Shehab, Russell, & Hamzeh (2025). From Projects to Systems: The Alberta Facilities Production System (AFPS). In O. Seppänen, L. Koskela, & K. Murata (Eds.), *Proceedings of the 33rd Annual Conference of the International Group for Lean Construction* (IGLC33) (pp. 1333–1344). https://doi.org/10.24928/2024/0294

FROM PROJECTS TO SYSTEMS: THE ALBERTA FACILITIES PRODUCTION SYSTEM (AFPS)

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ABSTRACT

The integration of academia-industry collaboration has a crucial role in advancing innovation and improving efficiency in the construction industry. Most of these collaborations remain fragmented, with academia pursuing theoretical research while industry focuses on practical business first execution. This is one of the obstacles to making Lean implementations truly effective, since continuous learning, adaptation, and system-wide integration are essential for such implementations. Although the benefits of Lean production systems are well-documented, construction projects tend to adopt isolated Lean tools on an individual project basis, lacking a structured framework for sustained implementation across many projects. This paper introduces the Alberta Facilities Production System (AFPS), a conceptual framework that bridges the academia-industry gap through the integration of Lean principles into large-scale public sector construction. Inspired by the Toyota Production System (TPS), AFPS ensures that academic research reinforces industry practice, while industry challenges and experiences drive academic research. The University of Alberta serves as a "Live Lab" to test, refine, and scale Lean strategies, in order to eventually optimize construction processes. By establishing a structured and data-driven partnership between academia and industry, AFPS aims to promote continuous improvement, waste reduction, and knowledge transfer. This paper contributes a roadmap that will help governments, universities, and industry practitioners collaborate effectively and efficiently.

KEYWORDS

Lean methods, PDCA cycle, academia-industry integration, collaborative framework, continuous improvement.

INTRODUCTION

Lean production systems are becoming increasingly popular in construction projects. In fact, many projects have already experienced the benefits of Lean construction methods, which focus on maximizing value to the owner, eliminating non-value added activities (waste), improving workflow efficiency, and pursuing perfection through continuous improvement (Howell 1999). These benefits are well-documented, and abundant evidence from numerous case studies

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provide compelling evidence of their effectiveness. However, despite this evidence, the vast majority of construction projects still follow traditional methods, rather than adopting Lean principles on a broader scale.

One reason for the slow and inconsistent adoption of Lean in construction is the misconception that a single project can operate as a self-contained Lean production system (Paez et al. 2005). However, compared to the gold standard of production systems, the Toyota Production System (TPS), this assumption falls short. In car manufacturing, an individual vehicle moves through the assembly line (Liker 2004). In construction, however, the product (a building) is too large to move through a production line and is therefore stationary. Instead, the production line, workers, materials, and equipment, moves through it (Paez et al. 2005).

The foundation of this paper is based on challenging this notion that an individual project can operate as an independent Lean production system and proposing a shift in thinking: for an organization to achieve the same long-term benefits that TPS generates for Toyota, it must establish an organization-wide lean production approach that applies across all projects, rather than treating each project as a standalone entity. By implementing a large-scale, structured lean production system, organizations can achieve more consistent improvements in cost, schedule, and quality across all their projects, rather than just a select few (Howell and Ballard 1998).

Numerous studies have examined the benefits of implementing a Lean production system in the design and construction industry, particularly at the project level. Zimina et al. (2012) documented a study conducted of 12 major capital projects using lean production systems, which reported an average of 14.83% improvement in targeted cost (when the project had not been completed) or realized cost (when the project was completed), and in the same study highlighted a case study on the Cathedral Hill Hospital Project where with a lean production system centred on target value delivery the integrated design team innovated the design from when it was cancelled at $400M over budget in 2005, to $25M below budget in 2011 after a redesign (Zimina et al. 2012). These, and many other studies, make a compelling case for a lean production approach to construction projects. Such examples illustrate the potential impact of lean construction at the project level, but they also highlight a missed opportunity to scale these improvements across entire capital portfolios.

