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Innovation Management through Engineering Internships

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Abstract

Introduction/Main Objectives: Innovation management is increasingly recognized as a critical component in engineering education and practice. Engineering internships provide an opportunity for students to apply technical knowledge in real-world settings, yet they often lack structured exposure to innovation processes. Integrating innovation management into internships can enhance creativity, adaptability, and problem-solving skills, preparing students for dynamic industry demands. The main objectives are to explore how innovation management principles can be implemented during engineering internships, to identify strategies that foster creativity and structured idea development among interns and to evaluate the impact of innovation-focused activities on interns' technical and managerial competencies.

Background Problems: Engineering students typically excel in technical skills but often lack experience in managing innovation. Traditional internships emphasize routine technical tasks, leaving little room for creative thinking or strategic planning. This gap limits students' ability to contribute to organizational growth and adapt to emerging technologies.

Research Methods: The study employs a qualitative approach, reviewing existing literature on innovation management and internship programs. Case studies from engineering firms are analyzed to identify best practices. Surveys and interviews with interns and supervisors provide insights into the effectiveness of innovation-oriented tasks during internships.

Finding/Results: Results indicate that structured innovation activities such as design thinking workshops, cross-disciplinary collaboration, and mini-projects significantly improve interns' problem-solving and adaptability. Interns exposed to innovation management reported higher confidence in proposing creative solutions and demonstrated improved teamwork and communication skills.

Conclusion: Integrating innovation management into engineering internships bridges the gap between technical expertise and strategic thinking. This approach not only enhances interns' employability but also contributes to organizational competitiveness. Future internship models should incorporate innovation frameworks to prepare engineers for leadership roles in a rapidly evolving industry.

Keywords: Innovation management, engineering internships, design thinking, creativity, adaptive skills.

Introduction

Innovation management is the structured process of managing ideas, creativity, and technological advancements to create value for an organization. It focuses on turning innovative concepts into practical solutions, products, or services that improve competitiveness and sustainability (Adams et al. 2006). Innovation management involves a structured approach to transforming creative ideas into impactful solutions. It begins with idea generation, where organizations encourage creativity and brainstorming within teams, often leveraging methods such as design thinking or open innovation platforms to capture diverse perspectives (Tidd, 2001). The next stage is evaluation and selection, which focuses on assessing the feasibility, market potential, and alignment of ideas with business goals. Prioritization is typically based on return on investment (ROI) and strategic fit to ensure resources are directed toward the most promising initiatives. Once ideas are selected, the implementation phase involves developing prototypes, conducting tests, and scaling successful innovations. Effective resource allocation and timeline management are critical at this stage to maintain momentum and deliver results efficiently. Finally, monitoring and continuous improvement ensures that innovations remain relevant and effective. This includes measuring performance and impact, gathering feedback, and adapting strategies to respond to market changes and evolving customer needs. Together, these components create a dynamic cycle that drives sustainable growth and competitive advantage through innovation. Beyond pedagogy, innovative management also involves agile administrative systems that streamline processes such as admissions, resource allocation, and performance evaluation (Goffin & Mitchell, 2025). Data analytics and artificial intelligence are increasingly used to monitor student progress, predict learning gaps, and personalize educational experiences. These technologies not only improve academic outcomes but also support evidence-based decision-making at the institutional level. Another critical aspect is industry-academia collaboration, which ensures that curricula remain relevant to evolving market needs. Through partnerships with corporations and research organizations, engineering programs can incorporate real-world projects, internships, and mentorship opportunities into their structure. This approach bridges the gap between theoretical knowledge and practical application, equipping graduates with the skills required for leadership in complex, technology-driven environments. Furthermore, innovative management emphasizes sustainability and inclusivity. Engineering institutions are adopting green technologies, promoting ethical practices, and ensuring that education is accessible to diverse populations. These initiatives align with global priorities and prepare students to address pressing societal challenges such as climate change and resource scarcity.

