



Optimizing Management Processes in Service Enterprises through the Application of QR Code Technology

Bachelor's Thesis
International Business
Autumn 2025
Khanh Linh Dao

DP International Business
Author Khanh Linh, Dao Year 2025
Subject Optimizing Management Processes in Service Enterprises through the Application of QR Code Technology
Supervisors Dr. Faisal Shahzad

This thesis examines how QR code technology can be applied to optimize service quality control processes and support human resource management in small and medium-sized service enterprises. The study was conducted in collaboration with Hoan My Co., Ltd., a Vietnamese cleaning service company operating nationwide. The research responds to the increasing need for digital transformation in SMEs, who often struggle with labor-intensive manual supervision, limited resources, and a lack of transparency in performance evaluation.

A qualitative case study approach was used, combining semi-structured interviews with managers, supervisors, and frontline staff, along with descriptive analysis of internal company reports generated during a pilot implementation of QR code technology. The findings reveal that integrating QR codes into daily work processes reduces administrative workload, enhances transparency in timekeeping and performance assessment, and improves the accuracy and responsiveness of service quality monitoring. Supervisors reported decreased manual inspection time, while employees recognized increased fairness and clarity in work expectations.

However, challenges were identified, including uneven digital literacy, network infrastructure limitations, and initial resistance to change. The study concludes that successful adoption requires strong leadership support, structured training, and process alignment. The thesis proposes practical recommendations and suggests future development toward system scaling, integration with payroll and customer reporting systems, and enhanced digital training programs. The findings contribute to both academic understanding and practical guidance for SMEs pursuing low-cost digital transformation.

Keywords QR code technology, service operations management, human resource management, SMEs, digital transformation, cleaning service industry.
Pages 71 pages and appendices 5 pages

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1. Introduction

1.1 Background of the Study

Optimizing the management of service quality control processes and supporting human resource management has become one of the top priorities of enterprises in the context of the Fourth Industrial Revolution (Industry 4.0), which is increasingly considered an inevitable global trend (Yong, 2023). Worldwide, service enterprises are gradually applying digital technology to improve service quality management, monitoring, and control. These technologies aim to improve work efficiency, minimize fraud and errors, and enhance transparency and traceability (Gao, et al., 2015).

What we already know is that, globally and in Vietnam, the integration of technology into operational processes has received considerable attention. According to FlowForma's 2023 Global Report, more than 80% of companies have accelerated their digitalization plans, with 67% citing operational efficiency as the main reason for implementing business process automation (FlowForma, 2023). In Vietnam, Le, Nguyen, and Pham (2023) found that businesses are increasingly motivated to adopt Industry 4.0 technologies due to factors such as technology readiness, leadership vision, and market competition. Their findings confirm that technology adoption improves organizational productivity, efficiency, and agility – making process transformation an essential method to remain competitive in a dynamic environment. This aligns with national policies that emphasize digital transformation as an urgent requirement for SMEs (Vietnam Law Journal, 2022).

At the same time, service businesses face ongoing challenges such as labor shortages, operating costs, and rising customer expectations (Boxall & Purcell, 2016). SMEs, in particular, are constrained by limited capital, human resources, and organizational capacity (Hudson, et al., 2001). While large corporations can afford advanced automated systems, many SMEs still rely on manual quality control methods such as on-site monitoring and paper-based timekeeping. This results in wasted time, higher labor costs, and frequent errors (Oliveira & Martins, 2011). For example, Dương's (2024) doctoral research on SMEs in Hanoi confirmed that "most SMEs do not have automated work monitoring systems, resulting in performance evaluations that remain subjective and lack transparency" (p. 45).

However, what remains less explored is how simple, low-cost technologies such as QR codes can be systematically applied in service businesses to address these operational and HR-related challenges. While studies point to digital tools as being useful for SMEs, there is still limited evidence of how QR codes specifically can improve service quality control and reduce reliance on manual methods.

Therefore, this study proposes QR codes as an effective, low-cost, and flexible solution for SMEs. Replacing manual time tracking and monitoring with QR codes offers several benefits, such as reducing labor expenses, increasing transparency, enhancing traceability, and enabling more objective performance evaluations (Gao, et al., 2015; Denso Wave, n.d.). By investigating the adoption of QR codes within a Vietnamese service enterprise, this study aims to fill the gap in existing research by providing practical insights into how a simple yet effective technology can transform service quality management in SMEs (Pedrini & Frederico, 2018).

1.2 Objective of the Thesis and Research Questions

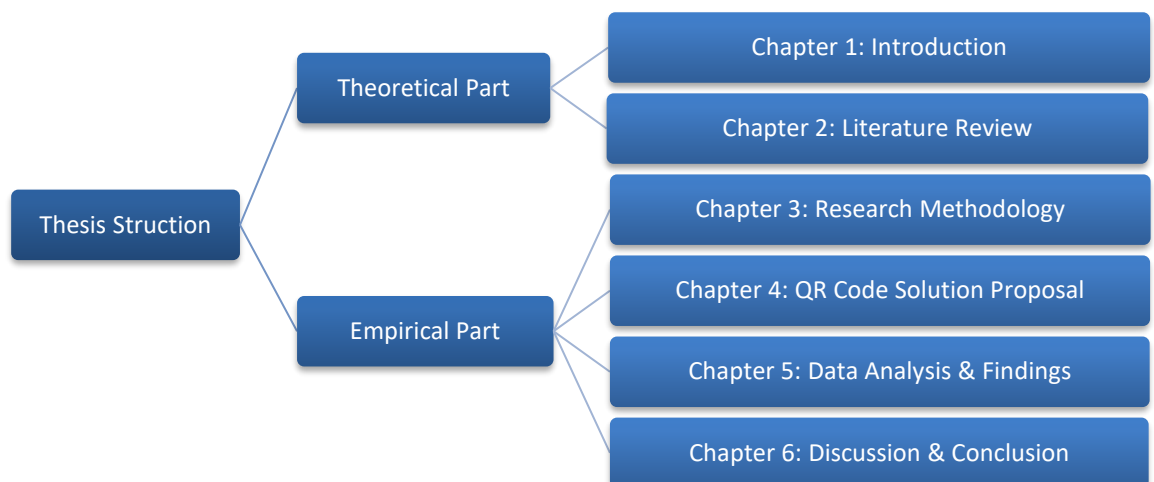
The primary objective of this thesis is to develop an optimal solution for operational management of service quality control processes and support human resource management at a small and medium-sized (SMEs) cleaning service enterprise, through the application of QR code technology. This study develops an alternative management solution to traditional manual monitoring methods. This solution aims to achieve common goals such as: monitoring work performance, minimizing fraud and errors, enhancing transparency and enabling traceability. In addition, the study also provides recommendations and future directions for other companies in the same industry, contributing to the common goal of sustainable development. To achieve these goals, the author has developed the following research question:

1. How can QR code technology be effectively integrated into service quality control processes to replace traditional manual supervision?
2. What measurable improvements in operational efficiency and service quality can be achieved after implementing QR code technology?
3. What challenges, limitations, and best practices from the pilot implementation can inform the scalability and application of the solution across other enterprises in sustainable contexts?

1.3 Thesis Structure

This thesis is organized into six main chapters. The first chapter introduces the research background, explains the rationale for choosing the topic, outlines the research objectives and questions, and provides an overview of the trust company to help the reader understand the scope and current situation. The second chapter presents a literature review, which forms the theoretical framework of the study by examining relevant theories, concepts, and case studies, including the TOE Framework, Learning Organizations, Innovation Theory, and Lean Services. The thesis also discusses the use of technology, especially QR codes, in business operations and identifies the research gaps. Continuing with the third chapter, where the author explains the research methodology, detailing the research approach, data collection procedures, and sampling techniques used to ensure valid and reliable results. Next, the author describes the proposed QR code solution, including system design, technical requirements, workflow integration, and expected benefits in addressing the limitations of traditional manual monitoring. The fifth chapter analyzes the results of interviews and company data report from pilot implementation, in which the author comparing pre- and post-implementation data to assess improvements in efficiency, service quality, while identifying challenges, limitations, and discuss about lessons learned, provide practical recommendations for scaling up the solution within the company or applying it to other businesses. The final chapter concludes the study by discussioning, summarising, and suggesting future directions, including potential technical improvements and broader applications of the QR code solution.

Figure 1. The Structure of the Thesis



1.4 Commissioning Company

Hoan My Company Limited was established on February 18, 1997, in Hanoi, marking the beginning of more than 25 years of continuous development in Vietnam's cleaning service industry. With its headquarters in Cau Giay District, Hanoi, Vietnam, the company has expanded its operations to cover all 63 provinces and cities nationwide, employing over 5,000 staff members and serving more than 1,000 clients. Its service portfolio ranges from regular maintenance cleaning for office buildings and commercial centers, to deep cleaning for hospitals, airports, and schools, as well as large-scale industrial and construction projects. In addition, Hoan My provides consulting services in facility hygiene and environmental safety, strengthening its position as a reliable partner across diverse high-standard environments. Over the years, the company has earned a strong reputation for quality, safety, and stability, and today it is embracing automation technologies and digital transformation as key drivers of sustainable growth and competitiveness in a rapidly changing market.

This thesis aims to examine and analyze the human resource management strategies at Hoan My Co., Ltd., focusing on how the company builds, develops, and manages its cleaning workforce in the context of organizational growth and automation. The study seeks to propose practical HR solutions to optimize labor resources, improve productivity, ensure occupational safety, and maintain a balance of interests among the company, employees, and clients.

The research is expected to provide Hoan My with practical insights and data-driven recommendations to enhance operational management effectiveness, particularly in adapting to technological advancement and nationwide market expansion. Additionally, the study aims to contribute to the development of a sustainable business model that places human capital at its core, while offering strategic suggestions on recruitment, training, employee retention, and the creation of a safe, efficient, and inclusive working environment in cleaning service industry, especially in Vietnam.

2 Theoretical Framework

2.1 Basic Concepts

This part aims to establish the fundamental concepts that form the foundation of the thesis. By defining the basic concepts of operational management, optimization, small and medium-sized enterprises (SMEs), and QR code technology, the study creates a shared understanding of the core ideas that underpin the research. Clarifying these concepts is essential to frame the scope of the investigation and ensure consistency in interpretation. This foundation also provides the basis for exploring how QR code technology can be applied as a practical tool to optimize management processes and strengthen human resource practices in SMEs, particularly within Vietnam's service sector.

2.1.1 Operational Management

Operations management is simply the design, operation and improvement of the internal and external systems that deliver the company's products and services (Slack, et al., 2010; Russell & Taylor, 2009). Management studies suggest that operations management is a fundamental part of management, focussed on the efficient and effective utilisation of resources such as people, technology and processes, in order to achieve the organisation's operations goals, while maximising profits for the business (Slack, et al., 2022; Russell & Taylor, 2023).

Operation management in service-providing businesses is directly related to the quality control of the service. It involves designing work procedures, designing control systems, monitoring performance and making adjustments when variances are noticed (Inyo & Githii, 2022).

Efficient operations management in service quality assurance guarantees that the operations always follows the same routine, reduces the amount of mistakes, and guarantees the fulfilment of the customers need according to the minimum or the maximum, every time. Inadequate system for management of operations results in excessive waiting time inter-process resource underutilization broken processes loss of customer confidence (Inyo & Githii, 2022).

For small and medium-sized enterprises (SMEs), operations management plays a fundamental role in building competitive advantage. With limited resources, SMEs rely on effective operations processes in quality control to maximize labor productivity, increase transparency, and strengthen customer trust (Hudson, Smart, & Bourne, 2001). Furthermore, employee engagement and adaptability to new management tools significantly influence the success of operational activities (Boxall & Purcell, 2016). Therefore, the adoption of a QR code-based service quality control system is not only a technological change but also a transformation in the way resources and people are coordinated to achieve sustainable efficiency (Dessler, 2020).

2.1.2 Optimization in Operational Management

Operational management optimization of service quality control is a process of processes and procedures improvement, and monitoring systems in order to assure the service quality standards are being met. The objective being to improve the efficiency, dependability and transparency of the provision of that service and to reduce levels of waste, errors and inconsistency (Revathi, et al., 2024).

Manual traditional methods have been for years linked to delays, extra expenses, and lack of standardization of evaluations, which stresses the need for digital optimization (Oliveira & Martins, 2011). Implementing optimization principles is to reengineer service quality control procedures so that inefficient operations can be eliminated and the accuracy can be improved. This involved the standardizing of reporting systems, implementing evidence-based performance review, and minimizing subjective supervision. Digital tools are more important than ever in this process. With the support of QR codes and other technologies, real-time task-tracking, instant reporting, and structured collection and storage of data, make it possible to trace and access to operation information in an transparent and consistent manner (Gao, et al., 2015).

There are various advantages for SMEs in optimising by QR code-based systems. It improves the monitoring by management, reduces the chance for fraud or misreporting, and yields more accurate information on which to base decisions. At the same time, it fosters a crystal clear atmosphere in which employees are responsible for their responsibilities, discussions, gaining customer trust and satisfaction (Pedrini & Frederico, 2018). Finally, improving the operational management in terms of services quality control will not only improve the daily efficiency, but also is laying the foundation for the future long term success in business.

2.1.3 Small and Medium Enterprises (SMEs)

Small and medium-sized enterprises (SMEs) are businesses that typically have a small workforce, modest income, or both. They typically meet a range of employment and financial requirements that vary by country or region. Because they often account for a significant share of trade, employment, and innovation in a given location, SMEs are essential to the economy (Enaifoghe, 2025).

In Europe, 99% of businesses are SMEs. According to the European Commission, SMEs play a significant role in contributing to the financial and economic well-being of the EU. In Vietnam, there are approximately 900,000 active businesses. More than 97% are SMEs, contributing to 45% of the country's GDP and 31% of total budget revenue. According to the Ministry of Planning and Investment, these companies employ more than 5 million workers. The majority of small and medium-sized enterprises (SMEs) operate in the service sector (e.g. restaurants, cafes, hotels, logistics, industrial cleaning, education, health services). SMEs are often characterized by flexibility, close relationships with customers, and the ability to make quick decisions (HuSmart & Bourne, 2001). However, they also face constraints: limited resources hinder formal transactions. Small and medium-sized enterprises (SMEs) are businesses that typically have a small workforce, modest income, or both. They often meet a range of employment and financial requirements that vary by country or region. Because they often account for a significant share of trade, employment, and innovation in a particular location, SMEs play an essential role in the economy (European Commission, 2016).

2.1.4 QR Code Technology

QR Code (Quick Response Code) is a type of two-dimensional barcode that can be scanned in seconds using a smartphone or a specialized scanner. It can store many kinds of data — from plain text to website links and other digital information — and make that data instantly accessible (International Organization for Standardization [ISO], 2015). First created in 1994 by the Japanese company Denso Wave to keep track of automotive parts, QR codes have since found their way into almost every corner of daily life and business, appearing in retail stores, logistics systems, marketing campaigns, and service operations.

For small and medium-sized enterprises (SMEs), QR codes are particularly appealing. They are inexpensive, easy to use, and don't require major investments in infrastructure. They can

be slotted straight into existing workflows without causing disruption, while giving managers the ability to monitor task completion in real time, track work progress continuously, and receive customer feedback instantly (Gao, et al., 2015; Pedrini & Frederico, 2018).

In countries like Vietnam, where digital transformation is still uneven and many SMEs depend heavily on manual processes and paperwork, QR codes can be an ideal first step toward going digital. They make it possible to maintain consistent service quality and respond to problems more quickly (Al-Awlaqi, et al., 2024). Beyond that, they bring greater transparency and speed to information management, making it easier to trace data during audits, reduce errors, cut administrative workload, and save on the costs of human supervision.

2.2 Theoretical Foundations

2.2.1 Technology–Organization–Environment (TOE) Framework

The Technology–Organization–Environment (TOE) framework was first introduced in Tornatzky and Fleischer's book *The Processes of Technological Innovation* (1990). It identifies three key contexts that influence the adoption of innovation: the technological context (T), the organizational context (O), and the environmental context (E). The framework explains how the internal and external conditions of a company shape its decision to adopt and implement new technologies (Suradi et al., 2025).