To explore this idea, this paper presents a conceptual framework for the Alberta Facilities Production System (AFPS), which adapts the principles of TPS to a large-scale public construction portfolio. Using lean principles, AFPS is designed to provide insights into its ongoing capital projects. The Government of Alberta's capital portfolio is used in this framework due to it being the governing agency in the area in which the authors are located, which provides some ease of access to information. Additionally, the Government of Alberta's three-year capital budget is valued at approximately $25 billion, which requires a significant amount of motivated human resources (Alberta 2024).

As universities increasingly engage with industry to drive innovation and efficiency, their role as neutral facilitators in the development of industry-wide standards becomes ever more crucial. Khalife et al. (2024) emphasize that universities play a fundamental role in shaping Lean construction education and integrating research with industry best practices, ensuring continuous improvement and knowledge transfer. Unlike corporations that operate under the pressures of competitive markets, universities have the liberty to act as open arenas for research and development. This unique position allows them to lead initiatives like the AFPS, fostering collaboration and setting benchmarks that push the entire industry forward. In fact, AFPS relies on a TPS-style culture driven by the owner. Industry on their own tends to focus directly on the financial business case for their individual entities, and not so much on delivering value for the customer as the primary objective. Arguments can be made that integrating academics into the PDCA culture offers a trifecta of value. First, academics and researchers gain access to real-world situations, enhancing their ability to identify practical problems, test theory, and provide unique, unbiased perspectives. In fact, Hamzeh et al. (2015) argue that immersive learning environments, such as simulation exercises and direct collaboration with industry partners, enhance Lean construction education and facilitate smoother industry adoption. Second, designers and builders benefit from this fresh perspective and robust, objective approach, along with additional resources that, similar to Toyota, allow work to continue while resolving issues. Third, owners forge deeper and more meaningful relationships with academics and benefit from a culture of continuous improvement, as both designers and builders grow, learn, and work more efficiently.

Therefore, this paper also explores the role of academia in supporting the implementation of AFPS. The University of Alberta, as a leading research institution, provides expertise, data-driven insights, and a structured approach to continuous improvement, which can be leveraged to refine Lean strategies for large-scale construction. By integrating academic research into real-world construction processes, the AFPS framework highlights how academia-industry collaboration can enhance decision-making, problem-solving, and process optimization in public sector construction. The research conducted in support of the AFPS highlights a highly mutually beneficial relationship between integrating academia into a large-scale provincial production system. By shifting the focus from individual projects to a continuous production system at the organizational level, this research aims to provide a structured framework for integrating Lean principles into large-scale construction programs. The AFPS framework serves as a practical model for enhancing efficiency, reliability, and long-term value generation in Alberta's capital project delivery and beyond.

LITERATURE REVIEW

Numerous studies have examined academia-industry collaborations, proposing diverse models to enhance innovation and address practical challenges. These collaborations play a critical role in fostering knowledge exchange between academic and industrial parties (Bhullar et al. 2019).

KEY MODELS AND FRAMEWORKS

The "Triple Helix" model is a widely recognized framework for academia-industry collaboration, emphasizing the interaction between universities, industries, and governments to drive innovation. This model highlights the importance of universities as creators of knowledge, industries as applicators, and governments as enablers providing necessary policy and financial support (Esangbedo et al. 2024). While innovation often confers a competitive advantage, the Triple Helix model can facilitate a balanced approach where intellectual property rights are clearly delineated, ensuring that companies can participate in open innovation without forfeiting their competitive edge. Through this model, universities can act as neutral arbiters and custodians of knowledge, fostering an environment where shared innovation thrives under the protection of structured intellectual property agreements. Governments can play a crucial role by incentivizing such collaborations and establishing frameworks that support both the dissemination of knowledge and the protection of proprietary technologies. This collaboration ensures that while industries benefit from access to cutting-edge research and development, they do not have to compromise on their strategic competitive advantages. Open innovation is another influential framework, emphasizing the purposeful inflows and outflows of knowledge between academia and industry to accelerate innovation. Procter & Gamble's "Connect + Develop" program illustrates this approach, where external expertise and academic insights were leveraged to improve product development success rates and reduce costs (Saguy 2011). The Academia-Industry Collaboration Plan (AICP), as proposed by Ahmed et al. (2022), is a structured framework aimed at addressing organizational complexities in collaborative processes. It provides specific tools, methodologies, and processes to foster alignment between academic and industrial goals while mitigating conflicts (Ahmed et al. 2022).