Engineering students are widely recognized for their strong technical foundation, which equips them to solve complex problems and design cutting-edge solutions. Their academic training emphasizes analytical thinking, precision, and mastery of scientific principles skills that are indispensable in today's technology-driven industries. However, while these competencies are critical, they often overshadow another equally important dimension: the ability to manage innovation effectively. This imbalance creates a significant gap between technical proficiency and strategic thinking, limiting graduates' readiness for leadership roles in dynamic, competitive environments (Bozic & Dunlap, 2012). Traditional engineering education and internships tend to reinforce this gap. Internships, which are intended to provide practical exposure, frequently focus on routine technical tasks such as drafting designs, running simulations, or performing quality checks. While these activities are valuable for reinforcing classroom learning, they rarely challenge students to think creatively or engage in strategic decision-making (Nogueira et al., 2021). Opportunities to participate in product development cycles, market analysis, or innovation planning are often reserved for senior professionals, leaving interns confined to operational roles. As a result, students graduate with limited experience in conceptualizing new ideas, assessing their feasibility, and managing the processes that bring innovations to life (Fisher, 2017).

This lack of exposure has broader implications for both students and organizations. In an era defined by rapid technological change, businesses increasingly rely on employees who can adapt to emerging trends, integrate cross-disciplinary knowledge, and drive innovation (Mashwama & Madubela, 2025). Engineers who lack these capabilities may struggle to contribute beyond their technical assignments, reducing their potential impact on organizational growth. Moreover, without training in innovation management, graduates may find it challenging to navigate roles that require collaboration with marketing, finance, and operations teams' functions that are essential for transforming technical concepts into market-ready solutions (Esteban et al., 2025).

To address this gap, engineering education must evolve to incorporate experiential learning opportunities that go beyond technical execution. Programs should integrate modules on innovation strategy, entrepreneurship, and project management, enabling students to understand the broader context in which engineering solutions are developed and deployed (Solodikhina & Solodikhina, 2021). Collaborative projects with industry partners can provide real-world scenarios where students practice balancing technical feasibility with business objectives. Additionally, internships should be restructured to include participation in brainstorming sessions, design thinking workshops, and innovation road mapping exercises. These experiences not only cultivate creativity but also teach students how to manage uncertainty, allocate resources, and lead multidisciplinary teams' skills that are indispensable in modern engineering careers (Gutiérrez-Pulido & Orozco-Rodríguez, 2025). Ultimately, bridging the gap between technical expertise and innovation management is essential for preparing engineers to thrive in a world where success depends on both technical excellence and strategic vision. By fostering these dual competencies, educational institutions and industry partners can empower future engineers to become innovators, leaders, and catalysts for sustainable growth.

Innovative management in engineering Internships means applying structured processes to develop, implement, and managing new ideas or technologies within an engineering context while gaining practical experience (Huynh et al. 2020). In the engineering field, innovation plays a crucial role in driving progress and efficiency (Haag et al. 2006). One key aspect is product and process innovation, where interns often contribute by improving designs, optimizing manufacturing processes, or integrating sustainable solutions to meet modern industry standards. Another important area is technology adoption, which involves learning how companies evaluate and implement new tools or systems to enhance productivity and competitiveness (Trego et al. 2019). Additionally, continuous improvement is a fundamental principle in engineering, where methodologies such as Lean, Six Sigma, or Agile are applied to streamline operations, reduce waste, and improve overall efficiency. These roles collectively help interns gain practical exposure to innovative practices that shape the future of engineering (Luk & Chan, 2022). Engineering students often gain hands-on exposure to various aspects of innovation throughout their internship. They actively participate in idea generation and brainstorming, contributing creative solutions to technical challenges faced by the organization. Many interns are involved in prototype development, assisting in building and testing new designs to validate concepts and improve functionality (Prabhu & Aditya Kudva, 2016). Additionally, they engage in research and analysis, evaluating the feasibility, cost implications, and environmental impact of proposed innovations to ensure sustainability and efficiency. Another critical component is documentation and reporting, where students learn how to present innovative concepts clearly and professionally to stakeholders, bridging the gap between technical ideas and business decision-making (Caviggioli, 2024)). This comprehensive experience equips interns with practical skills and a deeper understanding of innovation in engineering practice. During the internship, students acquire a diverse set of skills that are essential for driving innovation in engineering. One of the key competencies is design thinking, which equips them with problem-solving techniques to approach challenges creatively and develop user-centered solutions. They also gain experience in project management,

learning how to plan, organize, and execute innovative projects effectively while managing resources and timelines. Collaboration is another critical skill, as interns work closely with R&D, production, and sustainability teams, fostering cross-functional teamwork to achieve common goals. Additionally, students develop an understanding of intellectual property (IP) and patents, which is crucial for protecting engineering innovations and ensuring compliance with legal standards. These skills collectively prepare students to contribute meaningfully to technological advancements and innovative practices in their future careers.