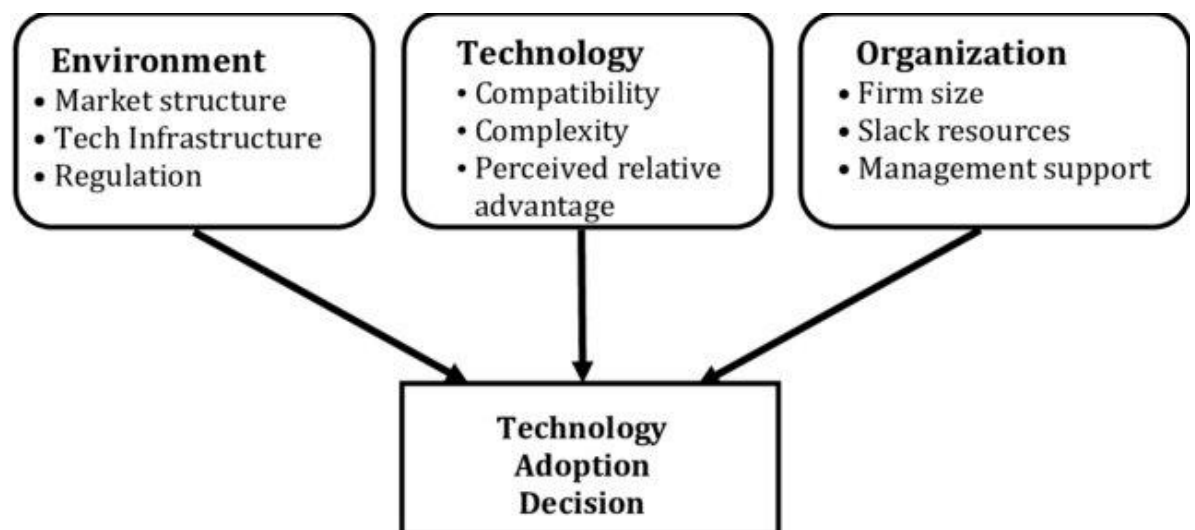
Since its introduction, the TOE framework has been widely applied across different industries and technologies. For example, it has been used in studies on the adoption of information systems (Grover, 1993; Mishra et al., 2007), e-business (Zhu et al., 2003; Zhu & Kraemer, 2005), electronic data interchange (EDI) (Kuan & Chau, 2001), and enterprise systems (Ramdani et al., 2009). Its relevance has also been confirmed in sectors such as healthcare (Lee & Shim, 2007), manufacturing and product industries (Mishra et al., 2007), and finance and retail services (Zhu, et al., 2006).

Research findings consistently demonstrate that the three TOE dimensions play a significant role in shaping organizational adoption behavior. For instance, Kuan and Chau (2001) showed the framework's usefulness for small businesses when identifying determinants of accounting information system adoption, including cost structure, technical capability, and government support. Similarly, Zhu et al. (2004) highlighted that technology availability was

a strong driver of e-business adoption, while financial resources, global scope, and regulatory environment also contributed to business value.

Overall, the TOE framework has proven to be both theoretically sound and practically adaptable, offering researchers and practitioners a structured way to analyze how firms adopt digital innovations in different contexts and industries.

Figure 2. Technology-Organization-Environment (TOE) framework (Yong, 2023)



The TOE framework is suitable for this study because it provides a comprehensive view of the factors influencing the adoption of new technology by an organization (Prakash, 2025). At the same time, it is a method of studying the practical problems of small and medium enterprises (SMEs) in Vietnam that lack individual technological applications. The TOE framework does not only focus on analyzing technological factors; it also allows the study to consider factors such as the organization's readiness for factors such as management support, resource constraints, and the company's sustainable development strategy; or related to external aspects, such as regulations, competition, and market demand (Paiva et al., 2024). Overall, the TOE framework enables this research to examine the application of QR codes in service quality control holistically, taking into account the combined effects of technological suitability, organizational capacity, and environmental conditions.

1. Technological Dimension

The Technology dimension of the TOE framework focuses on the characteristics of a new technology, such as perceived usefulness, complexity, and compatibility with existing

systems (Faiz et al., 2024). These attributes help businesses assess whether a technology is highly applicable, appropriate for their operations, or requires adaptation. Compatibility refers to the extent to which a new device or software matches the values, experiences, and operational needs of users (Zhong & Moon, 2023).

Research has shown that system compatibility plays an important role in both the decision to adopt and the intention to continue using a technology. When a solution fits the business environment, aligns with the organization's goals and strategies, and does not conflict with existing hardware or software, the likelihood of long-term adoption and adoption increases (Leung, et al., 2015).

QR code technology has significant benefits for SMEs, including low installation costs, easy interaction with existing mobile devices, and the capacity to store and retrieve information rapidly (Faisal et al., 2025). QR codes are also low-complexity; they can be integrated into existing service processes without requiring significant changes to infrastructure. This is especially significant for businesses that do not already have specialized technology to optimize human resource-related activities. Implementing a QR code-based system allows users to rapidly update information, synchronize correct records, and reduce errors that are frequent in traditional paper-based management techniques (Ledi, et al., 2025).

2. Organizational Dimension

Organizational readiness refers to the availability of technological, financial and human resources needed to implement innovation in an organization. While financial resources refer to the assets and capital of the enterprise, human resources refer to the human factor - the ability to access and use technology, and technological resources reflect the level of the organization in using innovative knowledge and skills (Thuy, et al., 2020). When an organization lacks resources, the ability to adopt and continue innovation is also difficult to implement and vice versa.

SMEs around the world, especially in Vietnam, are still under pressure from rigid structures, resistance to change, and cultures that discourage innovation, making SMEs reluctant to adopt new technologies. Organizational readiness positively affects the intention to adopt and maintain technology in business operations. A business is truly ready when it has management support, employee training and engagement, and process redesign. Company leaders must be aware of the value of QR codes in enhancing and improving operational

management processes, so that their support will be a solid foundation for practical operations and applications. On the employee side, they need to understand how technology benefits their daily work (Nazir, et al., 2025) thereby promoting learning and wider use of technology. Process redesign is also essential during innovation, ensuring that workflows are adjusted to enable efficient scanning, data management and record keeping.

3. Environmental Dimension

According to the study by Thuy, Tran, and Sinh (2020), environmental pressures such as pressure from competitors and market rivalry are two main factors influencing the decision to adopt and continue using technology. SMEs are increasingly adapting to new technologies, as delays or hesitation can be a disadvantage. Falling behind other companies in the same industry may lead to consequences such as reduced competitiveness, declining revenue, and the loss of high-quality labor (Sivathanu & Pillai, 2020).

Government regulations significantly affect business behavior in both network cooperation and market orientation (Nguyen, 2016). In Vietnam today, many policies encourage businesses to innovate and adopt information technology, with the ability to expand supported by government initiatives. For instance, SMEs are urged to use easy-to-implement, affordable digital technologies, such as QR codes, to improve operational efficiency and service quality under the National Digital Transformation Program to 2025, with orientation to 2030. These policies not only encourage businesses to use technology but also place pressure on them to transform, creating a premise for the transformation of the national economy (Do & Tran, 2022; Pham, 2023).

Pressure from customers is also a factor that strongly influences the decision to adopt and continue using technology (Leung, et al., 2015). In the era of Industry 4.0, customer needs are changing rapidly and becoming increasingly diverse, making the understanding and fulfillment of those needs essential for business survival. Today's customers demand transparency and accuracy; they want to be able to access and update service records at any time, which QR codes can fully support. According to Thủy et al. (2020), customer pressure not only drives businesses to adopt technology but is also closely linked to their decision to continue using it.

2.2.2 Learning Organization Theory

Learning organizations are an important factor in improving long-term organizational performance (Örtenblad, 2018; Peltokorpi & Niemi, 2018; Veelen & Ufkes, 2017). A learning organization is most generally defined as an open system that fosters and develops an organizational learning culture, facilitates learning activities, disseminates learning outcomes, and uses learning to improve performance (Xie, 2020). In a learning organization, employees will continuously learn, create, acquire, and transfer knowledge - helping their company adapt to unpredictability faster than competitors (Garvin et al., 2008). Senge (1990) emphasizes the importance of a culture that encourages learning and creative thinking in any organization. Learning organizations always promote continuous improvement in organizational structure and are beneficial to employee development and performance (Garcia-Morales et al., 2008).

Figure 3. The Learning Organization (Senge,1990)



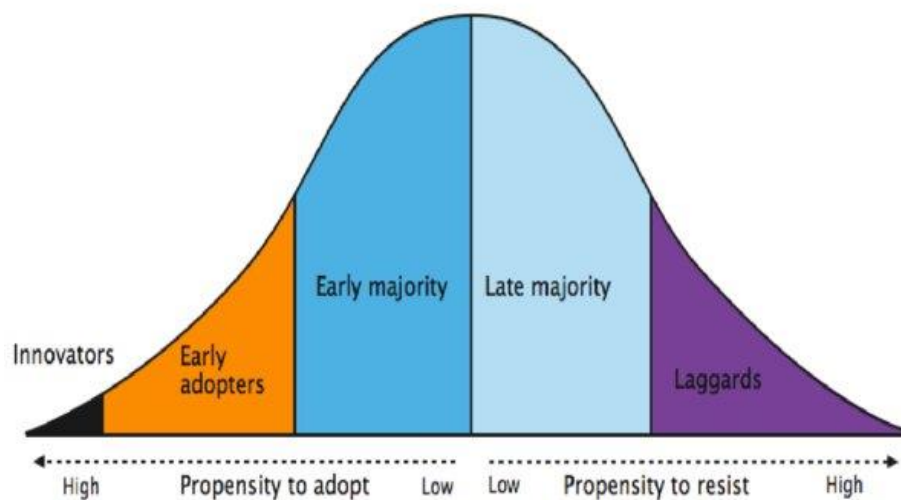
In service businesses, especially those that have never applied information technology in human resource management, adopting a new technology, even something as simple as a QR code, requires changes in behavior, awareness, and a willingness to redesign processes to adapt and continuously develop skills. Prior studies have shown that organizations with a strong learning culture are more successful at adopting and integrating new technologies because they are more flexible, adaptive, and open to continuous improvement (Hsu et al.,

2006; Jerez-Gómez et al., 2005). Such organizations can maintain and control operations with QR codes more effectively when they actively listen and adjust the system based on feedback from employees and customers (Hung et al., 2010). Therefore, a learning organizational culture is an indispensable and a core element for maintaining and developing an organization.

2.2.3 Innovation Theory (Diffusion of Innovations)

Theories commonly used in the exploitation and analysis of new technologies are often based on the perspective of the business. However, the user's perspective is also an indispensable part of the operation, affecting the success of a new method. DOI theory was proposed by Rogers (1983) to analyze the behavior of users in the context of new technology. The background layer is a process by which a technology is spread through different channels. Some important factors of DOI theory that promote usage behavior include competitive advantage, compatibility, trialability, and observability. Depending on the research context and different technologies, these factors may play different roles in usage behavior (Shahadat et al., 2023).

Figure 4. Innovation Theory (Diffusion of Innovations) (Rogers, 1985)



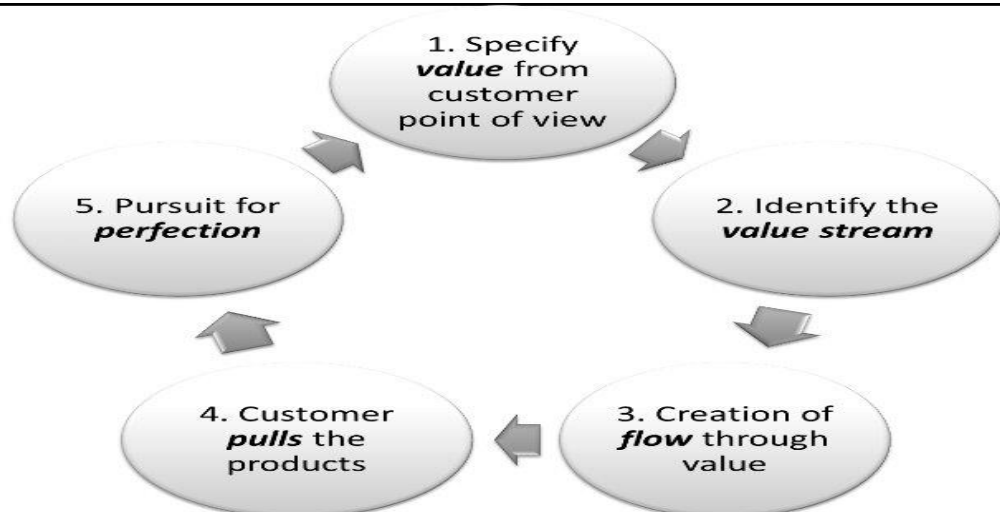
For the use of QR codes in optimizing service quality control, the relative advantage can be easily recognized as improving the speed of information retrieval, origin, faster checking, and reducing manual paperwork. High compatibility because it does not require major changes in infrastructure, QR codes are easily manipulated on phones or machines with smart

scanning systems. Low complexity because the software is easy to understand, easy to operate, does not require high expertise, nor complex operations. High trial ability because it is possible to run pilot projects for a few departments before running the entire system. Regarding observability, human resource management will bring visible improvements in service delivery and reporting accuracy (Zondo & Ndoro, 2023)

2.2.4 Lean Service Principles

Lean is a manufacturing methodology that includes a set of principles, tools, and techniques designed to address the root causes of lean and optimized manufacturing operations. It is a systematic approach to eliminating all forms of waste throughout the entire production chain to maximize customer satisfaction (Womack et al., 1990). Accordingly, the goal of Lean is to optimize the values of production productivity, product quality, production costs, and customer responsiveness while ensuring safe production conditions. To ensure these goals, Lean tries to eliminate three main sources of loss from the production management system: waste, variation, and inflexibility (Drew et al., 2004). According to Pascal, 2007: “Lean Manufacturing is known as the most effective method in eliminating waste and continuous improvement through activities to reduce inventory, excess capacity and any unnecessary activities that do not add value to the product or service”.

Figure 5. Schematics of the application of Lean principles. (Alveset et al., 2019)



QR codes are completely consistent with this theory based on their application in operations and optimizing management. From reducing redundant paperwork and minimizing unnecessary supervisory human resources to collecting data in real time and streamlining

service verification, they reflect the lean principle of eliminating waste (Womack & Jones, 1996). Lean theory in services allows businesses to identify value-creating and non-value-creating steps or operations from the customer's perspective, thereby improving points of waste to eliminate (Bowen & Youngdahl, 1998).

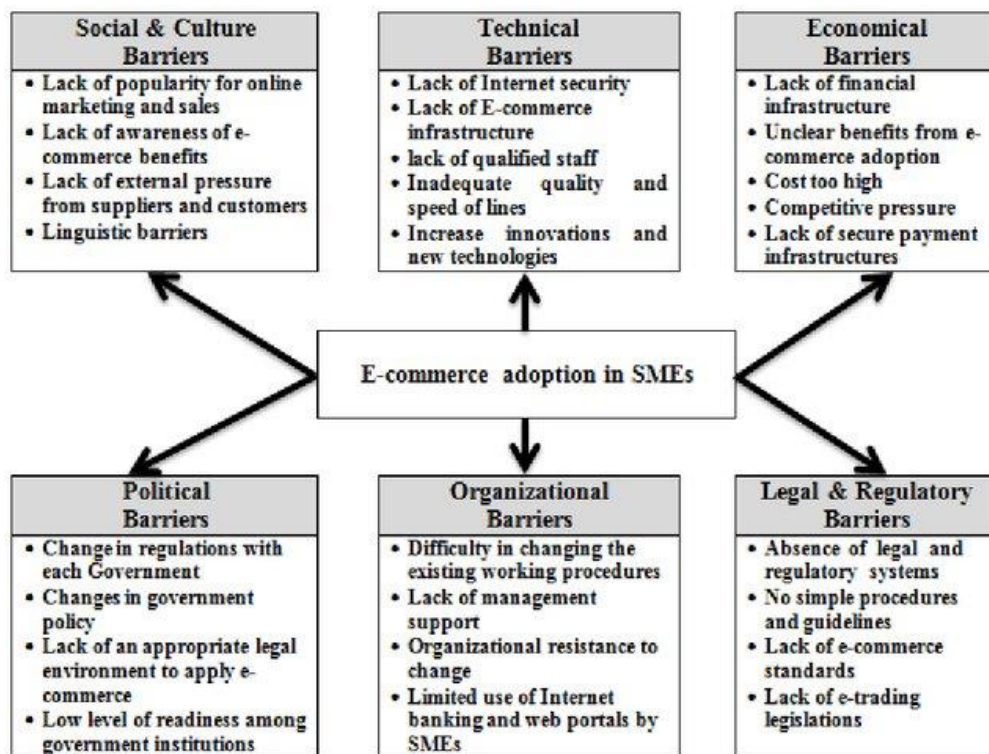
From the perspective of human resource management in cleaning service companies, waste from correction, waste from operations, and waste from waiting are three common problems in manually managed enterprises. These issues cause errors and delays in management work, leading to a lack of customer satisfaction (Hines, Holweg, & Rich, 2004). After identifying sources of value for the enterprise, implementing Lean Manufacturing requires establishing and applying highly detailed production instructions. These instructions, often called Standard Work, typically define the content, sequence, and standard time to perform tasks, as well as the outputs of employee activities (Liker, 2004).