Collaborative consortia have demonstrated their effectiveness in facilitating academia-industry partnerships. The RA-MAP consortium, a multi-partner initiative involving 21 academic and industrial organizations, successfully addresses challenges in genomic medicine through resource sharing, structured governance, and multi-stakeholder engagement (Cope et al. 2018). Additionally, government-driven initiatives have played a crucial role in fostering collaborations. In Japan, policies encouraging partnerships between universities and small and medium enterprises (SMEs) have enhanced productivity and innovation. These collaborations focus on leveraging academic expertise to solve practical problems and scale technological advancements (Arshed et al. 2022). Moreover, innovation hubs in China exemplify how academia and industry can integrate effectively. Research parks and technology clusters have facilitated the alignment of university research with industrial needs in areas such as artificial intelligence and big data. These initiatives have resulted in substantial increases in academia-industry projects and improved commercialization rates (Esangbedo et al. 2024).

Academia-industry collaborations generate mutual benefits. For academia, these partnerships provide access to real-world challenges, opportunities for applied research, and additional funding (Bhullar et al. 2019). Industries, on the other hand, gain access to cutting-edge research, specialized expertise, and innovative solutions that enhance their market competitiveness (Ahmed et al. 2022). Both parties also develop a potential relationship for career advancements for academics, and hiring of skilled personnel for organizations. One of the main drivers of successful collaborations is the alignment of shared objectives. When academia and industry jointly aim to address practical challenges while advancing knowledge, partnerships become more effective and productive (Bhullar et al. 2019). Intellectual property co-development and standardized agreements further strengthen these relationships by providing clarity on roles, responsibilities, and ownership rights (Esangbedo et al. 2024).

Despite their potential, academia-industry collaborations often face challenges such as misaligned priorities, communication barriers, and intellectual property disputes. Academic institutions typically focus on long-term knowledge generation, whereas industries prioritize short-term, profit-driven objectives (Ahmed et al. 2022). Intellectual property conflicts, particularly over ownership and usage rights, are frequent obstacles that require structured agreements and mutual understanding to resolve (Bhullar et al. 2019). The Academia-Industry Collaboration Plan addresses these challenges by emphasizing structured methodologies, including clear communication channels and shared governance frameworks. This structured approach fosters mutual understanding and helps align the goals of both academia and industry (Ahmed et al. 2022).

APPLICATIONS IN CONSTRUCTION MANAGEMENT

In the field of construction management, academia-industry collaborations facilitate addressing industry-specific challenges. Collaborative frameworks incorporating lean principles, such as the Plan-Do-Check-Act (PDCA) cycle, can enhance project management and improve efficiency. These methods emphasize systematic planning, implementation, and continuous improvement, all of which are essential in the construction industry (Arshed et al. 2022).

A study conducted by Bhullar et al. (2019) found that training programs and co-developed research initiatives can also play a significant role in addressing skill gaps and fostering innovation in areas such as sustainable construction and digital transformation. Such efforts enable the integration of academic insights into practical applications, creating value for both academia and industry.

