-Check-Act (PDCA) from Shewhart, and promoted by Deming, was tailored to manufacturing issues (Koiesar 1994). PDCA does not readily address construction issues such as information gathering and site dynamics however, it is helpful. PDCA contains other misalignments and blind spots, making it suboptimal for this industry. Construction needs a unified productivity method. This paper asserts one.

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3. Results

This paper captured the research literature's significant dynamics of constructing or rehabilitating work. These include information collecting and confirmation, collaborative planning, logistical support, task execution, real-time replanning, redeployment and measurement. The linear process in Figure 1 represents the race-like reality in construction. Once the participants pass the starting line, such as tendering or pre-project planning, they cannot revisit it. If done poorly, the opportunity is lost. See Figures 1, 2 and 3.

Project Scenario 1 - Optimum - Thoroughly Planned, Supported and Actively Replanned. Manager-Leaders execute Information Collection and Confirmation. Planning is collaborative and shared. Logistical support, including people, materials, tools, equipment, and financial logistics, is arranged to accomplish the task. The test crew begins the installation and aims to understand the optimal process, thereby reducing the learning curve for subsequent workers as task capacity is scaled up. Critical replanning occurs to address imperfect logistics until the task is completed. Redeployment of resources to other tasks occurs after the initial task is completed. End-to-end measurement enables compliance monitoring with management support activities, resulting in better-than-average safety, quality, and MFP.

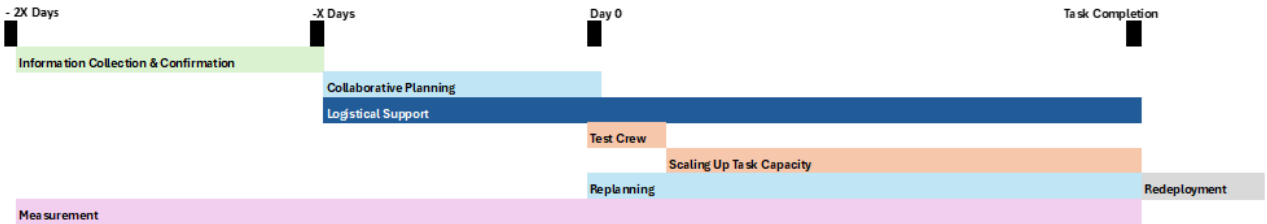

Figure 1. Optimum Construction Installation or Rehabilitation Task Process (Stevens, Smolders and Poshdar 2025)

3.2. Other Project Scenarios

Project Scenario 2 - Less Planned, Less Supported and Not Replanned (Sub-optimum) – The process was executed with a bureaucrat's mindset, or by a timid "rear echelon" staff member. Managers execute Information Collection and Confirmation Planning late. Planning is done with unconfirmed information. Taskwork is not performed with a test crew—supervisors who cannot or will not engage with the field and replan. Measurement is shorter in time and thus produces less monitoring to catch and correct deficiencies. People, materials, equipment, tools, and financial logistics support the task work while information is collected and confirmed. Resource redeployment to other tasks is unchanged in its timing but may be delayed as defects are remediated. This approach yields a higher probability of low-quality installations, resulting in significant returned material and rework.

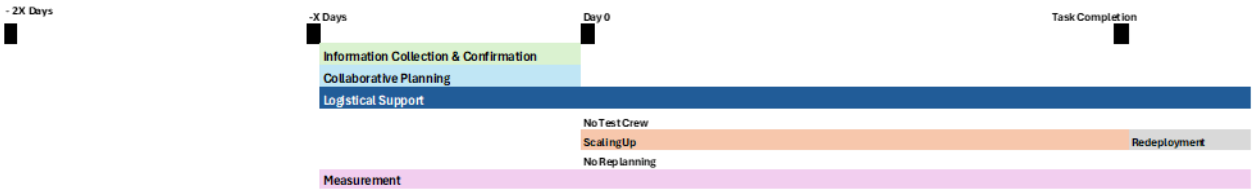

Figure 2. Sub-Optimum Construction Installation or Rehabilitation Task Process

Project Scenario 3 – "As You Go" (Worst) – The process was affected by several issues, such as a worker shortage, schedule acceleration or a busy project manager. All steps are performed at the same time. Planning is done with unconfirmed information. Replanning is not possible due to the lack of an original plan. Taskwork cannot be performed with a test crew and is initiated twice. Measurement is shorter in time and results in less monitoring to catch and correct deficiencies. Resource redeployment is done twice, interrupting the learning curve. This approach results in the highest probability of a low-quality installation, with the most returned material and significant rework of the three situations.