A basic principle of Lean Manufacturing is to ensure a continuous flow of work, eliminating “bottleneck” points, interruptions, retracing, or waiting that occur during process stages. This accelerates progress and allows work to flow more smoothly (Ohno, 1988). The pull mechanism in manufacturing aims to produce only what is required, and only when it is required. Each stage of production is “pulled” by the next stage, producing only when needed. This mechanism focuses on creating value from essential customer requirements while eliminating cumbersome manual processes (Womack & Jones, 1996). Finally, the principle of promoting perfection aligns closely with the theory of the Learning Organization. Enterprises must listen to feedback from employees and customers to continuously improve, seek perfection, and ensure that the human resource management system remains innovative and avoids obsolescence (Senge, 1990).

2.3 Challenges and Barriers to Technology Adoption in SMEs

While technology adoption can be a powerful driver of competitiveness, obstacles and barriers will always arise when small and medium-sized enterprises (SMEs) seek to transform, as illustrated clearly in Figure 6 below :

Figure 6. Conceptual framework for e-commerce adoption barriers in SMEs (El Said, M. F, 2014)



Applying technology to optimize operations and human resource management brings many benefits, but at the same time, it also poses many challenges for businesses. Although small and medium-sized enterprises (SMEs) all want to transform into modern digital enterprises to keep up with the trend of the times, the needs and speed of digital transformation of each industry and each type of enterprise are not the same. This comes from the fact that each business sector has its own characteristics and conditions, develops at different speeds, and the level of readiness or ability to access new technology is also very specific (Do, 2025).

Therefore, understanding the development characteristics of each industry will help businesses seize the opportunity to transform digitally at the right time and achieve the highest efficiency (Pedrini & Federico, 2018; Temel & Ayaz, 2019). On that basis, clearly

identifying the difficulties and challenges that businesses will face when applying new technology is a necessary step, playing a key role in deciding whether to deploy that technology or not. In this scope, the author analyzes the barriers and challenges in three main groups: economical, organizational-social and technological.

2.3.1 Economical Barriers

Economic factors, especially cost, are always one of the most significant barriers that any business faces when adopting new technology, especially SMEs. Limited budgets make many businesses hesitant to invest in software, hardware innovation and employee training (Lai et al., 2025). Even QR code technology itself, which is considered a low-cost and quick-to-effective solution, has many hidden costs such as upgrading equipment, providing necessary elements for use, such as internet for employees, reconfiguring the system or training employees to use the technology.

In addition to the cost factor, SMEs often do not fully understand the benefits of information technology, especially those that have not used IT before. Combined with the difficulty of unstable cash flow; if they allocate money for large investments without quickly reaping benefits, this can hinder innovation. This financial caution can slow down the pace of digital transformation and prevent businesses from staying competitive (Yong, 2023).

2.3.2 Organisational and Social Barriers

Difficulty in changing existing manual processes often leads to organizational resistance to new technology. Many businesses have maintained habits, informal processes, and organizational cultures that have been developed over many years of operation. Changing these social and cultural factors is often met with resistance (Hudson, et al., 2001). In addition, management sometimes does not closely monitor or adequately support employees during the process of changing and integrating new technology.

On the other hand, employees may feel pressured by fear of increased workload or having to learn to adapt to new tools and processes. In the cleaning service industry in particular, the workforce is mainly middle-aged people who are not used to using technology in tasks such as timekeeping or reporting work. According to international labor statistics, the average age of janitors and cleaners in the United States ranges from 44 to 48 years old, with the largest proportion of workers in the 45–59 age group (US Bureau of Labor Statistics, 2023).

The report shows that the cleaning service industry often has an older workforce, which is also a major obstacle to implementing technology into human resource management in this field. In fact, even if the leadership has a clear strategic vision, if employees are unable or unwilling to implement, the technology application project is still at risk of failure.

2.3.3 Technological Barriers

Technological Barriers While tools like QR codes are relatively simple, other technologies may require significant technical knowledge, infrastructure, or compatibility with existing systems. SMEs often lack in-house IT expertise, making them reliant on external vendors for installation, maintenance, and troubleshooting (Gao, et al., 2015). Poor internet connectivity, outdated equipment, or insufficient cybersecurity measures can also hinder adoption (Le, et al., 2023). Furthermore, without proper integration into existing processes, technology risks becoming an isolated tool rather than a seamless part of operations, reducing its overall effectiveness (Oliveira & Martins, 2011).

2.4 Gaps in the Literature

Existing QR-code studies concentrate largely on logistics, manufacturing, and marketing (Faisal et al., 2025) with limited attention to service quality control and human-supervision replacement in SMEs, especially in cleaning services and emerging markets such as Vietnam (Do, 2025). Previous studies have also rarely integrated business-focused frameworks such as the Technology–Organization–Environment (TOE) framework to explain why firms adopt new technologies (Prakash, 2025). In addition, perspectives like the Learning Organization highlight the importance of continuous learning in sustaining adoption (Paiva et al., 2024), while the Diffusion of Innovation theory provides insights into how adoption spreads across organizations (Shahadat et al., 2023). From a service perspective, Lean Service emphasizes eliminating waste and improving processes after adoption (Khaleel & Al-Mansoori, 2022).

Furthermore, there is a lack of before–after empirical evidence on operational efficiency, service quality, and cost outcomes (Pedrini & Frederico, 2018). Insufficient attention has also been paid to organizational learning capabilities and other conditions for sustaining and expanding QR code–based systems (Ali, Alshurideh, & Al Kurdi, 2024). To fill these gaps, this study uses the case of a Vietnamese SME providing cleaning services with qualitative interviews and pre/post implementation data to address a number of issues such as

demonstrating the effective integration of QR codes into service quality control, assessing improvements in efficiency, quality and cost reduction, and extracting challenges, constraints and best practices that inform enterprise-wide scaling and provide transferable insights to similar service businesses globally.

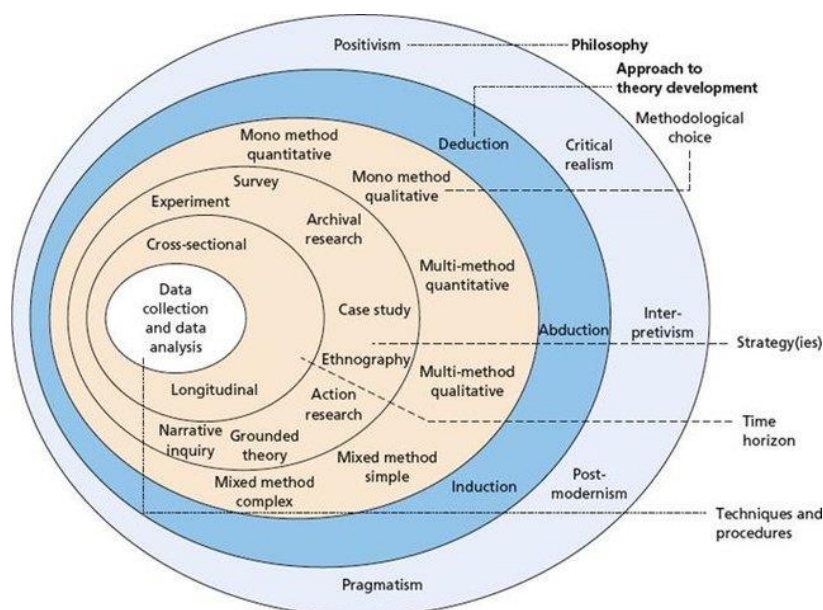
3 Research Methodology

Chapter 3 aims to describe the study's design, execution, and analysis as well as the methodological approach that was employed. There are two primary sections to the chapter. The research philosophy and methodology are covered in the first section, which also explains the methodological decisions used in the Research Onion methodological framework. The second part outlines the data collection and analysis procedures, detailing how data were collected, sampled, and analyzed to address the research questions.

3.1 The Research Onion

This study adopted the Research Onion (R&D) model proposed by Saunders et al. (2019) as a guiding framework for methodological design. By systematically analyzing the layers of the Onion model, the study ensured that the choices of philosophy, strategy, and process were consistent and aligned with the objectives of the study.

Figure 7. The Research Onion (Adopted from Saunders et al., 2019, p. 130)



In the Research Onion model of Saunders et al. (2019), the outermost layer is the research philosophy, which is considered the foundation for all scientific work. The research philosophy reflects the way the researcher perceives the world and approaches practice, thereby shaping the entire research process. Popular philosophies include: positivism, critical realism, interpretivism, postmodernism, and pragmatism.

Next is the theory development approach. This is the method the researcher uses to build or verify the theory. The three main approaches include: deduction - testing existing theories through data; induction - building new theories from collected data; and abduction - combining both of the above approaches to create more flexible explanations.

After determining the approach, the study needs to choose the appropriate research method. This is an important step in determining how to collect and analyze data. Research can use qualitative, quantitative, or mixed methods. Correspondingly, the data collected can be quantitative (statistics), qualitative (words, images, audio, video, documents), or a combination of both. Determining the type of data helps to choose the appropriate tools and methods of analysis.

The next layer is the research strategy, which is chosen based on the research question and objectives, while also taking into account practical factors such as resources, time, and data accessibility. Some common strategies include: experiments (testing hypotheses), surveys (gathering opinions from a large sample), grounded theory (developing theories from data), case studies (in-depth analysis of a specific case), or action research (focusing on solving practical problems in organizations with the participation and cooperation of stakeholders).

Next, the research needs to determine the time period for data collection. Research can be cross-sectional, which is data collected at a certain point in time; or longitudinal, when data is collected over a long period of time to observe changes over time.

Finally, the innermost layer of Research Onion is the process and techniques for collecting and analyzing data. This is the practical implementation phase, which includes the approach to the research subject, the tools used (interviews, surveys, document analysis, etc.), as well as the methods of data processing and analysis. All these steps need to be carried out systematically and consistently to ensure the reliability and scientific value of the research.

3.1.1 Research Philosophy and Approach

Saunders et al. (2019, p. 130) define “research philosophy” as “a system of beliefs and assumptions about the development of knowledge”. These assumptions will directly influence the way researchers approach a topic, from asking questions, choosing methods to interpreting results. According to Saunders, each researcher brings his or her own perspectives and biases, and that shapes how they perceive reality, construct knowledge, and draw meaning from research.

In this context, my research focuses on understanding how QR code technology can be applied to improve service quality control and human resource management in a cleaning service company in Vietnam. The nature of the problem is not only related to technology, but also depends heavily on human perception, organizational behavior, and contextual factors. Therefore, the chosen research philosophy is interpretive. Unlike positivism – which emphasizes big data, quantitative surveys and statistical analysis to build general laws and predict behavior – interpretivism seeks to understand social meaning from the “insider” perspective. It uses qualitative methods such as in-depth interviews, observation or content analysis to explore how individuals or organizations interpret and react differently when approaching new technology. Also, combining with data has been collected after pilot programme. This is particularly relevant in the context of small and medium-sized enterprises (SMEs), where social, cultural and managerial factors play a decisive role in whether or not technology is accepted.

Stemming from this philosophy, the study chose an inductive approach. Instead of starting with a rigid hypothesis, the study started from real data – through qualitative interviews and case analysis – to let patterns, themes and meanings gradually emerge. This approach allows the study to not only explore the benefits of QR code adoption but also to clarify the challenges, barriers and practical conditions that SMEs face when undertaking digital transformation. In other words, the inductive approach allows theory to be formed directly from the evidence collected at the case study enterprise, rather than imposing a pre-existing theoretical framework.

3.1.2 Research Design

The research design follows after the author has defined the interpretative research philosophy and chosen an inductive approach. This study aims to thoroughly examine the

experiences, perspectives, and challenges encountered by organizations when implementing QR codes in human resource management and service quality control. As a result, the qualitative approach is chosen as the primary method. This approach enables the researcher to take advantage of multiple viewpoints and specific settings, which are sometimes difficult to capture using solely quantitative surveys.

In terms of research strategy, this study uses a case study with a cleaning service company in Vietnam as the main survey unit. Case study is suitable because it allows for a detailed and comprehensive analysis of a real context, from which to draw out deep insights that can contribute to both theory and practice. In addition, methods such as semi-structured interviews with management and employees, as well as analysis of internal documents after QR code implementation, will be used to increase the diversity and reliability of the data.

Regarding the time horizon, this study adopts a cross-sectional approach, as data are collected at a single point in time after the completion of the pilot implementation of QR code technology. This allows the research to capture employees' and managers' perceptions of the system, as well as the challenges and benefits observed during its initial application in service quality management.

3.2 Sampling Techniques and Data Collection

3.2.1 Purposive Sampling Techniques

Purposive sampling is a method that allows the author to consciously select a sample of participants based on their knowledge and understanding of their research question or goals. Known as predictive sampling, this technique is unlikely to produce a representative sample, but it is a quick and relatively easy way to obtain results or responses (Etikan et al., 2016).

Purposive sampling is used in this thesis to ensure that participants are directly involved in the adoption and use of QR codes (Shahzad et al., 2025a; Shahzad et al, 2025b). The sample includes both management-level and frontline employees to capture diverse perspectives across the organization.

3.2.2 Data Collection Methods

In this thesis, the author gathered data from several sources, including interviews and company documents, to enhance the credibility of the results. This triangulation method allowed for cross-validation of information and made sure that the case context was better understood (Denzin, 1978). Table 1 shows a summary of each method's details.

Table 1. Data Collection Methods

Method	Purpose	Participants	Output
Semi-structured interviews	Deeply exploring perceptions, experiences, and challenges of QR integration from user's perspective.	6 participants (1 executive, 2 supervisors, 3 frontline staffs)	Rich qualitative insights, direct quotes
Descriptive Documentary Analysis	Provide objective data after pilot implementation to compare the impact of new technology systems.	Internal company documents after pilot implementation	Descriptive statistics, contextual evidence

First of all, the author used a qualitative approach, conducting semi-structured interviews with multiple stakeholders, including executive directors, supervisors, and frontline cleaners. These interviews were conducted on the ZOOM online platform from September 1, 2025 to September 15, 2025. Each interview lasted approximately 30 minutes, and the Vietnamese language was used to ensure the comfort and ability of the participants to fully express their opinions. In this case study, the author conducted at least 6 interviews to ensure diverse perspectives and reliability of the information.

Table 2. Characteristics of the Respondents

Respondents	Role	Gender	Age Range	Responsibilities	Technology Exposure
R1	executive supervision	Male	45-50	Strategic planning, monitoring overall service operations and staff performance, making decisions	High (regular use of management and digital tools)
R2	supervisor	Female	30-35	Supervising staff, quality control, reporting to company and clients, scheduling and coordinating work.	Moderate (previous experience with technology)
R3	supervisor	Male	35-45	Supervising staff, quality control, reporting to company and clients, scheduling and coordinating work.	Moderate–High (adaptable to digital tools)
R4	cleaning staff	Female	20-30	Performing cleaning duties, handling equipment, report and timekeeping	Moderate (familiar with mobile apps)

R5	cleaning staff	Male	35-45	Performing cleaning duties, handling equipment, report and timekeeping	Low (limited digital experience)
R6	cleaning staff	Female	50-55	Performing cleaning duties, handling equipment, report and timekeeping	Very Low (first-time tech user, minimal tech familiarity)

Second, with the support of the commissioning company, the author had access to the company's performance documents and reports after the idea was tested (e.g., timekeeping records, service quality reports after QR code implementation) which were reviewed to supplement the interview data and provide a more objective perspective on performance. The documents were collected during August 2025. The documents were extracted directly from HMGroup's report files, ensuring the accuracy and transparency of the data. These reports help the author have a more general view from the position of the business instead of just focusing on personal perspectives.