APPLICATION OF LEAN CONSTRUCTION IN ACADEMIA-INDUSTRY COLLABORATIONS

Several studies highlight the integration of lean construction principles into academia-industry collaborations to foster innovation and improve efficiency in the construction sector. These collaborations leverage lean principles to address operational challenges and enhance productivity. For example, Lavikka et al. (2020) described the creation of an industry-university consortium to promote lean and digital process innovations in the Finnish construction sector. This consortium involved 17 companies and a university working collaboratively between 2016 and 2019. The partnership focused on themes such as Takt production, lean design management, prefabrication, and waste measurement. The consortium demonstrated how lean principles could reduce production cycle times and improve trust between project participants through structured governance and collaborative processes (Lavikka et al. 2020). The consortium implemented lean design management to address friction between design and production processes, resulting in practical tools adopted by participating companies. Takt production, another lean method studied by the consortium, successfully reduced lead times without compromising quality or cost. These achievements illustrate the transformative potential of lean principles when applied through structured academia-industry collaboration (Lavikka et al. 2020).

Kettunen et al. (2022) further emphasized the importance of integrating lean approaches into collaborative research frameworks. In their study of the "Need for Speed" (N4S) program, they introduced agile and lean methodologies into the research process itself. Using short sprints and iterative research planning, the program ensured that academic outputs were immediately relevant and applicable to industrial needs. This iterative approach fostered continuous learning and adaptation, enabling rapid technology transfer and implementation in industrial settings (Kettunen et al. 2022). The N4S program also developed a collaborative knowledge-sharing platform, the "Treasure Chest," which encapsulated actionable insights and practical tools derived from research. This repository provided industry partners with immediate access to lean-based innovations and strategies for improving operational efficiency, demonstrating the potential of lean methodologies to bridge the gap between academic research and industrial practice (Kettunen et al. 2022).

While existing studies highlight the benefits of academia-industry collaborations in construction and facilities management, they often focus on specific lean techniques like Takt production or Lean design, without offering a comprehensive system that integrates these principles throughout the entire collaboration process. Much of the research has concentrated on improving individual projects, but there has been less focus on creating long-term, structured partnerships that embed lean thinking into the way academia and industry work together.

To address this gap, this paper aims to introduce the Alberta Facilities Production System (AFPS), a new conceptual framework inspired by the Toyota Production System (TPS). AFPS reimagines how universities and industry partners collaborate in facilities planning, development, and management by structuring their engagement around the Plan-Do-Check-Act (PDCA) cycle. Instead of academia primarily handling research while industry focuses on execution, AFPS ensures that both parties actively participate in all phases of project development, from the early stages of planning and experimentation to real-world implementation and continuous improvement.

METHODOLOGY

To develop the proposed AFPS, this study follows a structured approach consisting of three key phases: (1) Literature review and gap identification, (2) AFPS conceptual framework development, and (3) Implementation guidelines for practical applications. First, a comprehensive literature review was conducted to investigate previous studies on academia-industry integration. By exploring these studies, this research pinpoints persisting gaps and barriers in scaling Lean principles beyond individual projects and into large-scale public construction portfolios. Next, this paper proposes and describes the AFPS framework, while adapting Lean methodologies for continuous improvement. Finally, to facilitate real-world application, the study outlines practical implementation guidelines for AFPS, including strategies for stakeholder engagement, collaboration between academia and industry, and mechanisms for continuous improvement. The focus on large-scale public sector construction within the AFPS framework is driven by the unique challenges and opportunities this sector presents. Public sector construction projects are typically characterized by their scale, complexity, and the significant public investment involved. These projects not only serve immediate functional needs but also have long-term implications for community development and sustainability. Moreover, the public sector often faces heightened scrutiny regarding the use of funds and the efficiency of project execution, making the application of lean principles particularly beneficial. By applying lean methodologies, the AFPS framework aims to enhance transparency, increase efficiency, and improve the delivery of public projects, ensuring more responsible use of taxpayer money and increased public trust in government-managed construction initiatives. These guidelines provide a structured approach for governments, universities, and industry practitioners to integrate Lean principles into large-scale capital projects efficiently. For clarity, phases two and three are combined to provide implementation examples simultaneously with the framework description.

