

A PDCA+C FRAMEWORK FOR COMMUNICATION-ENABLED CONTINUOUS IMPROVEMENT: IMPLICATIONS FOR OPERATIONAL PERFORMANCE AND QUALITY MANAGEMENT SYSTEMS

Oleh Popyk¹

Received 02.02.2026.

Revised 19.04.2026.

Accepted 05.05.2026.

Keywords:

Quality, QM, continuous improvement, QMS, PDCA, PDCA+C.

Original research



ABSTRACT

This study examines the integration of communication into continuous improvement systems through an extension of the Plan-Do-Check-Act approach. The objective is to determine whether communication can be structured as a transversal and managed dimension within quality management frameworks. The scope includes analysis of the harmonized structure of international management system standards and selected excellence models. A qualitative methodology based on literature review, conceptual synthesis, and comparative framework analysis is employed. The results indicate that communication is implicitly embedded across all phases of improvement but lacks formal integration as a quality-critical factor. The proposed extended model addresses this gap by positioning communication as a unifying element supporting alignment, coordination, evaluation, and improvement. The findings suggest that this approach enhances the effectiveness and coherence of quality management systems, particularly in complex and knowledge-intensive organizational environments.

© 2026 Journal of Innovations in Business and Industry

1. INTRODUCTION

The Plan-Do-Check-Act (PDCA) cycle is widely recognized as one of the most influential frameworks in the history of quality management (QM). Rooted in the work of Walter A. Shewhart and later popularized by W. Edwards Deming, PDCA provides a structured, iterative approach to continuous improvement that has been applied across manufacturing, services, education, healthcare, and public administration (Shewhart, 1923; Deming, 1986; Moen & Norman, 2010).

Despite its enduring relevance, the classical PDCA model was developed within an industrial paradigm that was characterized by relatively stable processes, hierarchical organisational structures and clearly defined roles. Contemporary organizations increasingly operate under markedly different conditions. They are embedded

in complex stakeholder environments, rely heavily on knowledge and creativity, and face growing demands for transparency, participation, responsiveness and digital transformation. These changes have exposed conceptual and practical limitations in traditional QM models, including PDCA.

One of the most significant limitations of PDCA in its classical formulation is the implicit treatment of communication. Although communication is essential for planning, implementation, evaluation, and correction, it is not regarded as a distinct quality process. Instead, communication is typically assumed to occur naturally as part of managerial activity, or separated process, with some distance from quality topic. This assumption is increasingly problematic in organizational contexts where quality outcomes depend not only on technical

¹ Corresponding author: Oleh Popyk
Email: o.v.popik@gmail.com

compliance but also on shared understanding, interpretation, and collaboration.

A growing body of empirical research indicates that many quality failures are not caused by inadequate procedures or insufficient technical knowledge, but by breakdowns in communication among individuals, teams, and stakeholder groups (Tourish & Robson, 2006). Misalignment of expectations, ambiguous quality criteria, delayed feedback, and ineffective knowledge transfer frequently undermine improvement initiatives, even when formal PDCA structures are in place.

Moreover, contemporary QM theory increasingly prioritizes soft factors or skills, such as organizational culture, leadership, employee engagement, and stakeholder relationships as critical determinants of performance (Oakland, 2014; Sila & Ebrahimpour, 2005). Communication is a foundational element underlying all these factors, yet it remains under-theorized in classical continuous improvement models. As a result, organizations may implement PDCA cycles formally while failing to achieve meaningful or sustainable improvement.

This conceptual gap suggests the need for an expanded framework that preserves the strengths of PDCA while explicitly addressing the communicative processes that enable it to function effectively in complex organizational settings. The PDCA+C (where C means communication) model responds to this need by introducing communication as an explicit, transversal dimension of continuous improvement. Rather than positioning communication as an additional step, PDCA+C conceptualizes it as a systemic quality function that permeates and connects all phases of the improvement cycle. By making communication visible, manageable, and measurable, PDCA+C aligns continuous improvement with contemporary organizational realities. It provides a theoretical foundation for integrating stakeholder dialogue, feedback mechanisms, and knowledge-sharing practices into quality management systems (QMS).

The purpose of this research is to establish the conceptual necessity of extending the classical PDCA cycle, review the theoretical foundations of PDCA, examine communication as a critical quality factor, and develop the PDCA+C framework applicable for all types of organizations.

2. METHODOLOGY

This article aims to conceptualize and analyze the integration of communication into the classical PDCA cycle through the development of the PDCA+C model. The central research question guiding this study is whether communication can be formally positioned as a transversal and managed quality dimension within continuous improvement systems.

The starting point of the research was a theoretical analysis of literature defining the PDCA cycle, continuous improvement and organizational

communication. The objective was to identify how communication is treated within established improvement frameworks and whether it is conceptualized as a structural component or merely an implicit support mechanism of QMS.

The following keywords were used in the literature search process across academic databases (Scopus and Web of Science): “PDCA cycle”, “continuous improvement”, “quality management systems”, “ISO standards” and “organizational communication”. Selected articles and foundational works were analysed to clarify the characteristics of the PDCA model and to explore intersections between communication theory and QM.

This theoretical review was followed by a conceptual gap analysis comparing classical PDCA formulations, Internal Standard Organization (ISO) standards requirements, and communication theories. The analysis revealed that while communication is implicitly present in all PDCA phases, it is not explicitly defined as a managed quality dimension.

Based on this insight, the PDCA+C model was constructed as a qualitative conceptual framework. The model positions communication as a transversal element intersecting the Plan, Do, Check, and Act phases. Its structure was validated through analytical mapping against ISO series of standards and relevant scientific research.

The methodological framework therefore combines theoretical synthesis, conceptual modeling, and structural validation, resulting in a qualitative system-based model that integrates communication into continuous improvement logic.

3. THEORETICAL FOUNDATIONS OF PDCA APPROACH AND THE ROLE OF COMMUNICATION

3.1 PDCA approach and Continuous Improvement

The theoretical foundations of the PDCA cycle are deeply embedded in the evolution of QM theory and reflect a broader epistemological shift toward learning-oriented organizational control. Although commonly attributed to W. Edwards Deming (1986), the intellectual origins of PDCA can be traced to Walter A. Shewhart’s (1931) work on statistical process control in the early twentieth century. Shewhart conceptualized quality improvement as a cyclical process of specification, production, and inspection, empirical observation and iterative learning as mechanisms for reducing variation. Deming later reformulated and popularized this logic into what became widely known as the PDCA cycle, positioning it as a universal method for continuous improvement across organizational contexts (Deming, 1986). Importantly, Deming did not view PDCA as a mechanical problem-solving tool but as a scientific method adapted for management practice. The cycle embodies a hypothesis-testing logic in which plans are

treated as assumptions to be tested through action, evaluated through evidence, and refined through learning. In this sense, PDCA reflects a pragmatic philosophy of knowledge creation grounded in experience and reflection.