3.3 Data Analysis Methods

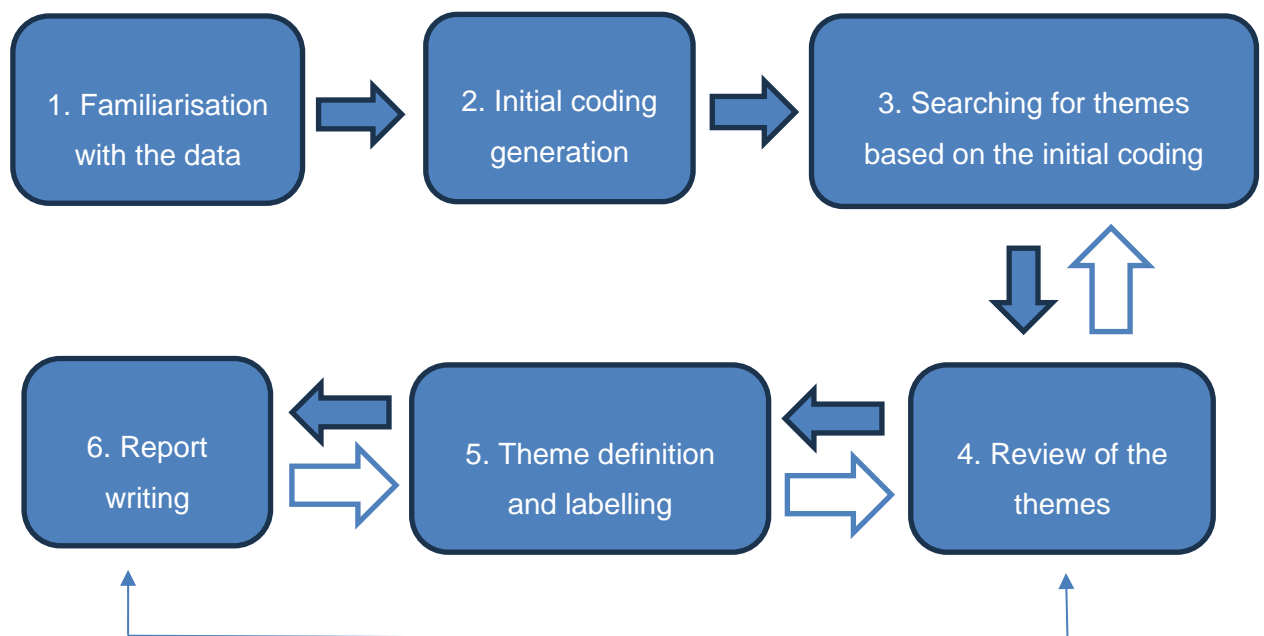
The data were analyzed using a combination of qualitative thematic techniques and descriptive documentary analysis. This dual analysis approach ensured that both subjective experiences and objective evidence were considered, thereby strengthening the robustness of the findings.

3.3.1 Thematic Techniques

This thesis focuses on presenting in detail the procedures for analyzing qualitative data using thematic analysis. This method, first systematized by Braun and Clarke, is understood as a way of identifying, analyzing, and reporting patterns (themes) in qualitative data (Braun & Clarke, 2006, p. 79; Nowell et al., 2017). Braun and Clarke (2006) argue that thematic analysis is a foundational method of qualitative data analysis that researchers must be clearly

and thoroughly trained in, since it also provides a useful basis for employing more complex analytic approaches. The method can be applied flexibly either within a theoretical framework or in relation to specific research questions in order to identify topics that warrant attention (Braun & Clarke, 2012). In thematic coding, the data are systematically analyzed through six steps (Braun & Clarke, 2006): (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. These steps provide a transparent and rigorous pathway for qualitative analysis (Nowell et al., 2017).

Figure 8. Thematic Analysis by Braun & Clarke, adopted from Howitt & Cramer (2011)



In the first step, the researcher must become thoroughly familiar with the data collected. This involves reviewing field notes, preparing and reading interview transcripts multiple times, and developing an in-depth understanding of the content (Braun & Clarke, 2006). The second step is to generate initial codes for the data, systematically identifying meaningful features in line with the research questions. These codes can be grouped under provisional categories or headings, which help guide the organization of data for subsequent interpretation. The third step is to consolidate codes into broader themes, a critical phase often described as open coding, where patterns and connections among codes begin to emerge (Nowell et al., 2017). The fourth step requires reviewing the themes to ensure that codes within each theme are coherent and that distinctions between themes are meaningful and clear. Finally, in the

fifth step, the researcher refines and names the themes, clarifying their scope and content before moving on to the stage of writing and presenting the findings (Braun & Clarke, 2006).

3.3.2 Descriptive Documentary Analysis

The second data analysis method used in this thesis is Descriptive Analysis. Descriptive analysis is a method that focuses on describing and summarizing existing data through the characteristics, trends, or variations of past data and then comparing them with current results to study what happened. Descriptive analysis answers questions about what happened, based on historical data, to make decisions for the future. Descriptive analysis techniques summarize large data sets to provide detailed information to stakeholders. It can be used on its own or as a preliminary stage of data processing to create summaries or summaries, which in turn support further investigation, analysis, or action taken by other types of analytics (Liu et al., 2023).

Descriptive analytics is the most common type of analysis and is typically performed by data analysts, often presented in reports, dashboards, bar charts, and other easily understood visualizations. This method allows the author to analyze, evaluate, compare, detect abnormalities and determine the relative strengths and weaknesses of the business, thereby making new judgments and directions for the future (Liu et al., 2023).

To synthesize data accurately, completely and concisely, the researcher needs to analyze the information description through a systematic process. (1) Define key questions and identify relevant data: The researcher needs to clarify the goal of the analysis and determine which data should be collected, thereby ensuring accuracy and effectiveness. (2) Identify supporting data: The researcher should gather additional information that can highlight and strengthen the main dataset, which is equally important for improving depth and accuracy. (3) Data preparation and cleaning: Multiple data sources should be consolidated and refined into a common structure for easier analysis. (4) Data analysis: The researcher may use tools such as Power BI or Tableau to organize the data visually or apply numerical algorithms for processing. (5) Data presentation: After analyzing the data, the researcher needs to choose the most appropriate and concise formats to display the results in a clear and understandable way for stakeholders. (6) Monitor and iterate: Finally, descriptive analytics also involves continuously evaluating outcomes and refining the process to ensure ongoing accuracy and relevance (Liu et al., 2023)

3.4 Research Quality and Ethics

Ensuring the quality of the research and maintaining ethical standards is essential to establishing the credibility, trustworthiness, and reliability of this study. In this section, author will outline the measures considered to ensure the high quality of this thesis as well as the confidentiality of the company and interview participants.

3.4.1 Research Quality

In order to evaluate the quality of this thesis through qualitative research methodologies, the author followed the principles of trustworthiness in research which are credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985).

Credibility was achieved by including multiple perspectives in the interviews and using authentic data from the case company. Participants included managers, supervisors, and frontline cleaning staff, which gave the researcher a broad and balanced view of the QR code implementation rather than relying on a single viewpoint. The use of purposive sampling also ensured that participants were relevant and knowledgeable, which increased the reliability of the data (Etikan, Musa, & Alkassim, 2016). Transferability was supported by providing detailed descriptions of the company's context, its workforce, and the technology adoption process. While the study focused on one Vietnamese SME, these descriptions allow readers to judge how the findings might apply to other service businesses in similar contexts. Dependability was ensured by maintaining a clear audit trail of interview protocols, coding methods, and data analysis procedures. Confirmability was maintained through reflexivity. The researcher remained aware of personal biases and was transparent about assumptions throughout the study. Company data were also presented clearly and accurately, using direct figures from the organization's system that could not be adjusted.

3.4.2 Ethical Considerations

This study was conducted in accordance with established ethical research principles, specifically those relating to informed consent, confidentiality, voluntary participation, and data protection (Bryman, 2016).

All participants were briefed on the purpose of the study, the nature of their participation, and how their data would be used. Respondents were informed in advance that participation was

completely voluntary and that they could withdraw from the study at any time without penalty. Participant identities were protected by assigning codes (e.g., R1–R6) rather than using personal names. Institutional and sensitive data were treated with strict confidentiality. Audio recordings and interview transcripts were stored securely on password-protected devices, with access limited to the researcher. Data will only be retained for as long as necessary for academic purposes and disposed of responsibly thereafter (Mirza, Bellalem, & Mirza, 2023).

4 QR Code Solution Proposal

4.1 Quality management system using QR code

4.1.1 Mechanism of action

The quality management system using QR code technology is implemented through HMGROUP software, developed based on the author's idea, in coordination with the consignee company and the IT department of HM Company Limited. The system is designed to standardize operations and improve management quality at all levels of the cleaning service enterprise. By integrating QR codes into the workflow, the system bridges the gap between frontline staff, supervisors and senior management, creating a seamless digital ecosystem, ensuring that information is transmitted accurately and effectively at all levels of the organization. The system is structured into three operational levels:

- Level 1: Workers working directly at the project - Each worker is given a unique QR code at the designated location. Workers scan the code daily to record attendance, confirm work completion and report any problems directly through the system. This ensures that each worker is a factor contributing to the overall service quality.
- Level 2: Project Monitoring – Supervisors track data transmitted from workers' QR codes in real time. This allows them to check attendance, verify work performance and resolve operational issues more efficiently, replacing traditional manual monitoring methods.
- Level 3: Enterprise Control System – At the corporate level, data is aggregated into automated reports, which can be used for payroll integration, quality assessment and strategic decision making. This provides management with a comprehensive view of project performance across different locations.

4.1.2 Supporting Devices

To ensure seamless operation, the system is supported by:

1. QR code tags placed at each working position, allowing accurate tracking of worker activities.
2. 4G mobile WiFi (Mercusys MB115-4G) provided by Hoan My to maintain stable internet connections, ensuring smooth data transmission even in locations without fixed networks.
3. Smartphones for workers and supervisors, enabling QR code scanning, photo capture, and direct reporting into the system.

Figure 9. Support Devices Simulation

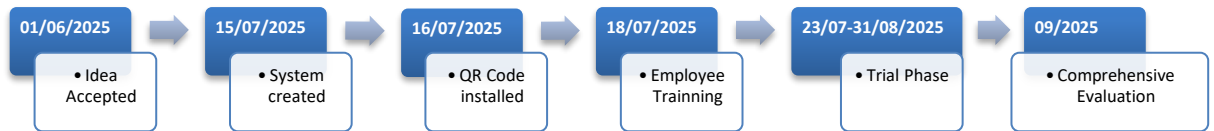


4.1.3 Project Implementation Plan

The project is implemented within a 3-month framework, including a 1-month pilot period at a management department within the company. The plan is implemented from June 1, 2025 when the idea is accepted. By July 15, 2025, the system is completely built by the IT department of Hoan My Company on the HMGROUP platform. One day later, QR Code Cards are installed at important work locations and tested for stable connection. After only 2 days, on July 18, 2025, the Employee Training process takes place. Workers and supervisors are trained to use the system by using smartphones to scan, report and send data. During the pilot phase from July 23 to August 31, 2025, workers practiced scanning QR codes daily to familiarize themselves with the system, replacing daily manual reporting activities with information technology, while supervisors tested reporting functions, automatically updating work to the company's system. After September 1, 2025, the company began a

comprehensive evaluation - System performance was evaluated, including connectivity, user adaptability, and reporting accuracy, before full deployment.

Figure 10. Project Implementation Plan



4.1.4 Operation Mechanism

The system operates in a clear 4-step process:

- Step 1: QR Scan – Employees scan the assigned QR code using their smartphones.
- Step 2: Recording & Reporting – The application allows for instant photo capture and reporting of work status. Data is saved offline if the connection is interrupted.
- Step 3: Data Synchronization – Once connected, data is automatically synchronized to the cloud server.
- Step 4: Report Generation – Summary reports are automatically generated for supervisors and business managers, ensuring timely and accurate information flow.

Figure 11. Operation Mechanism



This mechanism ensures real-time monitoring, minimizes manual monitoring and improves transparency, while minimizing administrative workload and errors. The implementation of QR codes turns each employee into a traceable contributor to service quality, creating a structured and effective quality management system.

4.2 Detailed Implementation Plan for Each Level

4.2.1 Level 1: Workers Working Directly at the Project

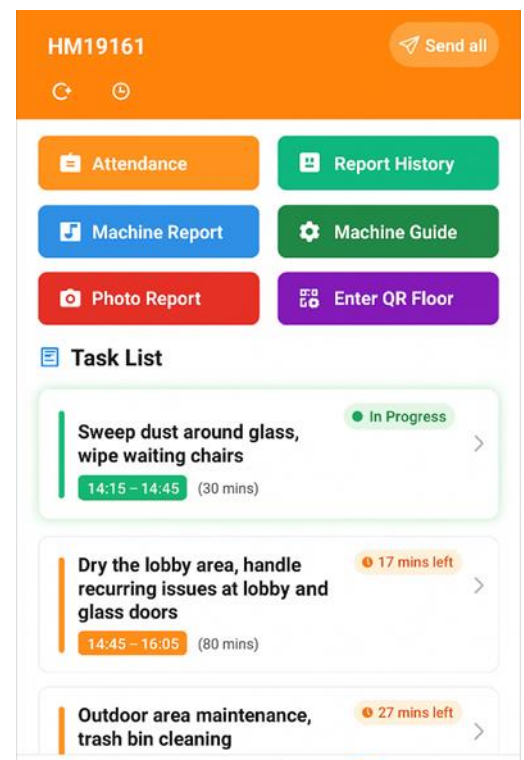
At the worker level, the QR code quality management system is designed to digitize all daily operations. Each worker will be assigned a fixed work position and correspond to a personal QR code. Through smartphones, workers can perform the necessary operations to meet the work requirements that have been set up on the HMGROUP application interface. This helps replace the previous manual paper reporting form, while improving transparency and accuracy in management.

Figure 12. Main phone screen for worker position

Worker phone interface after scanning QR code



Main phone screen for worker position

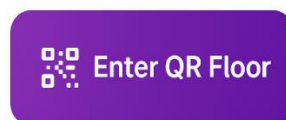


Workers' work requirements will be recorded directly through the HMGROUP software with specific contents such as:

- My attendance: Summarize all the work performed in the month, helping workers easily track work schedules and support transparent salary calculation.

- Reported History: A history of all submitted reports is compiled, creating a transparent basis for evaluating individual responsibility and performance.
- Machine report: Record the number of times machines and cleaning equipment are used in each area of the project, ensuring control and maintenance according to the process.
- Machine Guide: Provide instructions on how to use cleaning equipment according to standards, ensuring safety and quality during the work process.
- Photo reports: Workers can take and send images to demonstrate completed work or situations that need to be handled immediately.
- Enter QR Floor: With this mechanism, each worker is not simply a person performing the work, but also becomes an important element contributing to the overall quality management system of the project. This encourages initiative, responsibility and transparency throughout the entire operation process.

Each category in the HMGROUP App optimizes tasks to complement a system management process. However, the two items “Enter QR floor” and “My Attendance” are two main tools in the human resources and quality control system, helping businesses ensure data transparency, optimize automatic timekeeping and track the actual work performance of each individual.