In this paper, innovative management practices during engineering internships are examined. The study involves extracting and analyzing several findings from industrial training reports submitted, focusing on aspects related to innovative management. Additionally, qualitative responses from participating students are investigated and evaluated to assess the extent and effectiveness of innovative management practices implemented during their internships.

Research Methods

The study adopts a qualitative research approach to explore innovative management practices within engineering internships. It begins by reviewing existing literature on innovation management and internship programs to establish a theoretical foundation. Case studies from selected engineering firms are analyzed to identify best practices and strategies that foster creativity and adaptability in real-world settings. Furthermore, the research involves extracting and analyzing findings from industrial training reports submitted by interns, with a specific focus on elements related to innovative management. To complement this document analysis, qualitative responses from participating students are investigated and evaluated to measure the extent and effectiveness of innovation-oriented practices implemented during their internships. Surveys and semi-structured interviews with both interns and supervisors provide additional insights into how innovation-driven tasks influence learning outcomes, professional development, and organizational performance. This multi-source approach ensures a comprehensive understanding of how innovative management principles are integrated into internship programs and their impact on preparing future engineers for dynamic, technology-driven environments. Five companies with five students who were doing the internship were selected for the study. The innovative management practices from the companies are recorded and the students' perceptions and suggestions about the innovative management practices are evaluated.

Result

The results are tabulated in Table 1. The project management approach in Company 1 emphasizes a comprehensive understanding of the project life cycle, which includes initiation, planning, execution, monitoring, and closure. Effective resource management is crucial for allocating bandwidth, hardware, and technical teams efficiently to meet project requirements. Time management plays a significant role, supported by tools such as Gantt charts and task-tracking software to ensure timely delivery of tasks. Risk management strategies are implemented to mitigate potential issues like downtime, data loss, and security vulnerabilities, safeguarding project success. Stakeholder management is also prioritized to maintain clear communication and align expectations among clients, vendors, and internal teams. Furthermore, quality assurance processes are integrated to uphold high standards and minimize network failures throughout the project. Familiarity with project management tools such as Microsoft Project and Visio enhances the ability to track progress, manage resources, and streamline communication across all stakeholders. To enhance operational efficiency and maintain high standards, the implementation of an ISO 9001-based Quality Management System (QMS) is strongly recommended. This structured framework standardizes processes, reduces variability, and promotes proactive risk management, which is crucial for ensuring

network reliability and minimizing service interruptions. Additionally, the development of specialized lifting plan software is proposed to automate complex calculations and ensure compliance with Health and Safety Executive (HSE) requirements. This innovation not only improves safety and efficiency but also reduces costs by eliminating the need for third-party services, offering a practical and cost-effective solution for project engineers.

Student 1 (Figure 1) highlights the importance of structured project management and quality assurance in network solution projects. He perceives that implementing a Quality Management System (QMS) based on ISO 9001 would significantly improve operational efficiency and standardize processes across the organization. According to his suggestion, QMS would reduce variability, promote proactive risk management, and prevent issues before they occur—critical in a network environment where downtime and service interruptions can have severe consequences. This approach aligns with innovative management principles by ensuring reliability and customer satisfaction. Additionally, the student proposes the development of specialized software for lifting plan calculations. He observed that creating lifting plans manually for rigging operations was time-consuming and costly, as it often required third-party services. His idea involves designing software that integrates formulas and safety requirements (HSE compliance) to automate lifting plan generation. This innovation would reduce costs, improve safety, and streamline project workflows. The student even considers this concept as a potential Final Year Project, indicating its practical relevance and scalability. Overall, the student's suggestions reflect a strong focus on process standardization, risk mitigation, and digital tool development to enhance efficiency, safety, and competitiveness in the network solutions industry.

Figure 1. Student 1 internship at Company 1
Source: Private Documentation, 2025.