PROPOSED FRAMEWORK: ALBERTA FACILITIES PRODUCTION SYSTEM (AFPS)

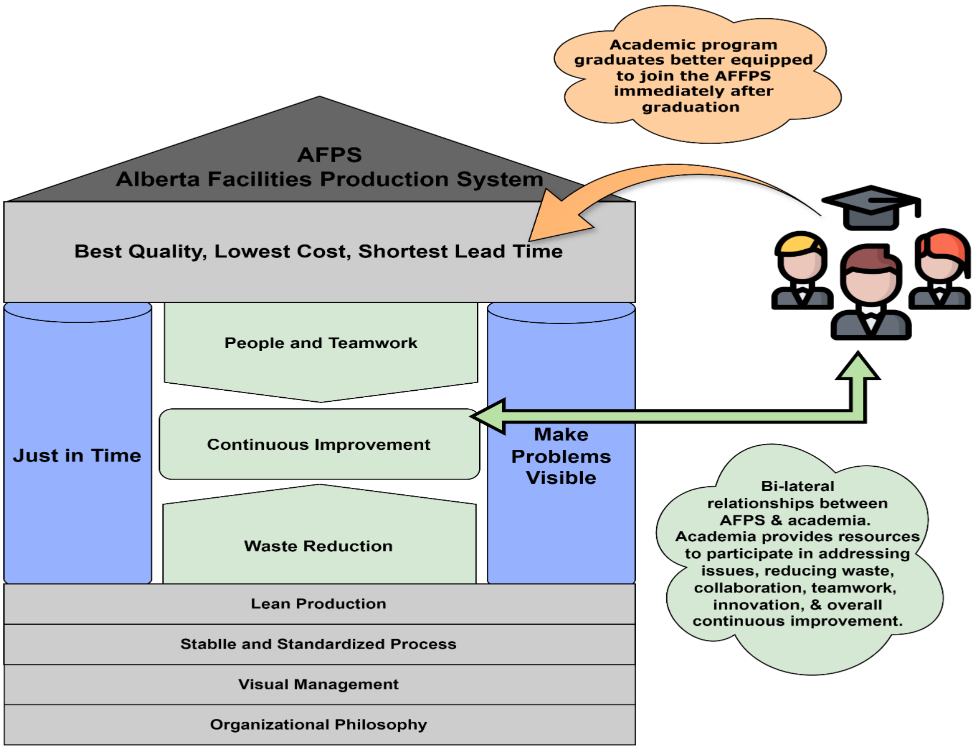

Figure 1: Alberta Facilities Production System House

Inspired by The Toyota Production System, the Alberta Facilities Production System (AFPS) reimagines the delivery of the provinces capital facility portfolio as a Lean production system that maximizes efficiency, minimizes waste, and fosters continuous improvement (Figure 1).

Imagine if each individual car that passes through the Toyota assembly line is the equivalent to an individual project? The benefit of a Lean production system at the project level (single car) is that it provides value to the end user by ensuring high quality, lower cost, and faster production and delivery. However, the biggest value is to the system as a whole: Toyota's

Market Capitalization of $247.42 Billion USD as of February 2025 (CompaniesMarketCap 2025) is not just a result of producing a single great car, but of optimizing every step of production over time, compounding performance gains across the entire system. Similarly, AFPS is not just about improving a single project; it's about creating long-term, system-wide efficiencies that transform facilities planning, execution, and operations. By bridging academia and industry, AFPS positions the University of Alberta and its campus projects as a "Live Lab" where lean principles are tested and refined. This approach embeds continuous learning and scientific problem-solving into real-world projects, ensuring AFPS is constantly evolving and improving. The following sections describe the key principles of the AFPS framework, including (1) aiding in waste reduction, (2) pulling towards common goals, (3) using campus as a "Live Lab" for testing innovation and continuous improvement, (4) fostering problem solving and Jidoka, and (5) developing a workforce culture focused on stopping to fix problems.