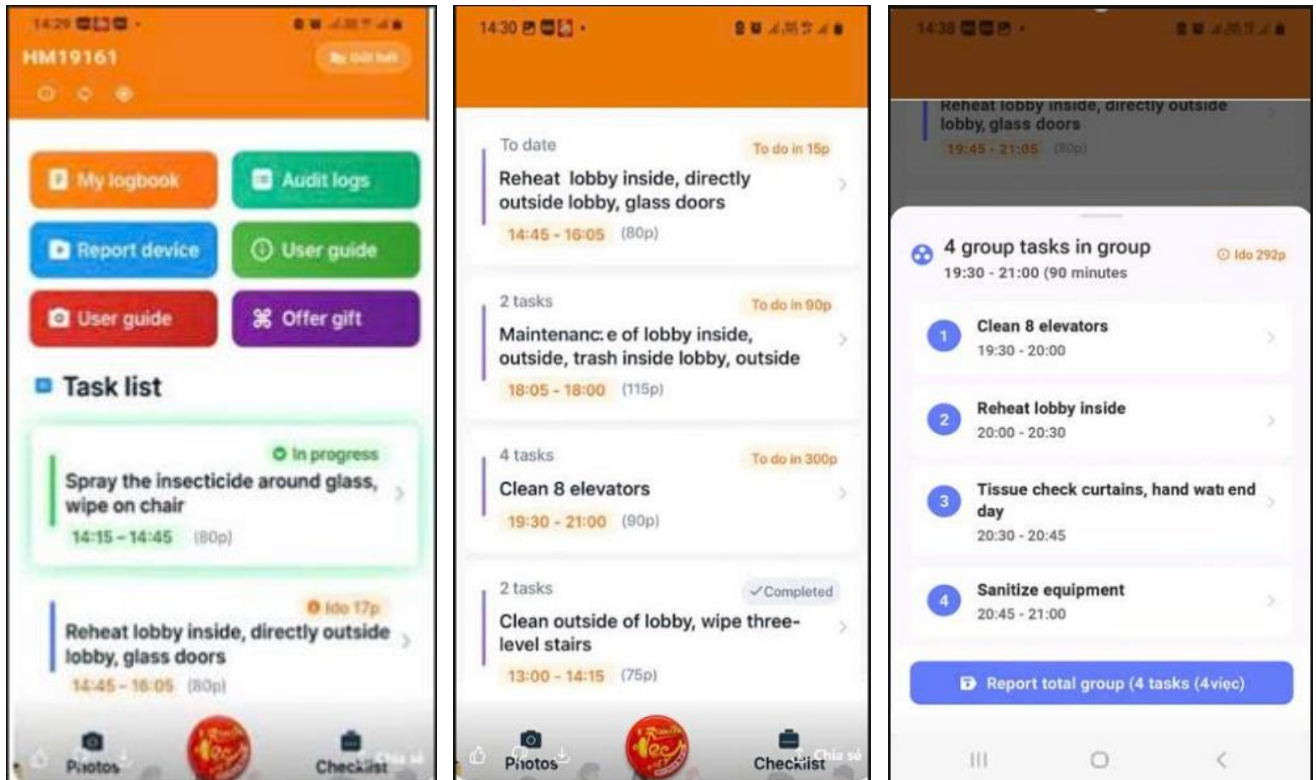
- Enter QR Floor: It is a tool to determine the attendance of each worker position in the work area.

Figure 13. Enter QR Floor

Enter QR floor/Tasks List

List of tasks for each worker

Detailed work group at each time frame



- My Attendance: It is an automated report on timekeeping, which is the basis for calculating salaries and bonuses.

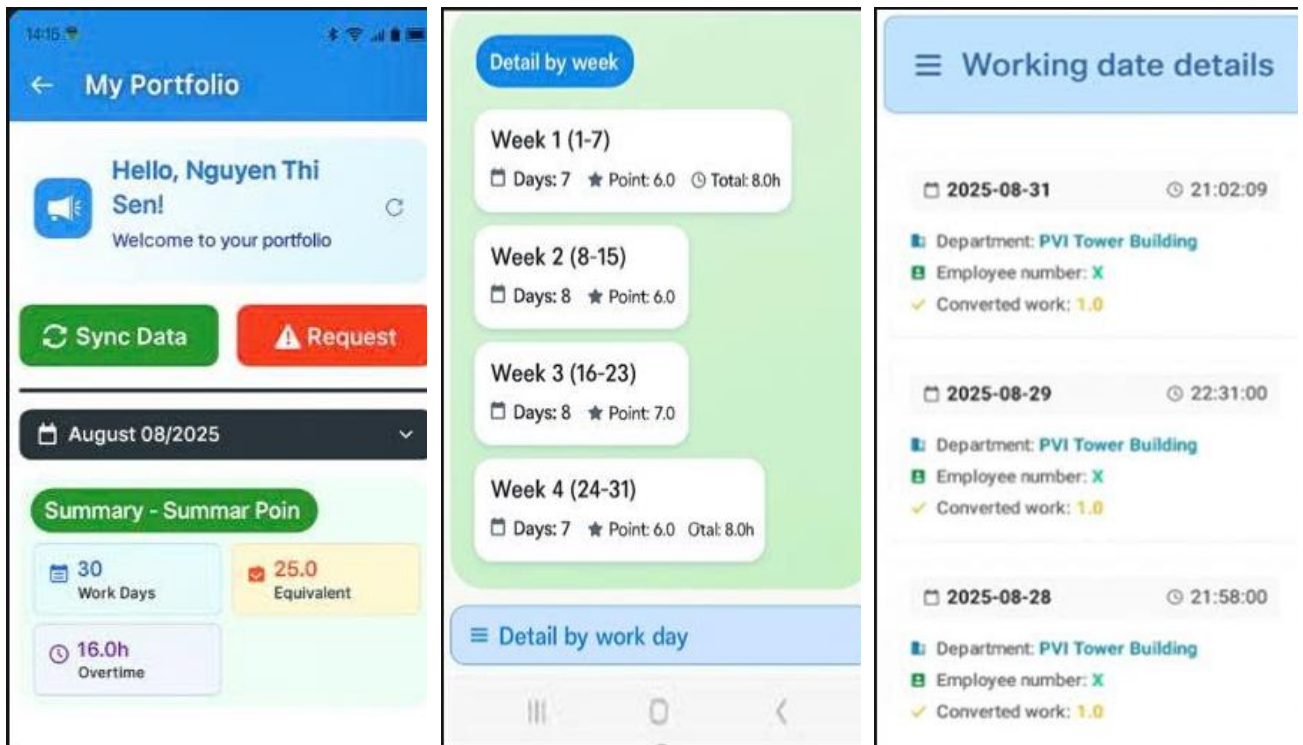
Figure 14. My Attendance



Summary of work/month

Details of work/week

Summary of work/day



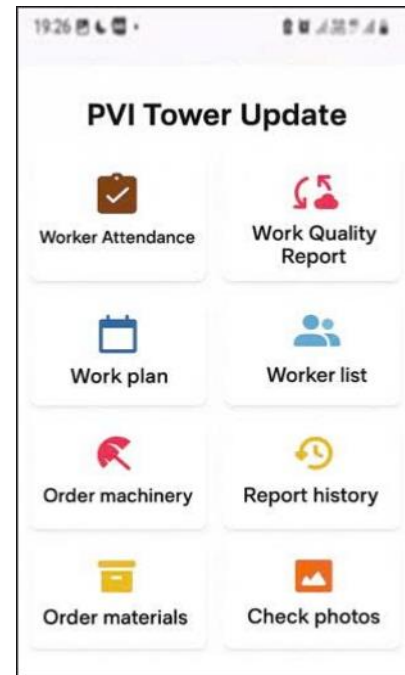
4.2.2 Level 2: Project Work Supervision

The application of QR code technology in the supervision process as well as in the general operation of the enterprise has significantly increased the efficiency in terms of personnel control, service quality, speed of updating reports and processing information that is regularly sent to the company and customers. Supervisors use the app to check locations without having to travel to each location, each building. During a period of time, supervision can check many service points without being limited by geography or distance. This is a special difference that the manual inspection process cannot do. From the results of continuous and regular inspections, it has also created pressure for workers to be more conscious and work harder. This increasingly meets the quality requirements of the company and the wishes of customers.

Figure 15. Main phone screen for supervisor position

Supervisor's phone interface after entering ID and Pass

Main phone screen for supervisor position



Workers' work requirements will be recorded directly through the HMGROUP software with specific contents such as:

- Worker attendance: Track the number of workers clocking in daily
- Work Quality Report: Report daily work results of workers
- Work plan: Work plan table created by Supervisor for each project
- Worker list: Track workers daily, monthly
- Order machinery: Send request for machinery to serve the work
- Report history: Look up history of reports sent to the system
- Order materials: Propose to issue standard and arising materials
- Check photos: View all photos of workers and supervise during the work process at the project

Each category in the HMGROUP App is designed to support supervision in personnel management, work operations and service quality control at the project. In particular, “Worker attendance” and “Work quality report” are two key tools, helping to control the actual number of workers, monitor progress and evaluate quality through images, ensuring transparent data and operational efficiency at the site.

The combination of these two tools forms the main control axis in the entire operating process — from recording presence, monitoring progress, to evaluating labor

performance and quality, helping the system operate more transparently, accurately and effectively.



- Workers' Attendance helps supervisors accurately grasp the actual number of workers working, comparing it with the assignment plan.

Figure 16. Woker Attendance

List of workers at the project



Monitor, track and control actual attendance

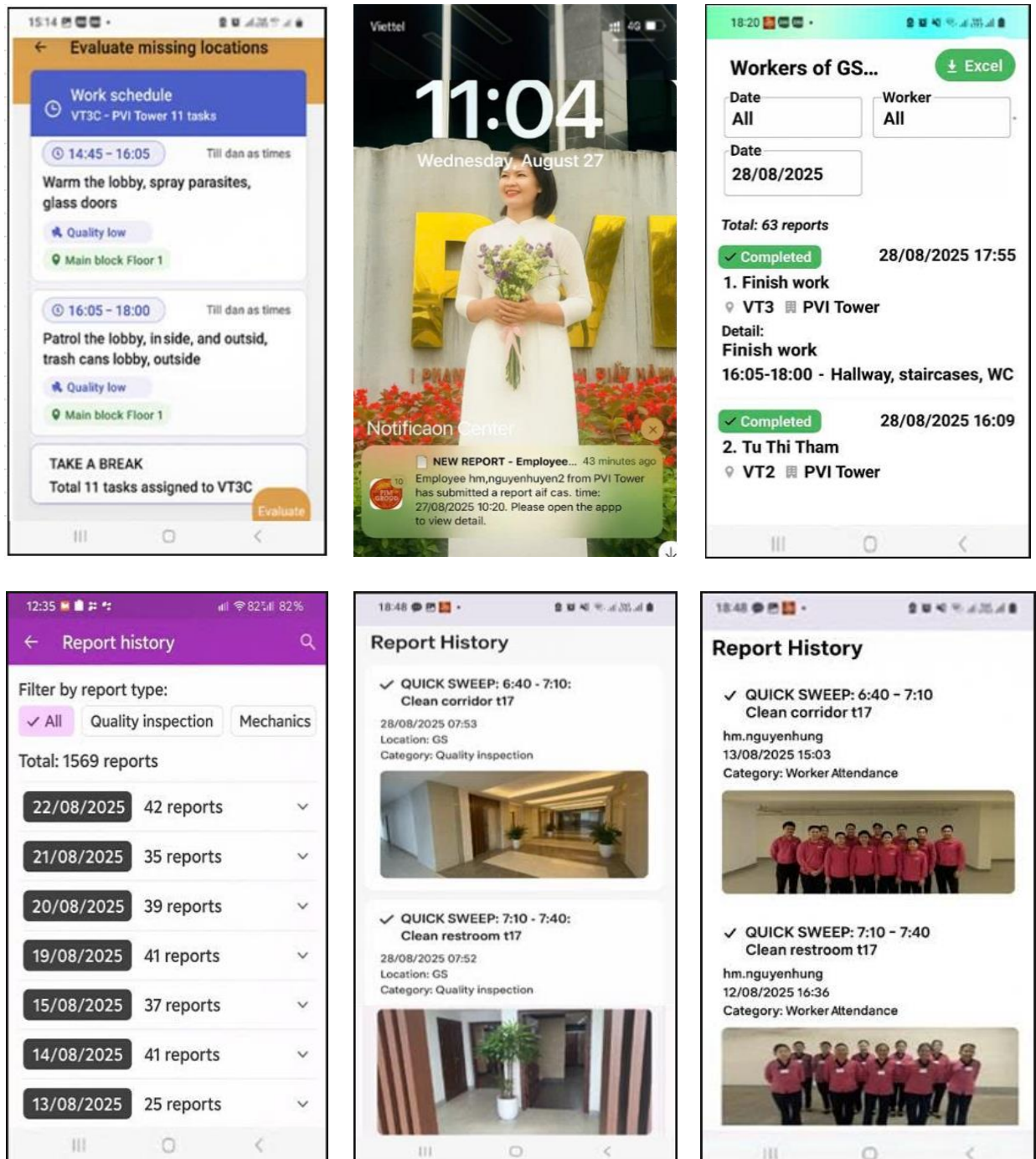


Monitor, track and evaluate missing vacancies



- Work Quality Report allows supervisors to monitoring, recording and evaluating work quality through reports and actual images.

Figure 17. Work Quality Report Tool

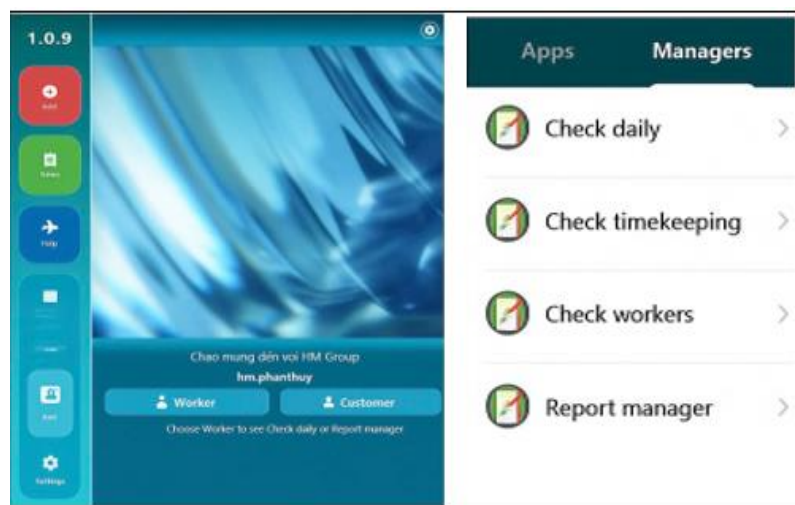


4.2.3 Level 3: Enterprise Control System

At the organizational level, the implementation of QR code technology has contributed to a more transparent, standardized, and data-driven management model across the company.

Instead of relying on fragmented verbal reports or manual documentation, operational information is now centralized and automatically synchronized through the HMGROUP system. This allows the management team to monitor performance across multiple project sites in real time, quickly identify irregularities, and make timely decisions based on verified data. The shift to digital reporting strengthens accountability between departments, reduces dependency on individual supervisors, and enhances coordination with customers through faster, more accurate service information. As a result, the company's supervisory structure becomes more scalable, consistent, and aligned with its long-term service quality objectives

Figure 18. Main screen interface of the company system



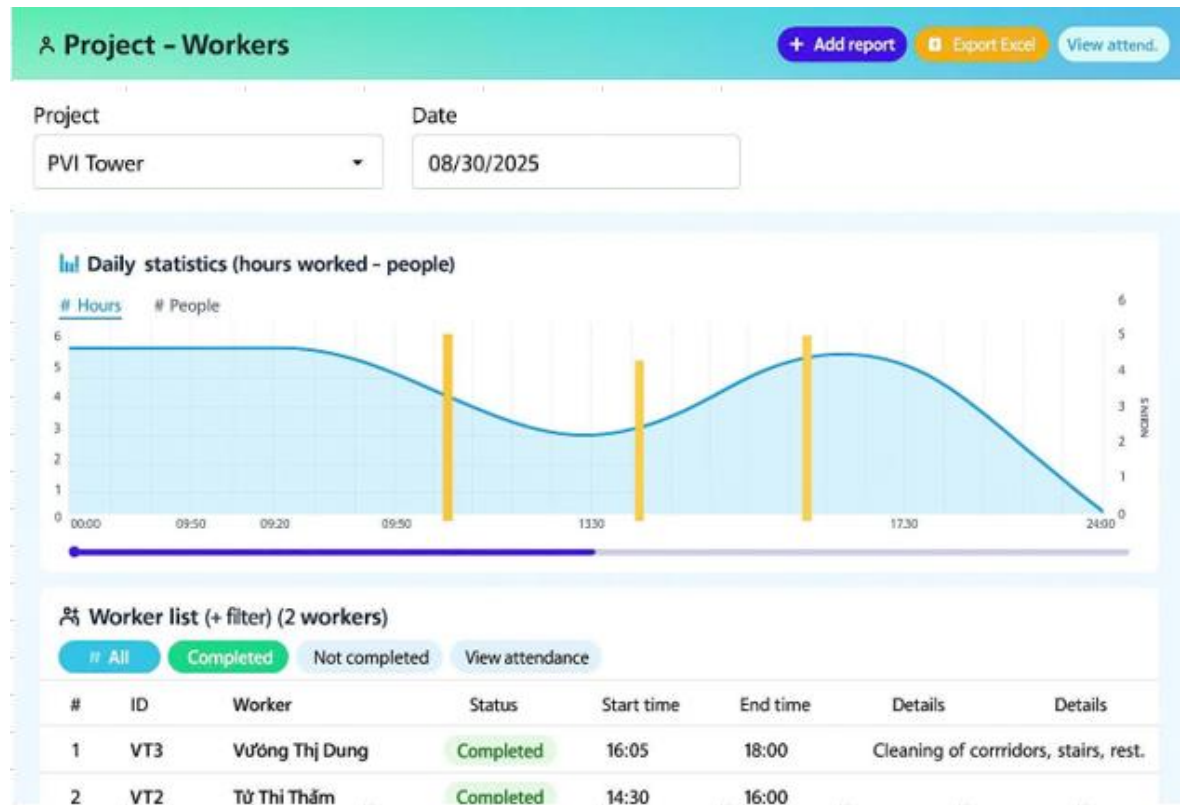
The main screen interface of the company system includes:

- Daily report
- Machine report
- Worker report
- Supervisory report

The report data is classified into separate categories. However, within the framework of this essay, we will only focus on "Worker report" and "Supervisory report" to grasp the role of data updated to the system via the HMGROUP app.