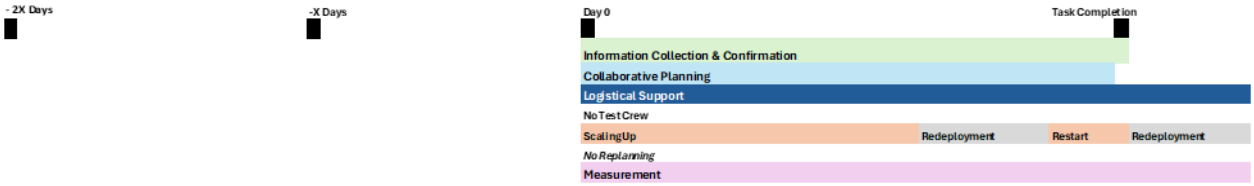

Figure 3. "As You Go" Construction Installation or Rehabilitation Task Process

A cyclical process has value and utility. Circularity suggests that speed is a factor—accurate work done with dispatch will lead to a competitive edge. Figure 4 illustrates the steps of Scenario 1 in a circular process. Alternatively, problems such as late information and slow logistical support will slow the cycle, producing measurable outputs such as person-hours overruns or significant rework, alerting to a problem.

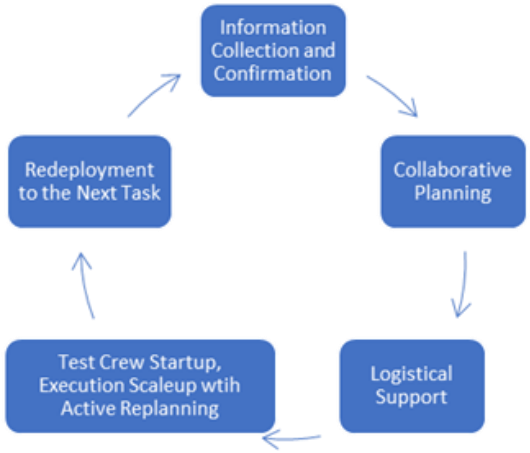

Figure 4. Reformed PDCA Cycle Reflecting Construction Task Dynamics - Measured at Each Stage.

The researchers analysed the three scenarios, enhanced the dynamics and projected outcomes as if each situation were done on each installation without exception. These extremes provide clarity. Although unrealistic, they allow for testing if done in a controlled experiment. The intermediate management inputs shown are readily identifiable through observation and project documentation. See Table 1.

Table 1. Input Variation, Worker Learning Curve and Management Intensity Needed for Successful Safety, Quality, Cost, and Schedule Performance for Three Project Situations

Factor	Scenario 1	Scenario 2	Scenario 3
Information Collection and Confirmation	Early, plentiful and accurate information from the client and partners	Just-in-Time information and confirmation from the client and partners	Late and inaccurate information flows from the client and partners
Material Logistics	Readily available material from trustworthy vendors delivered in the needed quantities	Variable availability of material from new or untested vendors delivered in both undercounted and overcounted quantities	Not readily available material from untrustworthy vendors delivered in consistently undercounted quantities
Tools and Equipment	Readily available tools and equipment are right-sized and dependable from trustworthy vendors	Tools and equipment that are inconsistently sized and not well-maintained by unfamiliar vendors	Tools and equipment not rightsized and past their useful life from untrustworthy vendors
Processes	Previously experienced installation process(s) perfectly fit technical requirements, meeting safety, quality, cost and schedule demands	Needs modification to the previously experienced installation process(s) to meet safety, quality, cost and schedule	A novel installation process(s) is needed to meet safety, quality, cost, and schedule requirements
Worker Learning Curve	Low due to familiarity with the task, and its required material, tools and equipment	Average due to a mix of familiarity and unfamiliarity with the task, with its required material, tools and equipment	High due to significant unfamiliarity with the task, and its required material, tools and equipment
Outcome Probability	Above-average safety, quality, cost, and schedule performance	Average safety, quality, cost, and schedule performance	Below-average safety, quality, cost, and schedule performance

Daily reports and project schedules can provide insights into the construction firm's management habits. To make sense of the model, a template or electronic audit process can be created. Training in this process and then auditing the practices can reinforce the process.