Table 1. Innovative Management Practices and Students' Perceptions

	Company/Student	Findings/Perceptions
1	Access Corporate Ventures (ACV)	Project management strategies Recommendations for improvement Risk management strategies Maintain clear communication Implementation of an ISO 9001-based Quality Management System (QMS)
	Muhammad Arif Afiq Bin Sadradin	Structured project management and quality assurance Specialized software for lifting plan calculations
2	Globe Engineering Sdn Bhd	Integration of Advanced Fire Protection Systems Structured Project Management and Digital Coordination Adoption of contract-based machinery procurement Preparation of detailed work instructions, memos, and official reports permit-to-work systems for scaffolding and height-related tasks
	Sharvin A/L Chandran	The importance of workflow efficiency, documentation, and resource management Mechanical and Electrical (M&E) plans Digitalization and automation Risk management practices, such as obtaining permits Improving efficiency and safety in project management
3	Gas Malaysia Retail Services (GMRS)	Digitalization and Smart Meter System Automation and IoT Integration Cybersecurity and Compliance Sustainability and Energy Efficiency
	Norasikin Binti Naali	Digitalization and modernization in gas distribution operations Automation and data-driven decision-making in improving operational reliability Adopting advanced metering technologies Continuous improvement and technology integration
4	Kian Joo Can Factory Berhad	Continuous Improvement Projects automated waste tinplate disposal system Standard Operating Procedures (SOPs) Digital and Design Tools ISO 9000 Quality Management System
	Levinath A/L Neelavannan	Continuous improvement and modernization Automation of waste tinplate disposal Aligns with Industry 4.0 principles Standardization and documentation The role of digital tools
5	Envipure Sdn. Bhd.	Material Receiving Inspection (MRI) comprehensive documentation for inspections, including ISO references Implemented systematic labelling and numbering Factory Acceptance Test (FAT) and Operational Acceptance Test (OAT) protocols
	Muhamad Azhari Bin Mazlan	Role of Quality Assurance and Quality Control (QAQC) Documentation and digital tools Implementation of teamwork and communication Value of standardization, such as labelling and numbering Continued adoption of structured QAQC systems

Source: Author's Work, 2025.

Company 2 demonstrates a strong commitment to innovative management practices aimed at enhancing project efficiency, safety compliance, and workflow standardization. One of the key

initiatives is the integration of advanced fire protection systems. The company employs modern fire prevention technologies such as fire-rated cables, automated alarm panels, and dry/wet pipe systems to ensure compliance with stringent safety standards and improve system reliability. Additionally, the use of Mechanical and Electrical (M&E) plans alongside precise engineering drawings facilitates accurate installation and optimizes workflow, reducing delays and errors during project execution. Another significant practice is structured project management supported by digital coordination tools. Project engineers utilize internal communication platforms to provide real-time updates and track progress, which enhances coordination between site teams and management. This digital approach is complemented by systematic inspection and approval processes that maintain quality standards and minimize operational mistakes, ensuring projects are delivered on time and within scope. Globe Engineering also prioritizes resource optimization and risk management. Instead of investing in permanent ownership of heavy machinery, the company adopts a contract-based procurement strategy for equipment such as cranes and sky lifts. This approach reduces capital expenditure while improving flexibility in resource allocation. Furthermore, the organization emphasizes insurance-backed reporting systems to address theft and damage incidents, ensuring financial recovery and operational continuity without compromising project timelines. To maintain consistency and accountability, the company implements standardization and documentation practices. Detailed work instructions, memos, and official reports are prepared for all site activities, promoting transparency and structured operations. Material requisition forms and delivery order tracking systems are also utilized to streamline supply chain management, ensuring timely availability of resources and reducing procurement-related delays. Finally, Globe Engineering places a strong focus on safety and compliance throughout its operations. Strict adherence to permit-to-work systems for scaffolding and height-related tasks ensures worker safety and regulatory compliance. Continuous monitoring and troubleshooting are conducted to meet consultant approval standards, reinforcing the company's commitment to delivering projects that align with industry best practices and safety benchmarks.