Aiding in Waste Reduction Through Data-Driven Identification

AFPS aims to eliminate waste in facilities management and operations. Academic researchers act as independent observers, applying Lean methodologies to identify inefficiencies and non-value-adding activities. Unlike industry stakeholders involved in daily operations, academics provide an unbiased, research-based perspective that enables evidence-based decision-making. For example, Lean research at the University of Alberta could analyze how inefficient workflows, energy and materials waste, or process bottlenecks contribute to budget overruns in projects. Insights from these studies could then be applied to all facility-related projects, leading to holistic and systemic improvements rather than silo-based problem solving. The system would incentivise contractors and third parties to participate openly in this model by objectively scoring firms' willingness to participate in continuous improvement through a fair and transparent public procurement process. By creating a culture centered on standardization and continuous improvement, these values can be prioritized when selecting partners.

Pulling Towards Common Goals

Similar to Toyota's Just-in-Time principle, AFPS would aim to ensure that facilities management activities are executed based on real-time demand and performance data, which helps in reducing inefficiencies and costs. To track progress and ensure empirical-based information, AFPS can implement real-time performance dashboards for monitoring operations and performance. It can also utilize Key Performance Indicators (KPIs) to reduce costs and improve productivity. Since advanced metrics in construction planning enhance decision-making by providing real-time data insights (Hamzeh et al. 2019), they can enable continuous performance evaluation and adaptation of Lean strategies. Standardization of data collection and monitoring across all facilities is also essential for enabling benchmarking and informed decision making. This ensures that facilities management strategies align with long-term institutional and public needs and deliver maximum value over time. The use of dynamic value dashboards to visually track KPIs, has been proven to successfully ensure that Lean strategies remain adaptable to project needs while maintaining alignment with overall performance objectives (Khalife and Hamzeh 2022).

Campus as a Live Lab

AFPS can leverage the University of Alberta as a "Live Lab" to test, refine and scale Lean facilities management practices before broader application. By integrating Plan-Do-Check-Act (PDCA) principles into campus projects, AFPS creates a structured and iterative approach for continuous improvement, or Kaizen (Figure 2). This ensures that facilities management processes are efficient, research and scientifically validated, and adaptable to real-world conditions. The following sections illustrate how a new research facility construction project on campus can demonstrate the full cycle of AFPS implementation.

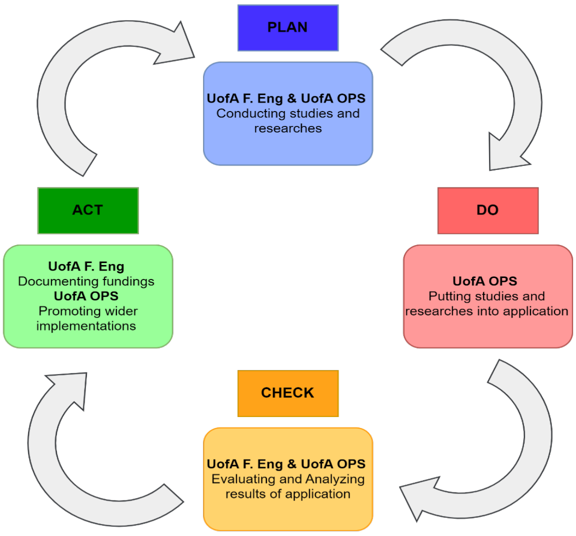

Figure 2: Lean-Based PDCA Cycle for Academia-Industry Integration

Plan: Every construction project begins with a plan, but AFPS enhances this by integrating academic research and operational expertise from the start. For a new research facility, teams build on evolving standards and analyze past project data to identify inefficiencies like material delays, trade workflow issues, or design bottlenecks. Using VSM, they map the entire process, from design approvals to closeout, spotting waste such as rework from late design changes or poor subcontractor coordination, and apply strategies to minimize these issues early. To align construction with university goals like net-zero carbon by 2030, Hoshin Kanri is applied. Sustainability is embedded through prefabricated components that reduce waste and speed up timelines. A3 problem-solving is used to tackle challenges like trade stacking—where crews congest work zones, by adjusting task sequencing with Takt planning before work begins. By the end of the Plan phase, the team has a clear roadmap, defined roles, and a Lean execution strategy to guide the project efficiently.