Table 2. Timing of the 7 management and worker activities

Process	Timing	Comments
Task Information Collection and Confirmation	One day or more before the start of planning, it is reviewed by one or more people.	The planning includes safety information.
Collaborative Planning	1 day or more before the task starts	Two or more people lay out the inputs, process and intended outputs.
Logistical Support	Material is located, made-ready and placed in proximity of the crew	8 hours' worth of material within 10 meters of the crew.
Crew Size	A smaller crew than the full-scale group has started on the task.	Above-average workers who have some teaching abilities are assigned.

Replanning	The supervisor engages with the crew daily, and adjustments/improvements are made.	An unengaged site supervisor is costing the project increased productivity.
Measuring	Unit installed per person-hour increases over time.	No financial calculation. Site people think in terms of time and the installed unit.
Redeployment	Immediately after the previous work finishes. The crew is told what the next work is while completing this work.	Crews with more work to go are less likely to slow down the last part of the existing work.

4. Discussion

Construction is not manufacturing; unfortunately, PDCA's roots lie in the latter. Unlike manufacturers, contractors do not produce a single end product. Customers' and designers' desire for uniqueness manifests in different installation and rehabilitation demands. To address this variation, construction organisations must continually adapt processes, materials, tools, and equipment. Australians have never desired "Soviet Style" architecture; they want something different from their neighbours, individually or corporately. Infrastructure typically presents different in situ problems and design intents. These significant variations reset the construction approach and human learning curve. A new process, wholly or partially, must be identified before starting the task.

Contractors are highly motivated to increase the productivity of their site workers. A 10% increase doubles net profit. (Stevens and Smolders 2025) However, many of the solutions recommended by experts, consultants, and academics have not been fully adopted. Australia has approximately 500,000 construction organisations in 2025 (ABS 2025), making competition high and new productivity enhancements critical. Contractors have tried many ideas to find answers; they must. This paper asserts that a granular, straightforward system serves as a building block in a complex, highly uncontrollable operation—constructing or rehabilitating an infrastructure or shelter. Simplicity enables faster task completion – it aligns with most client requirements.

A project-centric information collection and confirmation system enables better planning and proactive task management. Information collection and confirmation need time to complete with quality and accuracy, improving collaborative planning and reducing replanning at the installation stage. Replanning is necessary once installation begins due to the complexity of the inputs and many uncontrollable factors. Management tasks completed on time enable fully supported worker installations, resulting in higher quality. Project Management Intensity is critical if support is to be given in a timely and adaptable manner. A system of measurement prompts better practices and proactivity.

The optimum process (Figure 1) and the productivity cycle in Figure 4 could be used by other researchers as diagnostic tools to assess a completed project. Figure 1 shows the needed order and timing of steps. Indeed, instances of Figures 2 and 3 would be opportunities for improvement. Figure 4's cycle would display the elapsed time of each cycle, illustrating the learning curve (or lack thereof). The project executive can inspect these artefacts at any moment; thus, coaching can be performed in real time. This paper's multistep model prompts early information collection and collaborative planning of who, what, why, where, when, and how in installations. In post-job reviews, daily logs, project narratives, meeting notes, etc., you can gain insight into the effectiveness of a project's team's actions.

5. Conclusions

This paper's recommended granular multistage process will construct or rehabilitate any structure, vertical or horizontal. It is a key component of a system-of-systems approach for construction contractors. The client does not compensate for the four steps in Figure 4; only completing the fifth generates payment. This clarity points toward the efficiency needed for the enabling and perfecting steps. Performing these in order and speed can improve quality, cost, and schedule performance compared to the average contractor. The researcher used two corrupted scenarios for contrast.

Teaching a simplified approach as a starting point enlightens everyone and improves performance. Simplicity means speed. Complexity is challenging to learn, measure, and improve. If a straightforward method is adopted, those on the receiving end—the field worker—who need items and support actions can now know what to expect and, at times, demand. Problems can be identified and rectified, thereby improving profitability and enabling continuous

improvement. Technology can enhance efficacy at these stages. However, as it currently stands, construction software does not support best practices (Stevens et al. 2025).

Construction needs a unified productivity method. This paper distils one based on a TQM methodology. However, PDCA was created for the manufacturing industry. This paper examined the model's limitations and proposed a solution based on the characteristics of contracting. Completed tasks comprise a finished project. A typical project requires numerous physical installation activities performed by uniquely qualified crews that are not multi-skilled. As an improvement, the half-dozen management activities that support trade professionals' on-site tasks, done on time, will ultimately deliver quality, cost, and schedule. Project inputs behaviours produce results; when inconsistent with the optimum scenario, they negatively affect quality and productivity. The model can be used as a diagnostic tool in post-job reviews to prompt continuous improvement.

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