A project - workers report is a data file summarizing the number of employees, working time and projects implemented.

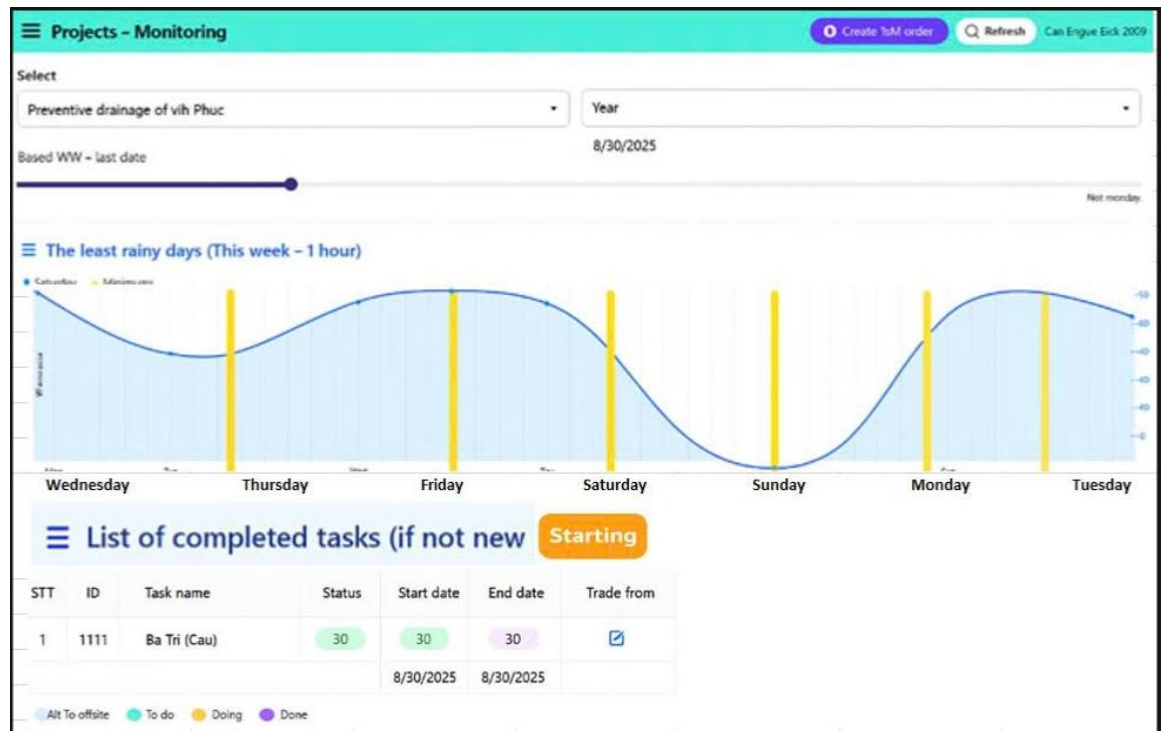
Figure 19. A project - workers report



- Project: Projects that are testing the HMGROUP App
- Date: Displays a 7-day chart
- List of workers: (Present ..., absent)
- Data exported to excel on a daily/monthly basis: TT number, Worker code, Worker name, Project name, Number of working days, Total report, Report with images, Machine report, Uniform report, Material report and report update date.

The Supervisory Report is a data file that summarizes the Supervisor's report in the technology usage management process.



Figure 20. Project - Supervisory report



- Project: Projects that are testing the HMGROUP App
- Date: Displays a 07-day chart
- Update the employee list: Supervisory list (Present ..., absent)
- Data is exported to Excel daily/monthly - Supervisory report data

Daily Quality Inspection Report (QR-Based System) report records the cleaning tasks performed by workers at specific time intervals throughout the day. Each entry includes the date, the worker or supervisor involved, the project location, a description of the work carried out, and photos uploaded as verification. The inclusion of photo evidence ensures that work quality is clearly documented and traceable, reducing the need for manual inspection. This system helps supervisors remotely confirm whether the tasks were completed correctly and on time, improving transparency and accountability in daily operations.

Figure 21. Daily Quality Inspection Report (QR-Based System)

QUALITY INSPECTION REPORT						
DAY	MONITOR	PROJECT	DETAIL	TEST TIME	LINK	UPLOAD PHOTO
27/8/2025	hm.vietanh	Hong Kong Tower	+ Calendar: 07:30-08:04 Push the moisture out of the A2 lobby floor + Report: SWIPE QUICKLY! + Upload photo	8:20:10	https://storage.googleapis.com/times1/test/116664_1.jpg	
27/8/2025	hm.vietanh	Hong Kong Tower	+ Calendar:12:00-14:00 Push damp lobby floor, Clean elevator cabin floor A2, Sweep floating trash, push damp lobby floor + Report: SWIPE QUICKLY! + Upload photo	14:10:24	https://storage.googleapis.com/times1/test/116663_1.jpg	

Total Number of Reports by Project report summarizes the overall volume of QR-based work reports submitted across multiple project sites over one month. It records the number of reports made per day and calculates a total for the month at each location. This data allows managers to compare productivity levels across different sites, identify patterns in work activity, and detect inconsistencies that may indicate staffing shortages or operational issues. By providing a quantified overview of work reporting frequency, this report supports data-driven decision making in resource allocation and performance monitoring.

Figure 22. Total Number of Reports by Project

TOTAL NUMBER OF REPORTS									
PROJECT	MONITOR	25/8/2025	26/8/2025	27/8/2025	28/8/2025	29/8/2025	30/8/2025	31/8/2025	TOTAL/MONTH
HongKong Tower	hm.vietanh	47	40	44	39	41	29		960
Court home CMC - 18 Only New	hm.tranthituyet	35	38	41	34	36	25		836
Court home Center Point	hmdinhha	59	46	48	49	42	31		1100

Monthly Worker Attendance Report report tracks the daily attendance of individual workers based on QR code check-ins. Each “x” marks a verified workday, while “off” indicates absence. At the end of the month, the total number of working days is automatically calculated for each employee. This eliminates the need for manual timekeeping and significantly reduces errors and disputes regarding attendance or payroll. The report ensures fair and transparent evaluation of working hours, and contributes to a more accurate and efficient human resource management system.

Figure 23: Monthly Worker Attendance Report

NUMBER OF MONTHLY ATTENDANCE									
ID	WORKER	25/8/2025	26/8/2025	27/8/2025	28/8/2025	29/8/2025	30/8/2025	31/8/2025	TOTAL/ MONTH
HM19167	Trần Thị Ngọc Lan	x	x	x	x	x	x		26
HM17086	Chu Thị Vui	x	off	off	x	x	x		24
HM15346	Lê Thị Ngà	x	x	x	x	x	off		25

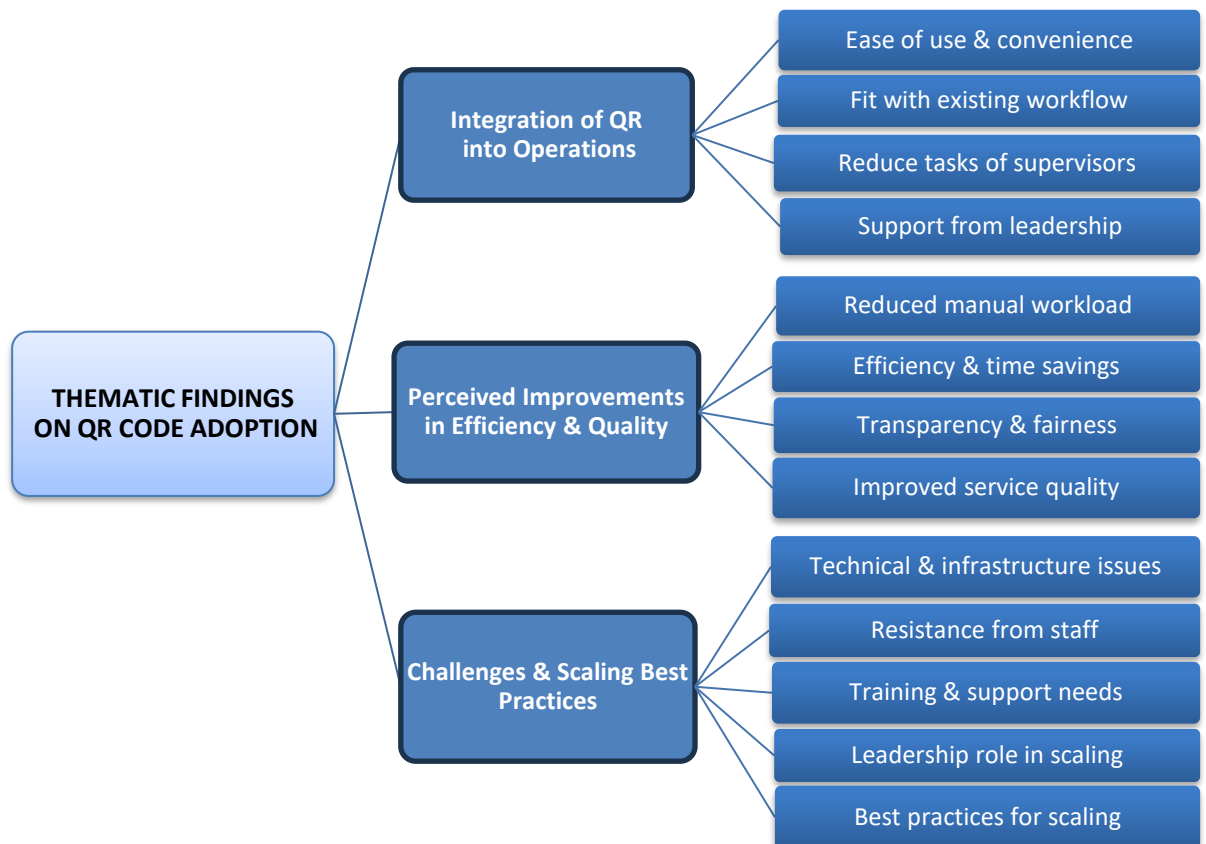
5 Data Analysis & Findings

5.1 Interview Data Analysis & Findings

This section presents a thematic conceptual framework derived from interview findings on the adoption of QR code technology in a small to medium-sized cleaning company. The framework brings together three overarching areas: integration into operations, improved efficiency and perceived quality, and challenges in scaling, under the overarching theme of applying QR codes to optimize service quality management and human resource management. The thematic findings from this analysis are presented in table format, showing each main theme with its sub-themes to provide clarity, along with direct interview quotes to ensure transparency and authenticity. In the tables, 'R' refers to the number of respondents, such as R1 for Respondent 1, and so on.

Figure 24 illustrates how the author applies the thematic conceptual framework in this thesis, demonstrating the interrelationships among the main and sub-themes derived from the interview findings. To provide a more detailed understanding of how these themes were formed and manifested in practice, Tables 3, 4, and 5 correspond to each of the three overarching themes, together with their respective sub-themes. Each table presents a concise description of the identified themes along with representative interview quotes to ensure transparency and authenticity of the findings.

Figure 24. Thematic Analysis of Interviews



5.1.1 Integration of QR into Operations

Starting with Table 3, which focuses on how QR codes have been integrated into daily operations, they are defined by four sub-themes: (1) Ease of use, (2) Fit into workflow, (3) Changing supervisory roles, and (4) Leadership support.

Interviews consistently found that integrating QR code technology into daily operations was initially challenging but ultimately transformative. Most respondents found the QR system easy to use after a short period of practice, although the transition was not equally smooth across all age groups. Younger and mid-level employees (R2, R4, R5) described the system as “easy and convenient,” while older employees (R6) acknowledged limited memory and slower adaptation. Thus, the initial adaptation and learning curve reflects generational differences in technological readiness.

As the technology became more familiar, QR codes naturally fit into existing workflows. Respondents highlighted how it replaced manual checklists and paper reporting systems, creating a more consistent and traceable workflow. As one supervisor (R2) explained, “The forms when using QR are digitized... similar to paper content,” while an employee (R5) added, “The content that was printed on paper in the manual process was converted to information content on the QR code scanning system.” This integration simplified monitoring and documentation, significantly reducing duplication in the reporting process.

The most significant transformation occurred in the supervisory role. Supervisors (R2, R3) described moving from physical inspection at each location to monitoring data directly through the system. This transition reduced the need for constant travel and allowed supervisors to focus on quality assurance rather than physical verification. One participant commented, “Without having to go down to the physical inspection location, supervisors can combine many things at once.” Such changes improved management efficiency but also required a redefinition of the supervisory role.

Importantly, leadership engagement and structured support were crucial to ensuring successful adoption. Managers (R1) highlighted how senior leadership, resourcing, and employee training supported the transition. Several respondents reported that the company had invested in smartphones, SIM cards, and on-site training to facilitate QR usage. These proactive measures reinforced acceptance and built a culture of digital confidence among employees.

Overall, Theme 1 demonstrated that successful technology integration was supported by clear communication, hands-on training, and leadership support, enabling the workforce to transition from traditional manual methods to a transparent, real-time operating system.

Table 3. Integration of QR into Operations

Sub-theme	Brief Description	Representative Quotes
Ease of use & convenience	Workers found QR code scanning quite convenient and easy to use once they got used to it, however, older people found it difficult at first.	“Scanning is easy and convenient.” – R4 “At first, it feels inconvenient, but after getting used to it, it feels normal and

		<p>easy, but because of age, I still forget things.” – R6</p> <p>“When first switching from manual to QR technology, learning the process needs to be practiced continuously. After a period of practical experience, getting used to QR is also easier and more convenient.” – R5</p>
<p>Fit with existing workflow</p>	<p>QR is integrated into existing workflows, replacing manual recording, but network infrastructure still needs improvement.</p>	<p>“QR is associated with scanning work schedules to confirm the work of each position, associated with cleaning checklists, creating quality reports, no need to enter manually, reducing errors.” – R1</p> <p>“The forms when using QR are digitized for use on phones and computers, similar in content and requirements when using paper documents. However, the use of specific technology, the telephone network, is still interrupted when the network system is weak.” – R2</p> <p>“Yes, the content printed on paper according to manual processes has been converted into information content on the QR code scanning system, so it is also easy to track and apply to the actual construction at the project.” – R5</p>
		<p>“From manual monitoring to each floor, each location, each time zone in</p>

<p>Reduce tasks of supervisors</p>	<p>Monitoring moves from manual checking to data tracking, saving time and improving efficiency.</p>	<p>the morning and afternoon to directly inspecting, switching to using the app to stay in one location and only check the probability of monitoring by image / data and still update the information.”</p> <p>– R2</p> <p>“No need to go down to the actual inspection location. Monitoring can combine many tasks at the same time.” – R3</p> <p>“Monitoring through the software system, receive quick work reports, right at the time the worker completes the work.” – R2</p>
<p>Support from leadership</p>	<p>The leadership has a role in providing direction, investing in equipment, training and supporting means to facilitate the integration and transformation process</p>	<p>“The board of directors has on-site training sessions, clearly explains to each team, invests in phones and wifi to ensure operation.” – R1</p> <p>“Supporting means such as phones (new issuance, installment loans for phones), providing SIM cards, phone network subscriptions, rewarding employees and workers when completing company requirements to motivate them to learn.” – R5</p> <p>“The operating system has changed, but thanks to the company’s training and clear instructions, workers have gradually become familiar with it and are able to use it.” – R6</p>

5.1.2 Perceived Improvements in Efficiency & Quality

Next, Table 4 focuses on how QR codes have been perceived as improving general efficiency and service quality. They are defined by five sub-themes: (1) Reduced manual workload, (2) Increased efficiency and time savings, (3) Transparency and fairness, (4) Improved service quality, and (5) Positive impact on employee morale.