PDCA also occupies a central position within the broader family of continuous improvement methodologies. Concepts such as Kaizen, Total Quality Management (TQM), Lean management, and Six Sigma all incorporate PDCA logic, either explicitly or implicitly, as a foundational improvement mechanism (Imai, 1986; Oakland, 2014; Sokovic et al., 2010). In TQM, PDCA underpins the principle of continuous improvement by linking strategic objectives with operational execution and evaluation. In Lean management, PDCA is embedded in routines such as A3 problem-solving and daily management practices. In Six Sigma, the DMAIC cycle can be interpreted as a more structured and data-intensive variant of PDCA. More importantly, the PDCA principle underpinned the methodological architecture of a family of ISO management system standards, serving as a unifying mechanism that ensures cross-functional integration and coherence across diverse organizational domains.

The PDCA approach is widely applied across organizations from different sectors of the economy, including manufacturing and automotive industry (Realyvásquez-Vargas et al., 2018; Pérez-Vicente et al., 2024), construction and engineering (De Cossio et al., 2025), services (Mosqueira-Stucchi et al., 2023), healthcare (Wang & Wei, 2024; Naughton et al., 2024), education (Zakharova, 2025; Mergen et al., 2014; Casanove et al., 2022; Fu & Liu, 2022; Samuela & Farrer, 2025), and public administration (Boniface & Sambumbu, 2017). In these settings, quality is often multidimensional and partially subjective, and improvement efforts rely heavily on interpretation, negotiation, and collaboration (Dahlgaard-Park et al., 2013). As a result, the theoretical assumptions underlying PDCA require reinterpretation.

Wolniak and Tomecki (2024) provide a more detailed and context-specific analysis of the possibilities and nuances of PDCA cycle implementation within the framework of Industry 4.0, emphasizing the role of digitalization, real-time data, and adaptive QMS. From a theoretical standpoint, this suggests a need to complement the procedural logic of PDCA with a communicative logic. While PDCA provides a structure for action and reflection, it does not explicitly theorize how shared understanding is produced or maintained throughout the improvement cycle. Communication is implicitly present but conceptually underdeveloped. This omission becomes critical in contexts where quality outcomes depend on alignment among diverse stakeholders with different professional languages, values, and expectations. Within this integrative perspective, communication emerges as a foundational mechanism that enables PDCA to function as intended. In general, the idea of PDCA-based improvement, or more precisely continuous evolution, is not new. The

PDCA cycle has been adapted across various domains to support learning, innovation, and process enhancement. For example, Mergen et al. (2014) proposed the use of PDCA stages as a pedagogical framework for teaching software engineering concepts and evaluating student learning outcomes, referring to this adaptation as the learning PDCA (l-PDCA) model.

The literature analysis is complemented by a conceptual comparison of PDCA with alternative improvement models, such as the 4P's cycle (Prepare–Perform–Perfect–Progress), which emphasizes process management over inspection-based control (Gupta, 2006). This enables a deeper understanding of continuous improvement as an evolving rather than static concept. Knop and Mielczarek (2015) analysed various modifications of the traditional PDCA cycle, including OPDCA (Observe, Plan, Do, Check, Act), EPACA (Evaluate, Plan, Action, Check, Amend), and PDAC (Plan, Do, Act, Challenge), highlighting their adaptation to different improvement contexts and organizational needs.

Thus, while PDCA remains theoretically robust as a model of iterative learning and systemic improvement, its classical formulation reflects historical assumptions that limit its explanatory power in complex, knowledge-intensive environments, such as nowadays in a quality context commonly called Quality 4.0, or even Quality 5.0 in a more recent study (Antomarioni et al., 2025). Recognizing these limitations does not diminish the value of PDCA, rather, it opens space for theoretically grounded extensions. The PDCA+C model builds upon the established foundations of continuous improvement theory while explicitly incorporating communication as a quality-critical dimension. This extension preserves the epistemological core of PDCA while enhancing its relevance for contemporary organizational contexts (Popyk, 2023).

3.2 Communication as a Critical Quality Factor

The role of communication in organizational performance has been extensively examined across multiple disciplines, including management studies (Baran et al., 2025), organizational behavior, communication science (Gardi et al., 2021), and quality management (Zulch, 2014; Özkan, 2025). Despite this breadth of research, communication has historically occupied an ambiguous position within QM theory. While widely acknowledged as important, it has often been treated as an enabling or contextual factor rather than as a core component of QMS.

It's quite natural, that communication should be considered an essential component of management strategy, not just as a source of information, but also as a method for inclusion, analysis, and group decision-making (Qerimaj–Lushtaku & Bellaqa, 2025). Numerous researchers have examined the role of communication in QM and its interconnections. Quality results from the interplay among scope, cost, and time, while communication integrates these elements to ensure a

high-quality outcome. Communication serves as the key area for unifying project management, rather than integration alone. As highlighted in the literature, integration cannot function effectively without communication as its foundation, therefore, communication is regarded as the essential element that cohesively links all areas together (Zulch, 2014). As far as communication is fundamental to any kind of organized form of management in organizational context, it concerns the channel, the forms and conventions and the methods or strategies for achieving communication objectives at work (Samsudin et al., 2017).

Early QM frameworks, including TQM, implicitly recognized the importance of communication through principles such as employee involvement, customer focus, and leadership commitment. Foundational TQM scholars emphasized the need for shared values, organizational learning, and cross-functional collaboration, all of which depend on effective communication (Oakland, 2014). Some of the research declared that one of the causes of failure in implementing TQM is that the management of communication strategies are not fully in place (Samsudin, Jalil and Ibrahim, 2017). However, these contributions rarely conceptualize communication as a distinct process subject to systematic planning, measurement, and improvement.

In quality communication, the communication process gets its input when the management defines the needs and targets for it. The process includes the delivery of the communication product, the reception of the message, and its processing in the minds of the target audience (Stanciu, Condrea & Zamfir, 2016). Communication must have a purpose, whether it be through formal or informal channels (Qerimaj–Lushtaku & Bellaqa, 2025). This strategic definition of communication could become a part of quality policy or communication policy as a part of QMS documented information.