Student 2's reflections emphasize the importance of workflow efficiency, documentation, and resource management in project execution (Figure 2). He perceives that structured planning and coordination between project managers, engineers, and subcontractors are critical for smooth operations. The use of Mechanical and Electrical (M&E) plans for accurate pipe and conduit installation demonstrates a systematic approach, which the student views as essential for reducing errors and delays. From his experience, the student suggests that digitalization and automation could further enhance project management. For instance, he highlights the heavy reliance on manual processes for material requisition, delivery order tracking, and progress reporting. Automating these tasks through digital platforms could improve accuracy, reduce paperwork, and save time. Similarly, he notes that real-time updates in internal communication groups were helpful, implying that more advanced project management tools could streamline coordination and monitoring. The student also values risk management practices, such as obtaining permits for scaffolding and ensuring compliance with safety standards. He suggests that maintaining proper documentation and adopting preventive measures are vital for minimizing operational risks. Additionally, he acknowledges the role of resource optimization, such as outsourcing machinery instead of purchasing, as a cost-effective strategy that aligns with innovative management principles. Overall, the student's insights point toward greater adoption of technology, automation of routine tasks, and enhanced documentation systems as key areas for improving efficiency and safety in project management.

Figure 2. Student 2 internship at Company 2
Source: Private Documentation, 2025.

Company 3 has embraced innovative management practices through digitalization initiatives, smart technologies, and efficiency-focused strategies to enhance operational performance and customer satisfaction. One of the most significant advancements is the transition from conventional meter reading to smart meter technology. These smart meters, which include diaphragm and ultrasonic types, are equipped with IoT sensors that provide real-time data on gas flow, pressure, and equipment performance. This system enables remote and wireless meter reading, real-time consumption monitoring, and even remote disconnection capabilities. By reducing the need for site visits, GMRS improves operational efficiency and customer service while leveraging predictive analytics to enable proactive maintenance, minimizing downtime and associated costs. In addition to smart metering, GMRS has implemented automation and IoT integration across its operations. IoT-enabled devices and automated systems are used for tasks such as valve control and pipeline monitoring, significantly reducing human error and increasing efficiency. The integration of data-driven decision-making processes allows the company to analyze patterns and trends, supporting predictive maintenance and optimizing operational workflows. These initiatives ensure that GMRS remains agile and responsive in a rapidly evolving energy sector. Recognizing the importance of security in digital transformation, GMRS prioritizes cybersecurity and compliance before deploying smart systems. The company adheres to stringent cybersecurity standards and industrial control requirements, reflecting a proactive approach to risk management. This commitment safeguards critical infrastructure and customer data, ensuring that digitalization efforts do not compromise safety or reliability. Finally, GMRS aligns its operations with global sustainability objectives through energy efficiency and environmental responsibility. The company promotes cogeneration technology, specifically Combined Heat and Power (CHP) systems, to optimize energy use and reduce carbon emissions. These efforts not only enhance operational sustainability but also demonstrate GMRS's dedication to environmental stewardship and long-term energy solutions.

Student 3 (Figure 3) features the importance of digitalization and modernization in gas distribution operations. She perceives the implementation of smart meter systems as a significant step toward innovative management. These systems enable remote and wireless meter reading, real-time consumption monitoring, and remote disconnection, which reduce manual work, improve efficiency, and enhance customer service. The student notes that smart technologies, including IoT sensors and automation for valve control and pipeline monitoring, can minimize human error and downtime while optimizing maintenance schedules through predictive analytics. Additionally, the student emphasizes the role of automation and data-driven decision-making in improving operational reliability. By analyzing real-time data patterns, engineers can predict equipment failures and schedule preventive maintenance proactively, reducing costs and service interruptions. She also acknowledges the importance of cybersecurity compliance before implementing smart systems, reflecting awareness of risk management in digital transformation. The student also suggests that adopting advanced metering technologies such as ultrasonic gas meters and smart diaphragm meters offers benefits like high accuracy, low maintenance, and enhanced safety features. These innovations align with Industry 4.0 principles and support sustainability goals by improving energy efficiency and reducing carbon emissions. Finally, the student views continuous improvement and technology integration as essential for maintaining competitiveness in the energy sector. Her experience reinforces the need for structured modernization strategies to deliver reliable, safe, and customer-focused services.

Figure 3. Student 3 internship at Company 3
Source: Private Documentation, 2025.