All respondents acknowledged significant improvements in efficiency and data reliability after implementing QR codes. Managers and supervisors noticed a significant reduction in manual workload, reporting errors, and time spent on administrative tasks. Executive supervision (R1) commented, “Reduced printing costs... reduced supervisor time for daily inspections... reduced staff costs for compilation and reporting.” Similarly, supervisors (R2) estimated a 90% reduction in paperwork and up to 70% reduction in time spent on patrols. These results underscore that digitization allows companies to optimize human resources while maintaining or even improving service quality.

The QR system also brings greater transparency and fairness to performance evaluations. Automated time and location logs have prevented issues such as manual timekeeping or data manipulation. A cleaner (R5) emphasized, “QR timekeeping is more transparent and clear for each worker... no counting, additions and subtractions.” Executive supervision (R1) further confirmed that time-stamped digital evidence has increased trust between the company, employees, and customers. In turn, this has strengthened accountability at all levels of operations.

In addition to internal improvements, respondents noted a clear impact on customer satisfaction and perceived service quality. Customers can now access digital records of completed tasks and quality reports, improving transparency and reliability. Management (R1) stated that expanding the use of QR from pilot projects to all sites “has seen increased customer satisfaction and trust...” This change reflects how technology not only optimizes internal management but also enhances the trust of external stakeholders.

At the human level, the implementation of QR has a positive psychological impact on employees. Initially, workers were frustrated because they were not used to it, “feeling bored because some operations are learned and then forgotten”, but with time and encouragement, they began to see the system as a source of fairness and recognition. One worker (R5) described how “all employees are motivated and the QR system also helps to control the

work, the process is fast and full of data.” Reinforcing leadership through immediate feedback and transparent reward mechanisms further boosted morale and commitment.

In summary, Theme 2 emphasizes that the QR system not only improves efficiency and cost effectiveness, but also transforms the organizational culture towards transparency, data-based accountability and fair recognition of employee contributions.

Table 4. Perceived Improvements in Efficiency & Quality

Sub-theme	Brief Description	Representative Quotes
Reduced manual workload	Significantly reduces paperwork, timekeeping and manual reporting.	<p>“Reduced printing costs (daily and monthly timekeeping forms), reduced warehouses and shelves for storing documents, reduced time spent on daily inspections (only random inspections), reduced labor costs for compilation and reporting.” — R1</p> <p>“Using QR reduced 90% of paper-related documents and 70% of actual time spent on patrols (only random inspections).” — R2</p> <p>“Using QR is neat and less paper-based. Cleaning process instructions as well as machine instructions are always available for viewing.” — R5.</p>
Increased efficiency & time savings	Increase efficiency, reduce work processing time and increase work productivity thanks to digital data.	<p>“Implementing QR helps businesses reduce costs and increase transparency in management. When there is complete data, the company can easily analyze and make decisions.” — R1</p> <p>“Accurate working speed, increased efficiency, more accurate work processes, easier management and control.” — R6</p>

		<p>“Clearly recording data (location, time, images) has created more awareness and responsibility for workers in completing their work.” — R2</p>
<p>Transparency & fairness</p>	<p>Increase transparency and fairness in timekeeping, evaluation and relationships between companies - employees - customers.</p>	<p>“Data transparency: Record the number of employees going and returning to each project. Working time and work content are suitable for the requirements (with pictures).” — R1</p> <p>“QR attendance is more transparent and clear for each worker. The total number of work/month is clear and does not require counting.” — R5</p> <p>“Reduces shirking and fraud during work; transparency in work, avoids arguing about whether to do or not to do.” — R6</p>
<p>Improved service quality</p>	<p>QR helps track, evaluate service quality and respond to customers quickly, creating trust and professionalism.</p>	<p>“The application of QR has helped increase customer satisfaction because the data is recorded in the system.” — R1</p> <p>“Initially, the company only applied the pilot in a few locations in the project, but now the number of QR has been deployed in the entire project. That partly reflects customer satisfaction.” — R1</p> <p>“It is very good to be able to confirm the work done, the quality of service and the results.” — R4</p>
<p>Positive impact on morale</p>	<p>Increase work motivation, create initiative and responsibility for employees after the familiarization period.</p>	<p>“To be fair, when I first used QR, I felt bored because some operations I learned and then forgot. But when using QR became a habit and was encouraged by the team and the company, everyone was motivated and recognized that QR</p>

		<p>helped to check work, the process was quick and had complete data.” — R5</p> <p>“Timely rewards/discipline motivates employees to work and increases their sense of responsibility.” — R1</p> <p>“It takes time to adapt to the new management model. It is very good to be able to confirm the work done, the quality of the service and the results.” — R4</p>
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5.1.3 Challenges, Barriers and Scaling Best Practices

Finally, Table 5 presents the challenges and enablers related to scaling up the use of QR code technology within the organization. They are defined by five sub-themes: (1) Technical and infrastructure issues, (2) Resistance from staff, (3) Training and support needs, (4) Leadership role in scaling, and (5) Best practices for scaling.

Despite the positive results, the findings also highlight technical and human challenges that need to be addressed to ensure sustainable scaling. Technical constraints were the most frequently cited issues, including unstable network connections, outdated equipment, and data transmission interruptions.

Executive supervisors (R1) cited high infrastructure costs—“High infrastructure investment: servers, data, cloud...”—while supervisors (R2) mentioned limited 4G coverage and equipment failures. At the worker level, practical issues such as wearing gloves or poor phone performance also hindered efficiency.

In addition to technical barriers, resistance to change among older or less tech-savvy employees was a significant obstacle. Leaders (R1) acknowledged that “older staff... have less access to technology, are less receptive, are afraid of change, and are reluctant to use technology.” Similarly, cleaners (R6) noted visual difficulties and slower learning rates than

their younger colleagues. This highlights a generational divide that needs to be addressed through appropriate training and motivation strategies.

Training therefore emerged as a key enabler. Participants at all levels emphasized that systematic training and communication are key to building acceptance. Supervisors (R2) described conducting step-by-step training sessions to explain the benefits of using QR codes, while managers (R1) emphasized the need to “synchronize thinking and awareness from leadership levels to workers.” Peer learning and mentoring are also encouraged, with incentive programs that reward employees who help others achieve competency.

At a strategic level, leadership plays a central role in successful scaling. Executives (R1) outlined clear policies that included clear direction, consistent communication, and tangible support such as smartphones, data plans, and monthly recognition. This combination of leadership vision and practical support proved essential to maintaining momentum during the scale-up process.

Best practices identified by participants included upgrading infrastructure, ongoing training, encouraging proper use, and peer mentoring to maintain engagement. Supervisors (R3) summarized that effective scaling requires “a consistent way of working, high security, transparency, and easy integration of paper forms.” These actions demonstrate that long-term adoption depends not only on technology, but also on organizational alignment, capacity building, and consistent leadership.

Overall, Theme 3 illustrates that while QR technology implementations encountered predictable barriers, a deliberate strategy of leadership engagement, targeted training, and hands-on support accelerated the path to sustainable digital transformation across the organization.

Table 5. Challenges, Barriers and Scaling Best Practices

Sub-theme	Brief Description	Representative Quotes
Technical & infrastructure issues	Technical and infrastructure issues are major challenges when implementing QR, including	“Investing in high infrastructure costs: servers, data, cloud... Cost of hiring quality technical staff.” — R1

	<p>equipment, transmission lines and internal networks.</p>	<p>“Facing many difficulties: no 4G network, buildings disrupting signals, transmission errors. Old, slow staff, unable to use technology.” — R2</p> <p>“In cleaning operations, wearing gloves and using water makes it difficult to use the phone touch screen, having to take off gloves and put them back on is sometimes inconvenient. Weak network system, poor quality phones also affect the recording of information.” — R5</p>
<p>Resistance from staff</p>	<p>A group of the workforce, especially the older group, tends to resist change due to habits and technological limitations.</p>	<p>“Mainly manual workers, old and slow personnel, who have not had much access to technology, find it difficult to absorb, are afraid of change and do not want to use technology.” — R1</p> <p>“Workers are very reluctant to learn new knowledge, new thinking and change.” — R1</p> <p>“For young people, applying QR is appropriate and convenient. But for the elderly and those with poor eyesight, learning the process and using QR is more difficult and requires more effort.” — R6</p>
<p>Training & support needs</p>	<p>QR training and guidance are key to changing perceptions, creating motivation and increasing adoption.</p>	<p>“Training and instruction change the thinking and awareness of workers. List the benefits of applying technology.” — R2</p> <p>“The key factor for QR to be able to replicate and succeed is training and instruction to change the thinking and</p>

		<p>awareness of employees. Synchronize thinking and awareness from leaders to workers.” — R1</p> <p>“Analyze the benefits for workers when they use it, especially in the cleaning service industry, sometimes it is almost proof to verify right and wrong.” — R3</p>
Leadership role in scaling	<p>Leadership plays a central role in providing direction, internal communications, infrastructure investment, and human resource support during expansion.</p>	<p>“Clear company orientation, specific instructions for employees and workers, support with means such as phones, SIM cards, phone network subscriptions, reward employees and workers when they complete company requirements.” — R1</p> <p>“Communicate to workers, change workers’ thinking, and ensure a good infrastructure system.” — R1</p>
Best practices for scaling	<p>Successful implementation requires a combination of training, rewards, technical support, and internal communications to build consensus.</p>	<p>“Monthly rewards for individuals who apply standard QR technology as required. Additional rewards for workers who continuously train and guide other workers for 3 months.” — R2</p> <p>“Infrastructure is upgraded and synchronized; workers and supervisors are equipped with smartphones.” — R2</p> <p>“Synchronized working methods, high security, transparency, flexibility and easy integration of paper forms.” — R3</p>

5.2 Company Report Data & Findings

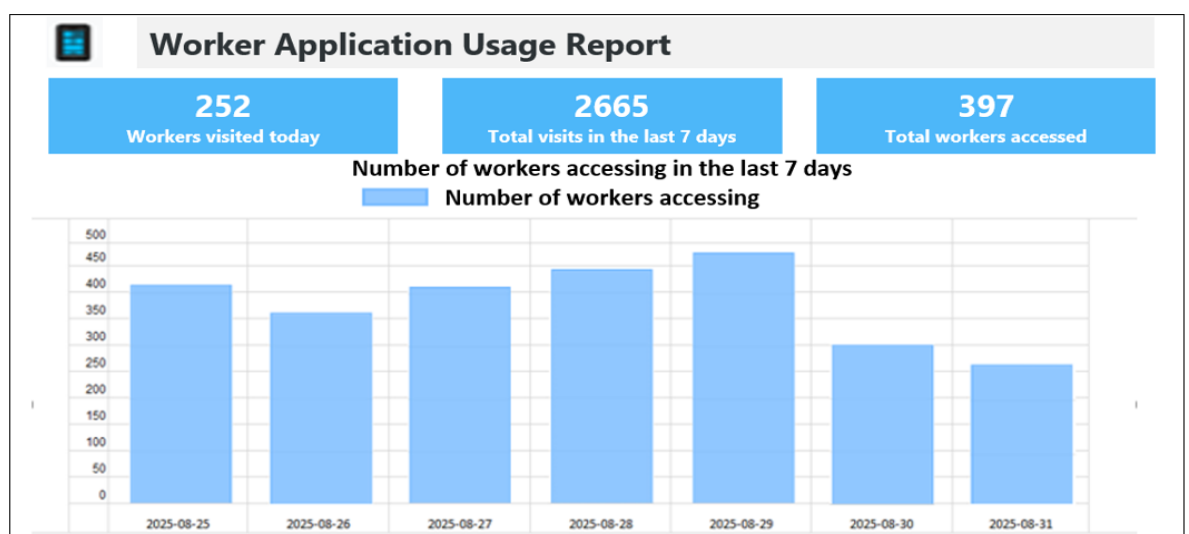
This section presents a descriptive literature review of company profiles related to the application of QR code technology in service quality management. Unlike thematic analysis, which focuses on abstract topics, the literature review here focuses on quantitative evidence, the actual results found in company performance reports and logs. The results are organized into three main themes to answer the research questions of this study which are Integration of QR into Operations, Perceived Improvements in Efficiency & Quality and Challenges and Scaling Best Practices

5.2.1 Integration of QR into Operations

To answer the first research question of “How is QR code integrated into the service control process?”, the author analyze the summary report data recorded on the enterprise's app system.

Each data gives us an overview of a specific performance indicator. In Figure 23- Worker Application Usage Report, the total number of workers accessing today, the total number of workers accessing the application, the total number of visits in the past 7 days in the column chart. The pie chart focuses on analyzing the number of visits on different days of the week, showing that there is a daily difference in personnel and working shifts. And the wave chart analyzes the number of visits at different hours of the week. This is also a characteristic of the service industry in which the company is operating.

Figure 25. Analyze the number of workers accessing

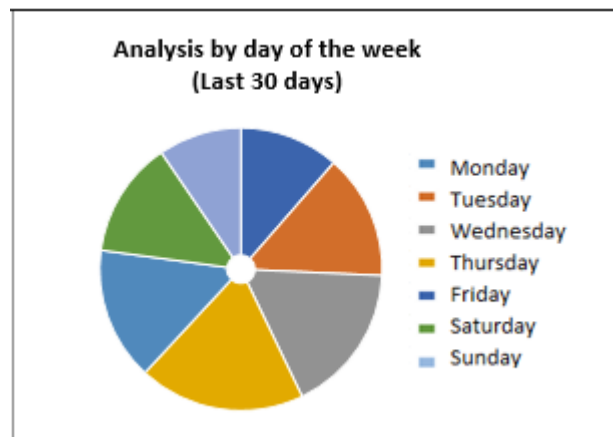


The bar chart describe the data about the number of accessing worker in the pilot project. Workers have adopted QR codes at a system scale – not a small-scale test: 397 is the total data of workers who have accessed the QR application. It reflects the acceptance of workers when the enterprise deploys the service control technology application. This proves that QR codes are a test applied at a system level with high user interaction. This is also a step to convert the manual control process to a digital control process in the service delivery process

QR coed has become a daily activity in the operating process – not a temporary use: 2665 is the total access data in the past 7 days (2025-08-25 to 2025-08-31) equivalent to an average of more than 380 accesses/day. This data shows that reporting via QR is not a sporadic, emotional activity but a regular activity, closely linked to the daily work process. Thus, QR codes have truly integrated into the operational rhythm of organizations and businesses and are a potential solution for future expansion.

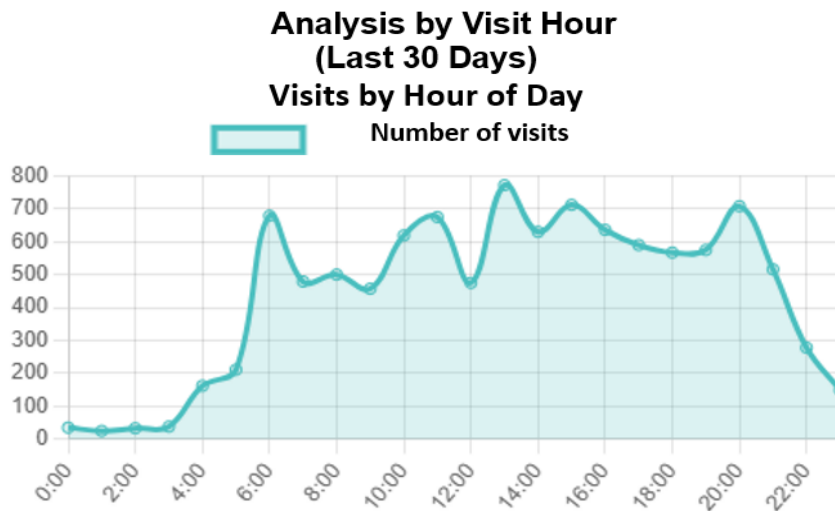
Data shows the actual operational regularity and consistent with the characteristics of the epidemic: 252 is the data of workers accessing today (2025-08-31) showing that the number of visits on weekends Saturday and Sunday decreased by 1/3 compared to the number of visits on weekdays from Monday to Friday.

Figure 26. Analyze the number of visits on different days of the week



The data analyzed the difference by working schedule between weekdays and weekends. The difference in system access data is fully recorded and analyzed by day of the week (last 30 days) in the pie chart with a clear difference in the percentage from Monday to Friday with a large percentage and Saturday and Sunday with a decrease in access in accordance with the positions of workers who are off work at the projects.

Figure 27. Analyze the number of visits at different hours of the day



QR operates according to the actual time frame: In this chart, the data records the interaction of visits made between 6am and 10pm, which are the time frames signed by the business to provide services and personnel working at the project. After 10pm, the number of visits for the night shift is reduced to only about 10% of the total number of personnel provided across the system. QR code accurately records the time points in the day: For peak time zones 6am, 11am, 1pm, 8pm are the periods when the shift starts, the shift ends and the work results are completed in turn. The reporting data is sent to the system the most.