Özkan (2025) examined the impact of ISO 21001:2018 and ISO 9001:2015 on organizational communication, finding that 75.9% of respondents perceived a positive effect on communication flow within the university, indicating enhanced communication practices. We must admit also that ISO standards have evolved in defining communication functions. For instance, p. 7.4 ISO 9001:2015 (ISO, 2015) outlines basic requirements for organizations to establish internal and external communications relevant to the QMS. Newer standards, such as ISO 10012:2026 (ISO, 2026), offer detailed guidance, requiring data to be clear and concise for all parties, mandating ethical policies to protect data integrity, and emphasising organisational responsibility. The relationship between communication and quality is further illuminated by organizational learning and knowledge management theories (Senge, 2006). Continuous improvement depends on the ability of organizations to generate, share, interpret, and apply knowledge derived from experience. Communication is the primary mechanism through which this knowledge is transferred and transformed. It is not a static construct,

but deeply influenced by social norms, power relations, and technological mediation. What constitutes effective communication in one culture or setting might be received differently in another. As organizations become more diverse and globalized, the ability to adapt communicative approaches becomes central to relationship management (Gardi et al., 2021). De Cossio et al. (2025) highlighted that effective communication and knowledge management remain significant challenges. In particular, the establishment of a robust platform for disseminating process improvements derived from time–motion studies, as well as the creation of an accessible knowledge repository for new team members, is essential. Such systems ensure consistent knowledge transfer and reduce reliance on informal communication or individual memory. The needs of skills, organization and coordination, management and communication, etc., promote the continuous spiral improvement of the quality of teachers and improve the management quality of teachers (Fu & Liu, 2022).

Contemporary QM increasingly extends beyond internal processes to encompass relationships with external stakeholders. Communication within QM is not like classical communication, because of the specificity of this subject, so far successful QMS implementation projects, the existence of effective communication between stakeholders is a vital element (Stanciu, Condrea & Zamfir, 2016). Customer satisfaction, user experience, and social legitimacy have become central quality dimensions, particularly in service and public-sector organizations. This shift has elevated the importance of stakeholder communication as a quality determinant. Without clear, empathic, and open communication, messages can be misunderstood, which in turn can lead to disharmony and rifts within the team or organization as a whole, because high-quality communication strengthens relationships and improves organizational performance (Gardi et al., 2021). Clear communication is a key consideration in the effective implementation of the PDCA cycle within a university context as well (Samuela & Farrer, 2025).

The reviewed literature converges on a critical insight: communication is a foundational mechanism through which quality objectives are interpreted, enacted, evaluated, and revised. While PDCA provides a robust structure for iterative improvement, its effectiveness depends on communicative processes that are insufficiently theorized in its classical form. Failures in PDCA implementation are frequently attributable to communication breakdowns, such as unclear planning assumptions, inadequate feedback during execution, superficial evaluation, or poorly explained corrective actions. These issues are not peripheral but strike at the core logic of the cycle.

Through the PDCA+C conceptual framework, a dualistic nature can be observed. On the one hand, communication represents an essential component of each PDCA phase, contributing critically to its effective implementation. On the other hand, the effective application of the PDCA+C

approach positively influences the performance of the QMS and enhances overall organizational effectiveness. While quality improvement and PDCA as a methodology to drive continuous improvements is already widely recognized and has been discussed and developed many times in organizations and literature and merged with other continuous improvements methods and tools there is a gap in the literature in relation to the need for a structured and procedural guide for process improvement that aligns with other systems within a company (Naughton et al., 2024). Such a guide could potentially increase participation levels, embed a desired culture, improve collaboration, effectiveness, and efficiency of process improvement projects and manage process improvement projects within the context of a broader continuous improvement framework, including communication part.

Consequently, there is a strong theoretical basis for extending PDCA to explicitly incorporate communication as a continuous, managed quality function. By doing so, the PDCA+C model responds directly to insights from QM, organizational communication, and learning theories. It acknowledges that continuous improvement is not only a technical cycle of action but also a communicative process of shared meaning-making and collective learning.

4. CONCEPTUAL BASIS OF THE PDCA+C FRAMEWORK

The preceding sections have established two foundational premises. First, the PDCA cycle remains a theoretically robust and widely accepted framework for continuous improvement. Second, communication has been empirically and theoretically demonstrated to be a quality-critical factor that is insufficiently conceptualized within classical PDCA-based models. Building on these premises, this section develops the PDCA+C model as a theoretically grounded extension of the Deming cycle, designed to enhance its applicability in complex organizational contexts.

4.1 Conceptual Logic of the Extension

The extension of PDCA with an explicit communication dimension is not intended to replace or disrupt the original logic of the cycle, rather, it seeks to make explicit what has historically remained implicit. Deming’s philosophy consistently emphasized the importance of understanding, cooperation, and learning; however, these elements were not formalized as distinct process components. The PDCA+C model responds to contemporary organizational realities by transforming communication from an assumed background condition into a managed quality function. Conceptually, PDCA+C rests on the assumption that continuous improvement is both a technical and a communicative process. Technical processes concern the design, execution, measurement, and correction of activities. Communicative processes

concern how objectives are interpreted, how knowledge is shared, how feedback is exchanged, and how meaning or sense is constructed among stakeholders. Quality improvement emerges from the interaction between these two dimensions.

This dual-process logic aligns with socio-technical systems theory, which argues that organizational performance depends on the joint optimization of technical and social subsystems (Ang et al., 2025). PDCA has traditionally emphasized the technical subsystem, while PDCA+C explicitly integrates the social and communicative subsystem into the improvement cycle. Effective communication is not only a technical process but a cultural and strategic element of organizational life that can influence employee satisfaction, motivation, and overall operational efficiency (Baran et al., 2025).

A critical conceptual decision in developing PDCA+C concerns the structural positioning of communication phase. Rather than adding communication as a fifth sequential step (e.g., Plan–Do–Check–Act–Communicate), the model conceptualizes communication as a transversal, continuous dimension that permeates all phases of the cycle.

This positioning reflects three theoretical considerations:

- non-linearity of communication: communication does not occur at a single point in time but continuously before, during, and after action;
- integrative function: communication connects planning assumptions with execution realities, evaluation results with learning, and corrective actions with acceptance;
- recursive influence: communication shapes each PDCA phase while simultaneously being shaped by them.