Do: Once construction begins, AFPS puts Lean strategies into action. Takt planning sequences work in steady intervals, ensuring trades move efficiently without congestion. For example, framers finish a section before electricians, then drywall and finishing crews follow—reducing idle time and scheduling conflicts. Just-in-Time (JIT) logistics bring materials only when needed, minimizing storage, waste, and improving site organization. Progress is tracked using Kanban boards, which provide visual updates on each task. If steel framing lags, bottlenecks are quickly identified and resolved before broader delays occur. Kaizen events further refine execution. For instance, if prefabricated panels don't align due to slight design variances, a quick Kaizen session with contractors, architects, and faculty leads to immediate design tweaks, avoiding costly setbacks. Standardizing management and procurement ensures a consistent delivery model. These Lean tools, Takt, JIT, Kanban, and Kaizen, create a structured, responsive workflow that enhances efficiency and teamwork. By embedding these practices into the Do phase, AFPS not only improves construction efficiency but also fosters cross-functional collaboration and sets a new benchmark for delivering future university projects.

Check: Once major milestones are reached, the Check phase begins. This stage focuses on reviewing what worked, what didn't, and updating standard practices accordingly. For the research facility, key performance indicators (KPIs) are evaluated: (1) Schedule adherence, did Takt planning keep trades on track? (2) Cost efficiency, did Lean strategies reduce waste and overruns? (3) Quality, did standardization improve consistency? (4) Safety, did site organization lower hazards? If targets aren't met, tools like the 5 Whys help find root causes. For instance, if delays occurred, it might be traced back to late design changes requiring last-minute approvals. Lessons learned are then documented in a central repository, ensuring future university projects benefit from past insights and that best practices evolve.

Act: The Act phase ensures that the insights gained from this pilot project don't just stay on paper but actively shape future construction projects. If the Lean strategies used in this research facility resulted in faster delivery, lower costs, and fewer issues, AFPS makes sure that these methods become standard practice for all university projects moving forward. For example, if Takt planning was successful in optimizing trade workflows, the university might require it for all future capital projects. Similarly, if JIT material deliveries significantly improved site logistics, procurement policies might be adjusted to support this lean approach long-term. To ensure continuous improvement, Kaizen continues even after project completion, allowing teams to refine processes and explore how to make them even more effective for the next build.

Finally, all findings are stored in a best-practices repository, making them accessible to construction firms, faculty, and policymakers. This ensures that Alberta's facilities management system remains data-driven, adaptive, and forward-thinking.

FOSTERING PROBLEM SOLVING AND JIDOKA

One of the key challenges in construction, compared to manufacturing, is that projects are stationary, while the production process moves around the site. Unlike in a Toyota factory, where a defective part can trigger an Andon cord to stop the production line, construction teams cannot simply halt the entire project when an issue arises. Therefore, AFPS implements Jidoka by detecting problems early, documenting solutions, and sharing findings across the whole system. It also promotes creating standardized corrective actions to prevent repeated inefficiencies. Finally, academics are encouraged to teach and share best practices, ensuring that knowledge is not lost but actively used to improve future projects. For example, if an issue in the construction process is discovered, AFPS ensures that the root cause is analyzed, corrective actions are developed, and knowledge is shared before similar failures occur in other buildings. This prevents reactive maintenance and enhances long-term facility reliability.

DEVELOPING A WORKFORCE CULTURE OF STOPPING TO FIX PROBLEMS.