Company 4 demonstrates innovative management through a strong focus on process improvement, automation, and standardization. The company has implemented several continuous improvement projects aimed at reducing downtime and enhancing efficiency in the 5L Cover and Ring lines. Key initiatives include lowering the chute and adding barriers to prevent plates from getting stuck, installing metal strips in chutes to guide covers smoothly and prevent dents, and modifying the stacker plate design to avoid cover flipping and reduce operator intervention. These improvements have successfully minimized waste, enhanced safety, and increased overall production output. In addition to these improvements, the company has proposed an automation solution to further streamline operations. The idea involves introducing an automated waste tinplate disposal system using rollers to replace

manual handling. This proposal is designed to save time, boost productivity, and reduce operator injuries, aligning with Industry 4.0 objectives and modern manufacturing trends. Standardization and documentation also play a critical role in Kian Joo's innovative management approach. The company has developed comprehensive Standard Operating Procedures (SOPs) and detailed flowcharts for all forming and component lines, including machine specifications. Furthermore, work instructions for essential machines such as the sheet feed press, beading machine, and stacker have been created to ensure consistent operations and simplify onboarding for new operators. To support precision and efficiency in maintenance and upgrades, Kian Joo leverages digital and design tools like SolidWorks for part design and technical documentation. This integration of technology enhances accuracy and facilitates continuous improvement. Finally, the company emphasizes strict adherence to the ISO 9000 Quality Management System, ensuring structured processes, quality assurance, and ongoing operational excellence across all departments.

Student 4 (Figure 4) views continuous improvement and modernization as essential for innovative management in manufacturing. His internship focused on identifying operational issues and implementing practical solutions to improve efficiency in the 5L Cover and Ring lines. He perceives that small design changes such as lowering chutes, adding barriers, and installing guiding strips significantly reduce downtime, minimize waste, and enhance safety. These improvements reflect a proactive approach to lean manufacturing and problem-solving. A major suggestion from the student is the automation of waste tinplate disposal. Currently, this process is manual, causing delays and posing safety risks. His proposed idea involves adding rollers to automate waste handling, which would save time, increase productivity, and reduce operator injuries. This recommendation aligns with Industry 4.0 principles, showing the student's awareness of technological trends and their potential benefits. The student also emphasizes the importance of standardization and documentation. He contributed to creating Standard Operating Procedures (SOPs), flowcharts, and machine specifications for multiple lines, ensuring consistency and simplifying training for new operators. Additionally, he suggests further research on production lines to identify more opportunities for improvement, indicating a mindset geared toward continuous innovation. Finally, the student highlights the role of digital tools like SolidWorks in supporting precision and efficiency in design and maintenance. He sees the integration of such tools as vital for modernizing operations and improving technical accuracy.

Figure 4. Student 4 internship at Company 4
Source: Private Documentation, 2025.

Company 5 demonstrates innovative management primarily through the implementation of robust quality assurance systems, structured workflows, and technology-driven

documentation. The company has established a comprehensive Quality Assurance and Quality Control (QAQC) framework to ensure compliance with project specifications and regulatory standards. This framework includes multi-stage inspections such as Material Receiving Inspection (MRI), Equipment Receiving Inspection (ERI), Installation Verification (IV), and Construction Completion (CC), all aimed at maintaining high-quality standards and preventing defects throughout the project lifecycle. To support these processes, the company has developed structured documentation and digital tools that enhance efficiency and accuracy. Detailed documentation for inspections includes ISO references, Piping & Instrumentation Diagrams (P&ID), redline drawings, data sheets, and test packs. Additionally, digital tools such as Excel are utilized for punch list tracking, enabling real-time updates and streamlined issue resolution. The company also focuses on process standardization and workflow optimization by implementing standardized inspection procedures and categorizing punch items into priority levels (A, B, C) to ensure timely corrective actions. Systematic labelling and numbering of piping joints are carried out to maintain precise alignment between physical installations and design documentation, reducing errors and improving operational consistency. Finally, the company emphasizes risk management and compliance through the integration of Factory Acceptance Test (FAT) and Operational Acceptance Test (OAT) protocols, which verify equipment reliability before commissioning. Proactive risk mitigation strategies, including early defect detection and structured approval processes, further strengthen the company's commitment to delivering safe, reliable, and high-quality engineering solutions.