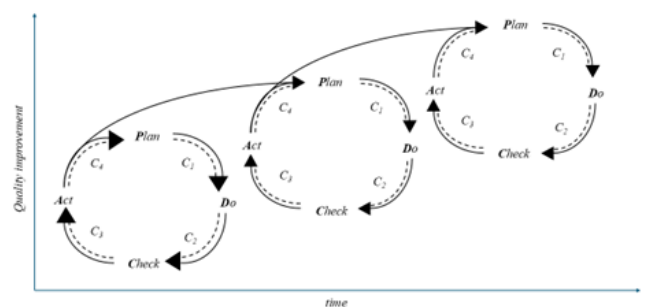


Figure 1. PDCA+C framework graphical view

Graphically, PDCA+C can be represented as a traditional PDCA cycle interwoven with a communicative layer, marked as C1, C2, C3, C4 stages relative to each phase of cycle. This representation underscores that communication both supports and constrains the effectiveness of improvement activities (Figure 1).

The PDCA cycle is more than just a tool; it is a concept of continuous improvement processes embedded in the organization’s culture. The most important aspect of PDCA lies in the “act” stage after the completion of a

project when the cycle starts again for the further improvement (Sokovic et al., 2010). This explains the evolution spiral, which replicates the PDCA+C cycle at a higher level with an improved quality grade.

Within the PDCA+C model, *communication is defined as systematic planning, execution, evaluation, and improvement of information exchange, dialogue, and feedback among all stakeholders involved in QM processes and organization performance*. This definition emphasizes several key attributes of communication, such as systematic (structured and intentional, not ad hoc process), bidirectional (flows vertically, horizontally, and also externally), stakeholder-inclusive (extends beyond internal actors to include users, audiences, partners, and communities), improvement-oriented (processes themselves are subject to evaluation and refinement). By framing communication in this way, PDCA+C aligns with contemporary views of QM that emphasize engagement, involvement, participation, transparency, and learning as key divisions.

4.2 Communication functions across PDCA phases

Communication is an essential element for the optimal functioning of any organization, regardless of its nature or size, especially as it operates in a turbulent external environment where globalization, internationalization, market liberalization, and digitalization are encountered at every turn (Qerimaj–Lushtaku & Bellaqa, 2025). The conceptual value of PDCA+C becomes evident when examining how communication operates within each phase of the PDCA cycle.

- In the Plan phase, communication enables the translation of strategic quality objectives into shared understanding. This includes articulating quality policies, clarifying expectations, and aligning stakeholders around common goals. Without effective communication at this stage, planning risks becoming a purely formal exercise disconnected from operational realities.
- In the Do phase, communication supports coordination, knowledge sharing, and adaptive problem-solving. Continuous feedback among actors allows deviations to be identified early and adjustments to be made without disrupting the overall process.
- In the Check phase, communication facilitates the interpretation of performance data and feedback. Measurement alone does not produce learning; it is the communicative process of discussing results, questioning assumptions, and contextualizing findings that transforms data into actionable knowledge. Open and transparent communication is essential to avoid defensive behaviors and superficial compliance.
- In the Act phase, communication legitimizes change. Corrective and preventive actions often require behavioral and cultural adjustments, not merely technical fixes. Communicating the

rationale for decisions, acknowledging contributions, and reinforcing learning outcomes increases acceptance and sustainability of improvements.

Effective communication is not only an operational requirement but also a strategic tool for economic development and enhancing organizational performance. Communication is a critical component in management decision-making, since it influences the quality and effectiveness of decisions taken in each enterprises. Clarity of communication promotes better understanding of information, reduces misconceptions, and allows for more accurate and coordinated decisions (Qerimaj–Lushtaku & Bellaqa, 2025). A central theoretical contribution of PDCA+C lies in its explicit orientation toward organizational learning. While classical PDCA implicitly supports learning through iteration, PDCA+C foregrounds the communicative processes that enable learning to occur. This emphasis aligns the model with learning organization theory (Senge, 2006). By embedding communication within each PDCA phase, the model creates structured opportunities for reflection, dialogue, and knowledge exchange. These opportunities are essential for challenging existing assumptions and fostering innovation, particularly in environments characterized by uncertainty and ambiguity.

Communication within an organization is a multifaceted process that encompasses various forms, directions, and functions. It plays a vital role not only in operational efficiency and employee engagement but also in shaping organizational culture and values. Both vertical and horizontal communication flows, along with verbal and non-verbal elements, contribute to the development of mutual trust, loyalty, and a sense of shared purpose. At the same time, communication challenges such as information overload or hierarchical distortion can hinder cooperation and productivity. Therefore, establishing effective, two-way communication systems remains a priority for modern organizations (Baran et al., 2025). From a theoretical standpoint, PDCA+C contributes to QM literature in three key ways.

- First, it extends to a classical model without contradicting its philosophical foundations.
- Second, it integrates insights from communication and learning theories into continuous improvement.
- Third, it provides a context-sensitive framework applicable to organization from different economic sectors.

In doing so, PDCA+C reframes continuous improvement as not only a cycle of actions, but as a communicative process of shared meaning-making and collective learning. This reframing responds directly to the challenges faced by contemporary organizations and offers a theoretically robust foundation for future empirical research.

5. APPLIED PRINCIPLES AND OPERATIONALIZATION OF PDCA+C FRAMEWORK

5.1 Applied principles of PDCA+C framework

While the conceptual value of explicitly integrating communication into the PDCA cycle is theoretically compelling, its practical relevance depends on the extent to which communication can be operationalized within QMS. This section translates the communication dimension of the PDCA+C model into concrete managerial mechanisms, process structures, and evaluation indicators. By doing so, it demonstrates that communication is not merely a normative ideal but a manageable and improvable quality process.

In the PDCA+C framework, communication is treated as a process with inputs, activities, outputs, and outcomes, analogous to other quality-critical processes. Inputs include strategic objectives, stakeholder expectations, and performance data. Communication activities encompass meetings, documentation, feedback systems, digital platforms, and informal dialogue. Outputs take the form of shared understanding, coordinated action, and documented learning, while outcomes include improved process performance, stakeholder satisfaction, and organizational learning.

Table 1. PDCA+C framework implementation tools and mechanisms

PDCA+C phase	Tools, mechanisms & practices
Plan	Stakeholder mapping and communication needs analysis Participatory goal-setting workshops Clear articulation of quality criteria and success indicators Documentation of assumptions and constraints
Do	Regular team briefings and check-ins Cross-functional coordination meetings Digital collaboration platforms Mechanisms for reporting deviations or ideas
Check	Transparent presentation of performance results Facilitated reflection sessions Open discussion of deviations and root causes Inclusion of qualitative feedback alongside quantitative indicators
Act	Clear explanation of decisions and their rationale Feedback on how input was considered Recognition of contributions to improvement Documentation and dissemination of lessons learned

This process-oriented view aligns with ISO’s standards emphasis on the process approach and risk-based thinking, reinforcing the compatibility of PDCA+C with established quality standards. Importantly, it allows

communication to be planned, monitored, and improved using the same logic applied to operational processes (Table 1).