One of Toyota's core principles is a workforce empowered to stop production and fix issues immediately. AFPS brings this mindset into Alberta's facilities management by training graduates to identify and address inefficiencies in real-time and encouraging staff and managers to escalate issues without fear of operational delays or blame. By promoting a problem-solving culture in Alberta's facilities management workforce, this approach not only improves operational quality but also ensures that Alberta attracts and retains a highly skilled, highly motivated workforce who are committed to Lean excellence.

CONCLUSIONS

AFPS represents a shift in the application of Lean principles in construction, from an isolated project-level implementation to a system-wide continuous production model. Drawing inspiration from the TPS, AFPS challenges conventional notion that a single construction project can function as a self-contained Lean production system. Instead, it advocates for a structured and repeatable approach that brings academia, industry, and public sector stakeholders together in efforts to raise efficiency, reduce waste, and create continuous improvement across multiple projects.

One of the strongest points about AFPS is its integration of academia and industry, using the University of Alberta as a "Live Lab" where Lean strategies have been tested, validated, and refined prior to scaling across Alberta's public construction portfolio. This model will ensure that the facilities management benefits from data-driven decision-making, scientific problem-solving, and structured feedback loops that assure sustained long-term improvements rather than one-time project optimizations. With its emphasis on waste reduction, empirical goal-setting, Jidoka, and workforce development, the framework positions AFPS as scalable and adaptable for continuous improvement in Alberta's capital project delivery.

For implementing AFPS, the core belief of Lean would need to move from being just one of the many optional tools for certain projects to a vital principle for each and every planning and execution at facilities. Stakeholder engagement in developing standardized methods of data collection, refining the KPIs, and assuring real-time knowledge sharing between academia and industry is imperative. AFPS offers the added advantage of bringing about better development within the workforce by equipping tomorrow's professionals in construction with Lean problem-solving skills and a proactive attitude toward continuous improvement.

However, while the principles of lean manufacturing, as exemplified by Toyota’s production system, offer valuable insights for enhancing efficiency and reducing waste, it is crucial to recognize the fundamental differences between automotive manufacturing and construction. Unlike the standardized environment of car manufacturing, where millions of identical products are produced annually, construction projects are characterized by unique designs, diverse teams, varying locations, and distinct logistical challenges. Therefore, while inspiration is drawn from Toyota’s 'stop to fix problems' approach to foster continuous improvement, these principles should be adapted to the specific realities of construction. This adaptation involves tailoring lean methodologies to accommodate the inherent variability and unpredictability of construction projects, ensuring that they are practical and effective in a project-based industry. For example, the PDCA cycle is utilized not as a rigid framework, but as a flexible guide that can be customized for each project's specific needs and challenges, thereby maintaining the spirit of lean while acknowledging the unique aspects of construction.

Future research should be directed at pilot projects demonstrating the application of AFPS principles in practice. Longitudinal studies will serve to assess the impact of the framework and further develop implementation strategies, along with the identification of potential barriers to large-scale implementation. This will involve cross-sector collaboration with government agencies, contractors, and academic institutions to adapt the framework for various construction environments outside Alberta. Additionally, future research will focus on developing and defining specific performance metrics and outcomes. This will include establishing quantitative and qualitative measures to assess the efficiency improvements, cost savings, and overall project delivery enhancements achieved through AFPS. These metrics will not only help in evaluating the effectiveness of the AFPS but also in identifying areas for continuous improvement, ensuring the framework evolves to meet the dynamic needs of the construction industry. In the future, AFPS, with its foundation in lean methodologies and continuous improvement, can offer versatile applications beyond public construction projects. It can be adapted to the private sector and industries like manufacturing and healthcare, where similar challenges in project management and efficiency exist. Future research will further explore the framework's scalability and adaptability, aiming to provide guidelines for its application in diverse industry settings.

Ultimately, the AFPS is more than a conceptual model-it is a practical, evidence-based way of transforming public construction management. Bridging the gaps between academia and industry by leading the application of Lean principles into practice, fostering innovative culture, and promoting accountability, AFPS would set a new benchmark in efficiency, sustainability, and excellence for Alberta and beyond in capital project delivery.

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