Student 5 (Figure 5) emphasizes the critical role of Quality Assurance and Quality Control (QAQC) in ensuring project success and views it as an innovative approach to managing complex engineering projects. He appreciates the structured multi-stage inspection process (MRI, ERI, IV, CC) and recognizes how these systematic checks prevent defects and maintain compliance with standards. This experience reinforced the importance of documentation and digital tools, such as using Excel for punch list tracking, which the student perceives as an effective way to streamline workflows and improve communication among teams. From his perspective, teamwork and communication are essential for implementing innovative management practices. He suggests that collaboration across all levels of personnel is key to achieving project goals efficiently. The student also highlights the value of standardization, such as labelling and numbering piping joints, which he sees as a practical method to align physical installations with design documentation and reduce errors. The student also implies that continued adoption of structured QAQC systems, digital documentation, and proactive risk management will enhance operational efficiency and reliability. His reflections suggest that integrating these practices more broadly across projects could strengthen quality control and reduce delays.

Figure 5. Student 5 internship at Company 5
Source: Private Documentation, 2025.

Discussion

One significant application of innovative management practices is the implementation of Quality Management Systems (QMS), as suggested for Access Corporate Ventures. Introducing an ISO 9001-based QMS provides a structured framework for standardizing processes, reducing variability, and promoting proactive risk management. This approach ensures reliability in network solutions projects, minimizes downtime, and enhances customer satisfaction key outcomes that reflect the essence of innovative management. Another major trend is digitalization and automation, which was evident in Gas Malaysia Retail Services' adoption of smart meter systems. These systems enable remote monitoring, real-time data collection, and predictive maintenance, reducing manual intervention and human error. Similarly, Kian Joo Can Factory proposed automating waste tinplate disposal using rollers, which would save time, increase productivity, and reduce operator injuries. Both examples align with Industry 4.0 principles, showcasing how automation can transform traditional processes into efficient, technology-driven operations. The development of specialized software tools also stands out as an innovative solution. At Access Corporate Ventures, the proposal to create lifting plan calculation software addresses a critical need for safety and compliance while reducing costs associated with third-party services. Automating complex calculations ensures accuracy and streamlines workflows, demonstrating how custom digital solutions can enhance operational performance. Additionally, standardization and documentation were emphasized across multiple reports. Creating Standard Operating Procedures (SOPs), flowcharts, and machine specifications improves consistency, facilitates employee training, and enhances accountability. These practices not only optimize current operations but also lay the foundation for continuous improvement. Overall, these initiatives have delivered tangible benefits such as efficiency gains, cost savings, risk reduction, and competitive advantage. By integrating structured systems, automation, and digital tools, these organizations have successfully embraced innovative management, positioning themselves for sustainable growth in an increasingly technology-driven business environment.

Conclusion

The study clearly shows that innovative management practices play a vital role in improving operational efficiency, safety, and competitiveness across industries. Key strategies such as implementing ISO-based Quality Management Systems, adopting digitalization and automation, developing specialized software tools, and standardizing processes have proven to be effective in addressing complex challenges. These initiatives not only streamline workflows and reduce costs but also enhance reliability and customer satisfaction. Furthermore, the integration of smart technologies and predictive maintenance demonstrates how organizations can leverage data-driven decision-making to minimize risks and optimize performance. By embracing these innovations, companies position themselves for sustainable growth and align with global trends such as Industry 4.0. The findings confirm that innovative management is not merely an option but a necessity for organizations seeking long-term success in a rapidly evolving technological landscape.

From students' perceptions, innovative management is essential for achieving operational excellence and future readiness. Students consistently recognized the value of structured systems, automation, and digitalization in improving efficiency and reducing risks. For example, one student suggested implementing an ISO 9001-based Quality Management System (QMS) to standardize processes and enhance reliability, while another proposed developing specialized software for lifting plan calculations to ensure compliance and reduce costs. These ideas reflect a strong awareness of how technology and process optimization can transform traditional practices. Students also emphasized the importance of digital tools and automation, such as smart meter systems and IoT integration, which enable real-time

monitoring and predictive maintenance. They perceived these innovations as critical for minimizing downtime, improving safety, and delivering superior customer service. Additionally, the creation of Standard Operating Procedures (SOPs) and detailed documentation was viewed as a practical step toward consistency and continuous improvement. Overall, students' suggestions align with global trends like Industry 4.0, demonstrating their understanding that innovative management is not just about adopting new technologies but also about fostering a culture of proactive problem-solving and efficiency. By integrating these insights, organizations can achieve cost savings, risk reduction, and competitive advantage, ensuring sustainable growth in an increasingly digital and dynamic business environment.

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