In practical organizational settings, the introduction of communication as a structured and continuously managed element within the PDCA cycle can have direct implications for operational performance. Many inefficiencies in quality management systems do not arise from the absence of procedures, but from delays, misunderstandings, and fragmented information flows between stakeholders. By making communication an explicit part of each improvement phase, PDCA+C helps reduce these gaps, enabling faster identification of problems and more coordinated responses. In such a way, organizations can expect not only improved clarity in decision-making processes, but also measurable benefits such as reduced rework, shorter response times, and more stable execution of quality-related activities.

The PDCA+C framework is grounded in a set of applied principles that operationalize the integration of communication within continuous improvement processes.

These principles extend the traditional logic of the PDCA cycle by positioning communication as a transversal and quality-critical dimension.

- First, the principle of communication as a continuous process emphasizes that communication is not limited to a single phase but operates across all stages of the improvement cycle. Effective planning requires shared understanding of objectives, execution depends on coordinated information exchange, evaluation relies on transparent feedback, and improvement requires the dissemination of lessons learned.
- Second, the principle of alignment and shared understanding ensures that all stakeholders interpret goals, processes, and outcomes consistently. This reduces ambiguity and supports coherent decision-making throughout the organization.
- Third, the principle of structured communication management highlights the need to define communication processes explicitly, including what information is communicated, to whom, when, and through which channels. This aligns with the requirements of modern quality management systems and enhances process reliability.
- Fourth, the principle of feedback-driven learning recognizes communication as the primary mechanism through which performance data, audit results, and stakeholder feedback are interpreted and transformed into actionable knowledge.
- Fifth, the principle of transparency and knowledge accessibility ensures that relevant information is available and understandable to all stakeholders, supporting accountability and continuous improvement.

- Finally, the principle of integration with organizational context underscores that communication practices must be adapted to the specific characteristics of the organization.

Together, these principles establish PDCA+C as a framework that enhances the effectiveness, coherence, and adaptability of QMS.

Effective QM involves successfully executing three activities: Quality planning, Quality assurance, and Quality control and improvement. Communication role clearly described as a part of assurance function, as far as quality assurance consists of a set of activities to properly maintain the quality levels of the products and services through documentation and formal communication channels (Pérez-Vicente et al., 2024).

Could be also added that having an effective communication plan can mitigate the perceived negative aspects of change (Naughton et al., 2024). Other QMS elements are also significantly important for the successful realization of PDCA+C framework.

A key contribution of PDCA+C is the assertion that communication can be measured without being reduced to simplistic metrics. Both quantitative and qualitative indicators are necessary to capture the richness of communicative processes. Possible indicators include communication satisfaction indices, stakeholder engagement levels, feedback response times, participation rates in quality-related discussions, quality of documented lessons learned. These indicators should be selected and adapted to organizational context, particularly depending on the level of organization culture maturity.

From a theoretical perspective, PDCA+C challenges the traditional instrumental view of QM that prioritizes control, standardization, and measurement. PDCA+C conceptualizes communication as a dynamic mechanism through which quality is interpreted, negotiated, and socially constructed. This shift aligns QM theory with organizational communication and institutional perspectives, which emphasize sensemaking, discourse, and stakeholder interaction. PDCA+C thus bridges functionalist quality models with interpretive approaches, offering a more comprehensive understanding of how quality emerges in complex environment.

Furthermore, PDCA+C contributes to the literature on continuous improvement by highlighting that learning loops are fundamentally communicative. Feedback, reflection, and adaptation depend on the quality of communication processes. By explicitly integrating communication into the PDCA logic, the model strengthens the explanatory power of continuous improvement theory. For PDCA+C to be effective, communication processes must be integrated into existing QMS rather than treated as parallel initiatives. Such integration reinforces the view that communication is not an optional soft skill but a core quality capability.

5.2 PDCA+C framework implementation in ISO Standards

The practical adoption of any conceptual quality model is strongly influenced by its compatibility with internationally recognized quality standards. ISO 9001:2015 (2015), which is now under final stage of the revision, as the most widely implemented QMS standard, is explicitly grounded in the process approach, risk-based thinking, and the PDCA cycle. Moreover, taking into account that all ISO standards have harmonized structure (Annex SL), definition of the transversal role of communication in QMS could make PDCA+C framework implementation easier and more efficient.

In real-world ISO 9001-certified organizations, communication challenges are often observed not in the absence of formal procedures, but in their inconsistent interpretation and execution across different organizational levels. For example, operational teams may receive quality objectives that are formally defined, yet insufficiently explained in terms of practical meaning or expected behavior. Similarly, feedback from production or service environments is frequently not translated into structured knowledge for management review. Within this context, the PDCA+C framework provides a practical lens for strengthening ISO implementation by ensuring that communication is not treated as an administrative requirement, but as an active mechanism that connects strategic intent with operational reality.

ISO 9001:2015 explicitly incorporates the PDCA logic as a guiding principle for the design, implementation, and improvement of QMS (ISO, 2015). The standard encourages organizations to plan processes (Plan), implement them (Do), monitor and measure performance (Check), and take actions to improve (Act). This structure aligns directly with the classical PDCA model and reinforces its status as a core mechanism for continuous improvement. Even though the company is well organized, with specific areas and a clear distinction of functions, there are unresolved issues due to the lack of communication affecting quality. In this case, communication among operators and managers is diverted from the objective of immediate identification of effective corrective and preventive actions. Possible solutions are an improvement in data management, training, and information transfer to provide prompt responses and not overlook the quality control objectives of the processes (Pérez-Vicente et al., 2024).

However, while ISO 9001:2015 emphasizes documentation, leadership, and customer focus, communication is dispersed across multiple clauses rather than conceptualized as an integrated process. Requirements related to communication appear in areas such as leadership and commitment (Clause 5), planning (Clause 6), support (Clause 7), and performance evaluation (Clause 9). This dispersion reflects the implicit importance of communication but also creates challenges for systematic management.

The PDCA+C model provides a conceptual framework that unifies ISO 9001's communication-related requirements under a single, coherent dimension. By treating communication as a transversal quality process, PDCA+C clarifies how information exchange supports the functioning of the entire QMS.

Clause 7.4 (Communication) of ISO 9001:2015 requires organizations to determine what, when, with whom, and how to communicate. PDCA+C operationalizes this

requirement by embedding communication planning, execution, evaluation, and improvement within each PDCA phase. This approach moves beyond compliance and supports meaningful implementation. The alignment between PDCA+C and ISO 9001:2015 can be illustrated through clause mapping (Table 2).

Table 2. PDCA+C implementation throw ISO standards structure logic

ISO clause according to Annex SL	Function	PDCA+C aspects
Clause 1: Scope	Defines the intended outcomes.	Communication ensures a shared understanding of the scope, purpose, and intended outcomes of the management system across the organization and relevant stakeholders.
Clause 2: Normative References	Related standards or documents.	Communication supports awareness and accessibility of referenced standards, ensuring consistent interpretation and application.
Clause 3: Terms and Definitions	Standardized definitions.	Communication ensures consistent understanding and reduces ambiguity in quality-related concepts.
Clause 4: Context of the Organisation	Internal/external factors and stakeholders.	Communication enables identification and alignment of stakeholder expectations, facilitating shared understanding of organizational context.
Clause 5: Leadership	Commitment and accountability of top management.	Leadership communicates vision, policy, and strategic direction, ensuring engagement, alignment, and a quality-oriented culture.
Clause 6: Planning	Risks, opportunities, and objectives.	Communication ensures clarity of objectives, risks, and opportunities, enabling coordinated planning and informed decision-making.
Clause 7: Support	Resources, competence, awareness, and documentation	Communication facilitates competence development, awareness, knowledge sharing, and effective use of documented information (including structured communication processes).
Clause 8: Operation	Execution of management system processes.	Communication supports coordination of activities, real-time information exchange, and effective interaction with internal and external stakeholders.
Clause 9: Performance Evaluation	Monitoring, measurement, and analysis.	Communication ensures dissemination and interpretation of performance data, audit results, and feedback for informed evaluation.
Clause 10: Improvement	Corrective actions and continuous improvement	Communication enables sharing of lessons learned, corrective actions, and improvement initiatives, supporting organizational learning and change implementation.

ISO 9001:2015 places significant emphasis on risk-based thinking, requiring organizations to identify and address risks and opportunities that may affect quality outcomes. Misunderstood objectives, delayed feedback, and stakeholder misalignment can all undermine quality performance. PDCA+C explicitly incorporates communication risk into quality planning and improvement. By identifying communication breakdowns as potential sources of nonconformity, organizations can proactively design mitigation strategies such as feedback mechanisms, clarification protocols, and participatory evaluation processes. From a certification and auditing perspective, PDCA+C offers practical advantages. Auditors frequently emphasize evidence of effective communication, leadership engagement, and employee awareness. By documenting communication processes and indicators within PDCA cycles, organizations can demonstrate conformity more convincingly. Moreover, PDCA+C supports management review by providing structured

insights into how communication affects quality performance. This enhances the analytical depth of reviews and supports data based decision-making. Although communication is often considered a qualitative aspect of organizational behavior, PDCA+C assumes that it can be systematically observed and improved through appropriate indicators. These do not need to reduce communication to purely numerical values, but rather to provide structured insight into how effectively information flows within the system. Examples may include the timeliness of feedback exchange, the level of stakeholder participation in improvement discussions, or the degree to which corrective actions are clearly understood and implemented. When monitored consistently, such indicators can help organizations identify weak points in communication chains and support more evidence-based management decisions within the continuous improvement cycle.

Beyond these frameworks, PDCA+C is also applicable in other management system standards derived from the Annex SL structure, such as ISO 14001 (environmental management), ISO 45001 (occupational health and safety), and ISO 27001 (information security). In all these systems, effective communication is essential for risk awareness, behavioral compliance, incident reporting, and organizational learning. By explicitly integrating communication into each phase of the improvement cycle, PDCA+C strengthens both compliance and performance outcomes.

5.3 Applicability of PDCA+C beyond ISO Standards

While ISO frameworks standards particularly ISO 9001:2015 (2015) provide a primary reference point for structuring QMS, the PDCA+C model is not limited to ISO-based environments. Its conceptual logic is inherently adaptable and aligns with a broader range of excellence models and sector-specific standards. In this sense, PDCA+C should be understood as a meta-framework that enhances existing systems by explicitly integrating communication as a transversal and managed dimension of continuous improvement.

A notable example is the EFQM Excellence Model, which emphasizes leadership, strategy, people, partnerships, and processes as drivers of organizational performance. EFQM Excellence Model represents a practical, non-prescriptive framework that provides organizations with a common vocabulary and shared way of thinking, thereby facilitating the effective communication of ideas both internally and externally (Sokovic et al., 2010). Within EFQM, communication is implicitly embedded in concepts such as “creating a sustainable future,” “leading with vision, inspiration and integrity,” and “managing with agility.” However, similar to PDCA, communication is not formalized as a standalone operational dimension. The PDCA+C model complements EFQM by providing a structured mechanism to operationalize communication across enablers and results, thereby strengthening coherence, alignment, and stakeholder engagement.

Importantly, the applicability of PDCA+C extends beyond formal standards into less structured organizational environments, including small and medium-sized enterprises (SMEs) and public institutions. In such contexts, where formalized procedures may be less rigid and outcomes more interpretive, communication becomes a primary mechanism for coordination, meaning-making, and value creation. The PDCA+C model provides a flexible yet structured approach that supports both accountability and creative autonomy. From an economic sustainability perspective, PDCA-driven integration of scheduling, cost control and business intelligence dashboards, including the proposed PDCA+C framework, improves predictability and shortens decision-making and validation cycles. Faster, more transparent verification processes contribute to improved cash flow stability and

reduced transaction costs, thereby supporting the economic resilience (Çelik, Pleşcan & Alpkökin, 2026). PDCA+C approach could also positively contribute in healthcare. In the context of communication, Wang and Wei (2024) highlight that the structured nature of the PDCA method can contribute to reducing anxiety and depression among patients by improving clarity, consistency, and the effectiveness of communication between healthcare providers and patients. In this context, communication functions become an integral part of the PDCA+C framework, ensuring that information is consistently and effectively exchanged between healthcare providers and patients.

Overall, PDCA+C offers a unifying conceptual lens that bridges multiple quality and excellence frameworks. By transforming communication from an implicit assumption into an explicit, manageable, and improvable dimension, the model enhances the effectiveness, adaptability, and relevance of continuous improvement systems across sectors and organizational contexts.

6. CONCLUSION

This paper proposed and developed the PDCA+C model as an extended framework for QM, emphasizing the central role of communication in continuous improvement processes. Building on the classical PDCA cycle, the model responds to contemporary organizational challenges characterized by complexity, stakeholder diversity, and digital transformation. By introducing communication as an explicit and transversal dimension, PDCA+C enhances both the conceptual coherence and practical applicability of QMS.

The primary contribution of this study lies in reconceptualizing communication from a supporting activity to a core quality mechanism. While existing quality frameworks implicitly acknowledge the importance of communication, they rarely integrate it systematically into improvement cycles. PDCA+C addresses this gap by embedding communication within each phase of the PDCA logic, thereby strengthening alignment, learning, and adaptation.

Additionally, the paper demonstrated the compatibility of PDCA+C with QM standards. Rather than introducing new compliance requirements, the model enhances the implementation of existing standards by clarifying how communication supports leadership, risk management, performance evaluation and improvement.

For practitioners, PDCA+C offers actionable guidance for designing QMS that are both rigorous and context sensitive. Managers are encouraged to invest in communication competencies, participatory structures, and reflective practices. Such investments enhance employee engagement, stakeholder trust, and organizational resilience.

This study is primarily conceptual in nature, which represents both a strength and a limitation. While the PDCA+C model is grounded in established theory and practice, its effectiveness has not yet been empirically

tested across diverse organizational contexts. The proposed framework should therefore be viewed as a foundation for further investigation rather than a definitive solution. Another limitation relates to contextual variability. Communication practices are shaped by organizational culture, leadership style, and institutional environment. As such, the implementation of PDCA+C may yield different outcomes depending on these factors. Future research should empirically examine the PDCA+C model through qualitative and quantitative studies. Case studies of organizations implementing PDCA+C could provide rich insights into its practical dynamics and outcomes. Comparative studies across sectors would further clarify its generalizability.

Additionally, the development of communication-related quality indicators represents a promising research direction. Measurement tools capturing dialogue quality, stakeholder engagement, and shared understanding could

complement traditional performance metrics and enrich quality assessment.

Finally, longitudinal studies could explore how communication-centered QM influences organizational learning and sustainability over time. Such research would contribute to a deeper understanding of quality as a socially constructed and evolving phenomenon.

In conclusion, PDCA+C represents a meaningful extension of the Deming cycle, reflecting the realities of contemporary organizations and the communicative nature of quality improvement. By making communication visible, manageable, and improvable, the model offers a robust framework for advancing both theory and practice in QM.

Conflict of interest statement: The authors have declared that no competing interests exist.

References:

- Ang, K.C.S., Sankaran, S. & Liu, D. (2025). Advancing sociotechnical systems theory: New principles for human-robot team design and development. *Applied Ergonomics*, 129, 1-11, DOI: 10.1016/j.apergo.2025.104604
- Antomarioni, S., Fani, V., Bandinelli, R., Ciarapica, F.E. & Bevilacqua, M. (2025). Toward Quality 5.0: Integrating Industry 4.0, Human-Centricity, and Quality Management. *IFAC-PapersOnLine*, 59(10), 1414-1419, DOI: 10.1016/j.ifacol.2025.09.238
- Baran, D., Górka, E., Cwiąkała, M., Wojak, G., Grzelak, M., Olszyńska, K., Mrzygłód, P., Frasunkiewicz, M., Ręczajski, P., Ślusarczyk, M. & Piwnik, J. (2025). The Role of Communication in Effective Business Management. *Scientific Papers of Silesian University of Technology*, 228, 9-32, DOI: 10.29119/1641-3466.2025.228.1
- Boniface, O. & Sambumbu, A.M. (2017). Exploring the Applicability of Deming's Concept of "Continuous Improvement" in the Contemporary Public Sector Organisations. *Public Policy and Administration Research*, 5(7), 50-60. <https://www.iiste.org/Journals/index.php/PPAR/article/view/37234>
- Casanove, O., Leleu, N. & Sèdes, F. (2022). Applying PDCA to Security, Education, Training and Awareness Programs. 16th International Symposium on Human Aspects of Information Security and Assurance (HAISA), 39-48, DOI: 10.1007/978-3-031-12172-2_4
- Çelik, U., Pleşcan, C. & Alpkökin, P. (2026). Digital Integration for Sustainable Motorway Delivery: A Case Study of the Sibiu-Făgăraş Motorway, Romania. Preprints. DOI: 10.20944/preprints202602.1679.v1
- Dahlgaard-Park, S. M., Chen, C. K., Jang, J. Y. & Dahlgaard, J. J. (2013). Diagnosing and prognosticating the quality movement – A review on the 25 years quality literature (1987–2011). *Total Quality Management & Business Excellence*, 24(1–2), 1–18. DOI: 10.1080/14783363.2012.756749
- De Cossio, B., Murguia, D., Gonzalez de Cossio, J. & Gonzalez de Cossio, J.A. (2025). A structured continuous improvement process for high-rise construction using time-motion studies. Proceedings of the 33rd Annual Conference of the International Group for Lean Construction (IGLC33), 364–375. DOI: 10.24928/2025/0123
- Deming, W. E. (1986). *Out of the crisis*. MIT Press. <https://mitpress.mit.edu/9780262541152/>
- Fu, J. & Liu, X. (2022). Application Research of PDCA Cycle Theory in the Improvement of Professional Teachers' Competency in Higher Vocational Colleges. *Advances in Vocational and Technical Education*, 4, 19-26, DOI: 10.23977/avte.2022.040403
- Gardi, B., Udjari, H. & Darmawan, D. (2021). Understanding the Function of Communication in Building and Sustaining Quality Relationships Across Organizational Boundaries. *Journal of Social Science Studies*, 1(2), 245-252. <https://jos3journals.id/index.php/jos3/article/view/131>
- Gupta, P. (2006). Beyond PDCA — A new process management model. *Quality Progress*, 39(7), 45–52, https://www.researchgate.net/publication/259497347_Beyond_PDCA_-_A_new_process_management_model
- Imai, M. (1986). *Kaizen: The key to Japan's competitive success*. McGraw-Hill. <https://www.scirp.org/reference/referencespapers?referenceid=2019198>
- ISO 10012:2026 (2026). *Quality management — Requirements for measurement management systems*, 46, <https://www.iso.org/standard/10012>

A PDCA+C Framework for Communication-Enabled Continuous Improvement: Implications for Operational Performance and Quality Management Systems

- ISO 9001:2015 (2015). Quality management systems. Requirements, 40, <https://www.iso.org/standard/62085.html>
- Knop, K. & Mielczarek, K. (2015). The improvement on the basis of PDCA and SDCA cycles. *Qual. Prod. Improv.*, 3, 60–71, DOI: 10.30657/qpi.2015.03.06.
- Mergen, S. L. S., Kepler, F. N., Silva da Silva, J. P. & Cera, M. C. (2014). Using PDCA as a General Framework for Teaching and Evaluating the Learning of Software Engineering Disciplines. *ISys - Journal of Information Systems*, 7(2), 5–24. DOI: 10.5753/isys.2014.249
- Moen, R. & Norman, C. (2010). Circling back: Clearing up myths about the Deming cycle and seeing how it keeps evolving. *Quality Progress*, 43(11), 22–28. <https://asq.org/quality-resources/articles/circling-back?id=8ca4f1f71c3847a7b1d89f6e1f2f6c47>
- Mosqueira-Stucchi, A., Vassallo-Burneo, I., Flores-Pérez, A., Quiroz-Flores, J. & Collao-Díaz, M. (2023). Operations Optimization Model under the PDCA Approach to Increase the Number of Visitors in a Shopping Mall: An Empirical Research in Peru. *Journal of Economics, Business and Management*, 11(4), 196-200. <https://www.joebm.com/show-112-1154-1.html>
- Naughton, E., Moran, R., Kharub, M., Sa, J.C. & McDermott, O. (2024). A structured model for continuous improvement methodology deployment and sustainment: A case study. *Heliyon*, 10, DOI: 10.1016/j.heliyon.2024.e40034
- Oakland, J. S. (2014). Total quality management and operational excellence (4th ed.). Routledge. <https://www.academia.edu/36077225/TQM>
- Özkan, F. Z. (2025). Analysis of motivation and communication aspects in universities through ISO 21001:2018 management system standard and Total Quality Management. *International Journal of Professional Business Review*, 10(5). DOI: 10.26668/businessreview/2025.v10i5.5393
- Pérez-Vicente, H.A., Ruiz-Morales, M., Torres-Bermúdez, E.G. & Velasco-Álvarez, J. (2024). Statistical process control and PDCA for quality improvement in the mexican automotive industry. *Ingeniería Investigación y Tecnología*, 25 (01), 1-8. DOI: 10.22201/ifi.25940732e.2024.25.1.002
- Popyk, O. (2023). Conceptual and applied principles of organization context in the quality management system. *Economy of Ukraine*, 66(8 (741)), 61–77. DOI: 10.15407/economyukr.2023.08.061
- Qerimaj-Lushtaku, S., & Bellaqa, B. (2025). The role of communication in management decision-making in manufacturing enterprises. *Edelweiss Applied Science and Technology*, 9(8), 1612–1623. DOI: 10.55214/2576-8484.v9i8.9676
- Realyvásquez-Vargas, A., Arredondo-Soto, K. C., Carrillo-Gutiérrez, T. & Ravelo, G. (2018). Applying the Plan-Do-Check-Act (PDCA) Cycle to Reduce the Defects in the Manufacturing Industry. A Case Study. *Applied Sciences*, 8(11), 2181. DOI: 10.3390/app8112181
- Samsudin, S., Jalil, N.H.M. & Ibrahim, M. (2017). Exploring the Pattern of Internal Communication in Total Quality Management Implementation in Manufacturing Companies. International Conference on Communication and Media: An International Communication Association Regional Conference (i-COME'16), 33, 1-9, DOI: 10.1051/shsconf/20173300078
- Samuela, S. & Farrer, H. (2025). Integrating The PDCA Cycle for Continuous Improvement and Academic Quality Enhancement in Higher Education. *Journal of Comparative & International Higher Education*, 17(2), 115-124. DOI: 10.32674/yzwgm25
- Senge, P. (2006). The Fifth Discipline: The art and practice of the learning organization. Random House Books. <https://assets.super.so/b091f13e-a478-4b06-88d7-2f9ce25d435e/files/0dd438d1-3d0f-4f50-b290-699e09f1bbf2.pdf>
- Shewhart, W.A. (1923). Economic control of quality of manufactured product. D. Van Nostrand. <https://archive.org/details/in.ernet.dli.2015.150272>
- Sila, I. & Ebrahimpour, M. (2005). Critical linkages among TQM factors and business results. *International Journal of Operations & Production Management*, 25(11), 1123–1155. DOI: 10.1108/01443570510626925
- Sokovic, M., Pavletic, D. & Pipan, K.K. (2010). Quality Improvement Methodologies – PDCA Cycle, RADAR Matrix, DMAIC and DFSS. *Journal of Achievements of Materials and Manufacturing Engineering*, 43(1), 476-483. https://www.researchgate.net/publication/49600834_Quality_improvement_methodologies_-_PDCA_cycle_RADAR_matrix_DMAIC_and_DFSS
- Stanciu, A.C., Condrea, E. & Zamfir, C. (2016). The Importance of Communication in Quality Management. *Ovidius University Annals*, 2, 393-396, <https://ideas.repec.org/a/ovi/oviste/vxvivy2016i2p393-396.html>
- Tourish, D. & Robson, P. (2006). Sensemaking and the distortion of critical upward communication in organizations. *Journal of Management Studies*, 43(4), 711–730. DOI: 10.1111/j.1467-6486.2006.00608.x
- Wang, Y. & Wei, L. (2024). Impact of Applying PDCA Circulation Method on Surgical Care Interventions in the Operating Room on Patients Undergoing Cardiothoracic Surgery: A Retrospective Study. *Heart Surg. Forum*, 27(10), 1182–1192. DOI: 10.59958/hsf.7813

- Wolniak, R. & Tomecki, I. (2024). The usage of PDCA cycle in industry 4.0 conditions. *Scientific Papers of Silesian University of Technology*, 210, 627-638. DOI: 10.29119/1641-3466.2024.210.41
- Zakharova, Y. (2025). The Concept of Digital Transformation Management in Higher Education Institutions: A PDCA-Approach to Improving Educational Quality. *European Journal of Interdisciplinary Issues*, 2(2), 50–56. DOI: 10.5281/zenodo.16934360
- Zulch, B.G. (2014). Communication: The foundation of project management. *Procedia Technology*, 16, 1000-1009, DOI: 10.1016/j.protcy.2014.10.054

Oleh Popyk

State Organization "Institute of Market and
Economic & Ecological Researches of the
National Academy of Sciences of Ukraine",
Odesa, Ukraine

o.v.popik@gmail.com

ORCID 0000-0001-9170-2312