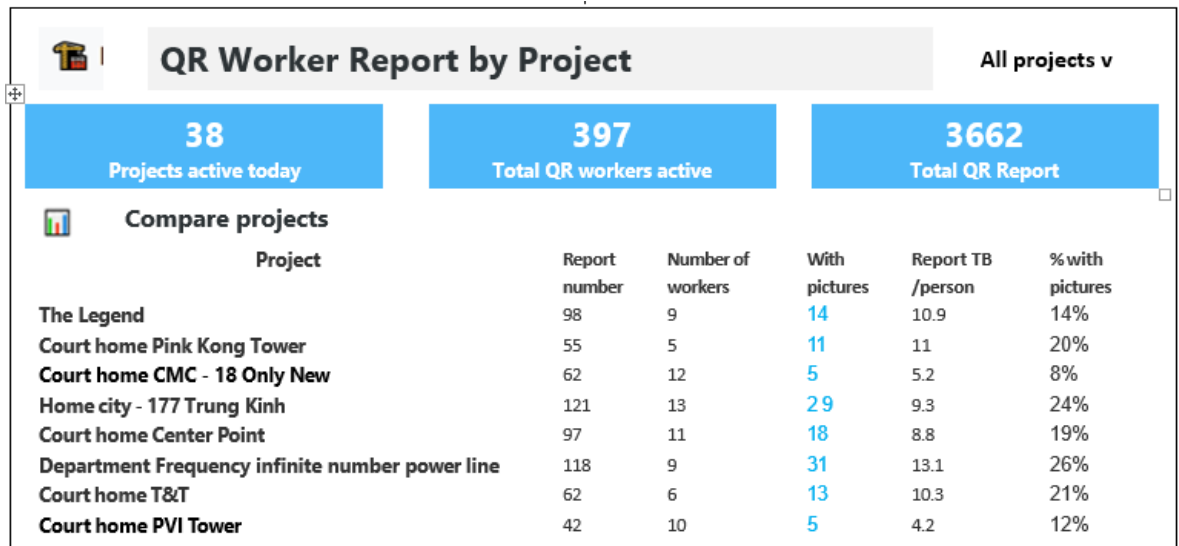
Generally, from the data analysis through the chart above, the use of QR codes integrated into the service control process has recorded clear data on the number of employees, total daily visits, the difference between the number of visits on weekdays and between time zones during the day. This initially shows that the digital transformation of the enterprise has also received the consensus of employees. And this is also the premise for the work of synchronizing enterprise data and increasing the speed of processing statistics and reports.

5.2.2 Perceived Improvements in Efficiency & Quality

Continue with research question 2: "How do QR codes perceive improvements in efficiency and quality?". When discussing the measurable improvements in personnel control and service quality of a service enterprise that applies QR codes, the author need to analyze the main operational factors directly related to workers and supervisors. These factors are a synthesis of analysis from data recorded from projects, the number of active QR workers,

and the total number of reports specified in Figure 26- QR worker reports by project. And monitoring reports on the number of participating supervisors, types of written or visual reports on service quality, are detailed in Figure 27- Supervisor activity reports.

Figure 28. QR worker reports by project

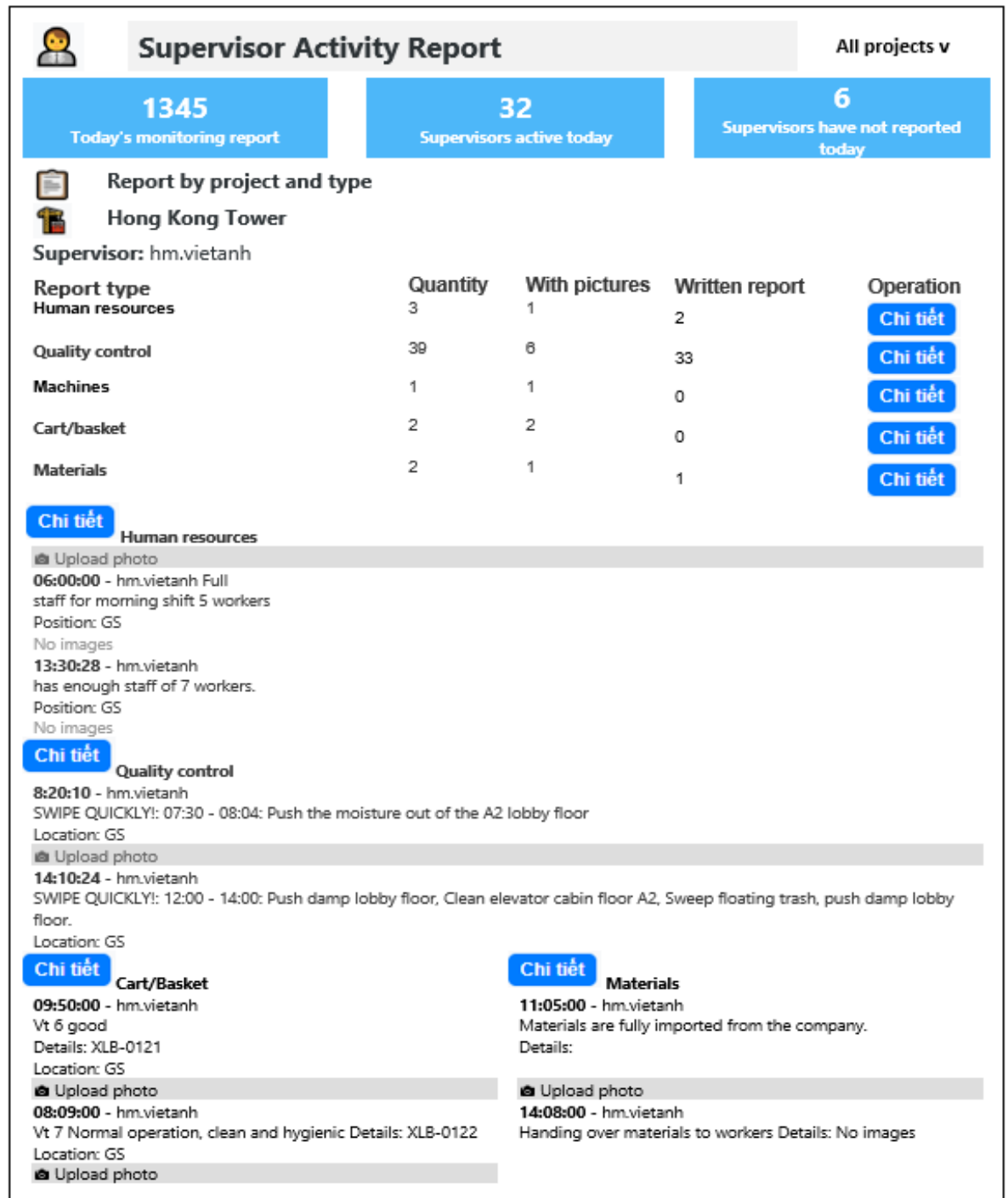


The level of acceptance and habit formation of QR code usage by workers is shown in the reported data, showing that a total of 397 active QR workers created 3662 reports/day at 38 projects, an average of 9.2 reports/person. This is a significant number in the context of the previous manual monitoring often lacking full and continuous recording, the low rate of paper reporting, which proves that QR code has created a habit of accepting, using and converting technology during the operation process. Looking at the factor of improving transparency in management activities, the data shows that the company has improved transparency in data extraction, but not evenly in each project: The rate of reports with images fluctuates from 8% to 26%. For example Department Frequency Power Line achieved 26% of photo evidence, while the CMC Building project only achieved 8%. This reflects two points: QR codes have significantly improved transparency compared to manual reports which completely lack visual evidence; updated data are not consistent, possibly due to differences in implementation levels, infrastructure conditions, or compliance between projects.

As a result, QR codes improve the quality of updated data for the management system, which is shown in many aspects such as synthesizing the number of personnel working on the project, service quality through language reports and image comparison, increasing reliability and the ability to verify information.

Optimizing the speed and efficiency of control compared to manual ones is proven when QR codes support the operation process, improve the measurement of personnel control efficiency and service quality in the process of automatic data synthesis directly on the system, and export reports quickly and promptly when needed to avoid the situation of slow or missing reports as the manual control process has been and is being implemented.

Figure 29. Supervisor activity reports



First, Supervisors have actively and proactively used QR codes. Data shows that with 1345 reports from 32 supervisors in 38 projects, each supervisor created an average of 42 reports, reflecting the active use of QR codes at the management level. This is a big improvement because previously supervisors often only recorded manually, which took a lot of time. The content was short, not specific, and the data was unclear, increasing the possibility of errors and delays.

Second, QR codes expanded the scope of supervision in many categories. Supervisor data shows that QR codes are an application that covers many aspects of service management such as: number of employees at the project, service quality, machinery, vehicles/baskets, and supplies. This is a remarkable new point compared to the previous manual supervision, which only focused on employee attendance. The presence of images in these types of reports allows supervisors to confirm the actual situation (e.g., broken machinery and equipment in detail at specific locations) instead of just reporting in text. This is important for faster decision making based on recorded visual evidence.

Next, QR codes record data in real time and are linked to specific actions and tasks. To clearly demonstrate the working principle of QR code, the author extracted the data collected from hm.vietanh monitoring to illustrate how the system records data with measurement indicators of actual operating time, associated with specific work content and visual evidence, thereby showing the fundamental difference compared to the previous manual, paper-based monitoring method in each type of report:

- High-precision personnel attendance and fraud elimination:

Personnel report type: Record specific time, accurate to the hour, minute, and second of each working position at the project in terms of attendance, summarizing the number of working positions of each shift (for example, 06:00:00 is the start time of the morning shift with 5 workers and 13:30:28 is the start time of the afternoon shift with 7 workers). QR code application provides accurate real-time data and is a prominent advantage compared to manual methods, which often only record the end-of-shift summary, lack accuracy in time markers and are prone to errors and fraud.

- Controlling service quality in writing and detailing with images which offering effective remote control:

Type of quality inspection report: Work content is detailed for each work position, work item and cleaning operation such as sweeping the exterior, pushing the hallway floor, vacuuming the room... This proves that QR code is not only applied to timekeeping, but also directly integrated into the service quality management process. Each inspection report can record images proving that work items have been monitored and controlled remotely or directly. These data are clear evidence and this is also a remarkable step forward in the sensitivity of information that manual monitoring processes cannot meet. The QR code application has created a link between customers, building management, investors or the company's operating system to participate in the process of checking and evaluating the actual status of the project anytime, anywhere and with full evidence.

- QR code increases the ability to proactively monitor assets such as machinery, materials:

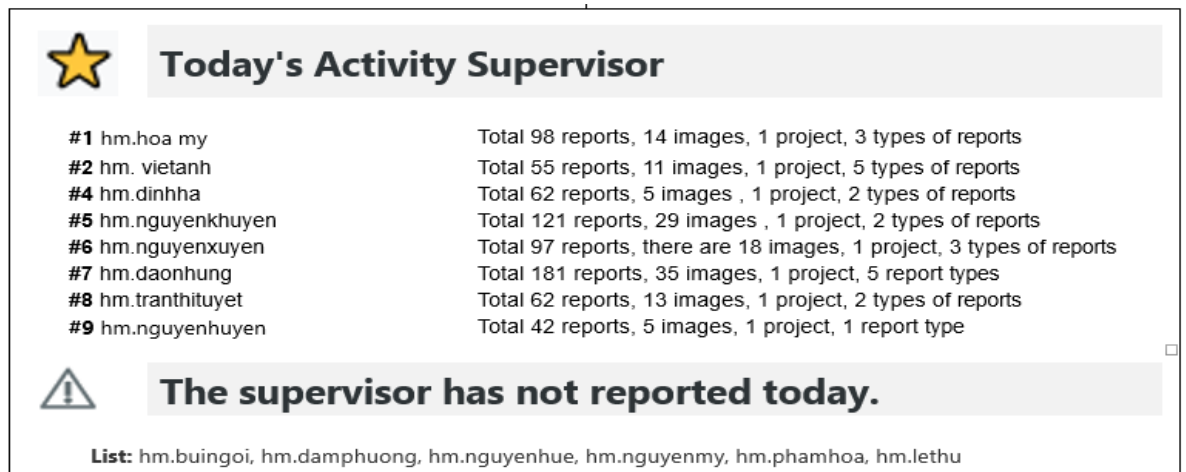
Type of report on machinery/vehicles/materials: One of the items in the mandatory control process to ensure that machinery is always operating well, vehicles and materials are fully supplied. Each type of report has independent values but is a chain of linked values in terms of quality provided to customers. All are recorded through reports and adjusted immediately when problems and problems arise.

In conclude, QR code upgrades data to improve the overall system from direct operating personnel. The combination of worker report data and supervisor report data shows that QR code improves efficiency at both levels: (1) the level of employees performing the work, and (2) the level of supervisory management, thereby increasing the reliability and transparency of the service monitoring system data. Thus, QR code helps supervisors expand the scope of control from one dimension to multi-dimensional, which has contributed to improving the overall process of human resource management, service quality control and reducing inspection time while still achieving optimal efficiency in control information.

5.2.3 Challenges, Barriers and Scaling Best Practices

The statistical data in the Figure 28 gives the author answer to research question 3 "Challenges and limitations from the practical pilot implementation of QR code". In the process of implementing QR code from idea to pilot application at service enterprises, it shows that besides the effectiveness achieved in the process of implementing QR code, there are still limitations and challenges in the digital transformation of enterprises.

Figure 30. Today's Activity Supervisor



Data in Figure 28 shows that the number of reports, the rate of reports with images and the type of reports have clear differences between the supervisors. In the same 8 working hours a day, supervisor hm.phanthuy created a total of 216 reports, equivalent to 27 reports / 01 hour. With the commendable frequency of positive reporting of supervisor hm.phanthuy, customers and company managers are always continuously updated with developments as if they were directly present at the project. However, the data also shows that there is still an unevenness in some supervisors creating only 05 reports / 01 hour, such as the case of supervisor hm.nguyenhuyen, and it is really serious when there are supervisors who do not make reports. This comes from many factors:

Human factors: The difference between the level of reporting participation in each project must be considered and evaluated truly objectively and comprehensively based on the number of projects participating in the test. Factors such as the age of the workers, for example, older workers are often reluctant to change, reluctant to learn and always want to maintain old habits. The level, ability to perceive and receive training information is more limited than in other professions. For supervisors, it is also necessary to consider the ability to receive, not yet proficient in technology, not yet formed the habit of reporting via applications, still working manually or maybe from the fact that some projects still maintain parallel manual practices, which will reduce the effectiveness of the system's synchronous implementation at the company level. This reflects the level of QR code implementation is not really stable between projects or between supervisors. Some supervisors make daily reports as a daily habit, some supervisors only apply it at a formal level, to cope with the company's requirements. In addition, there are some supervisors who have not yet made a report during the day (6/36 supervisors, equivalent to 16%) of the total number of supervisors

who are participating in the process of converting to apply technology to the business's operations.

Regarding the factor of supporting equipment and tools: Each project in high-rise buildings or areas near state government agencies with high security will be limited due to weak networks and signal blocking. Technology-related equipment systems such as telephones, Wifi and software specifically designed for the industry were almost not applied in the past. Therefore, the company needs to consider, evaluate and have technology equipment support to increase the ability to meet work requirements at each service point.

Regarding the operational factor: For the service industry, there are many diverse work areas and work items, but in reality, there are currently no mandatory standards for updating information with many types of reports. To maximize the exploitation of reporting information, it is necessary to issue mandatory standards on reporting rates, number of reports, types of reports (text reports/image reports) that are screened for content, in case each supervisor reports in a different way, inconsistently and without common evaluation criteria.

In conclusion, a group of supervisors has not used QR means that the monitoring data is incomplete, reducing the transparency and continuity of the entire system. The system has not set up automatic warnings, reports are slow or there are no supporting images. It is necessary to set up a control group in the initial stage to continuously check and instruct after each shift or each working day for supervisors who have not yet caught up with the technology conversion process. Build a real-time synchronization mechanism between workers and supervisors, ensuring the system's seamless connectivity. This is also a challenge for businesses that need training, guidance on using the app, and standardizing reporting processes that need to be done more deeply in the expansion phase.

6 Conclusion & Future Directions

6.1 Theoretical and Practical implications

This thesis aims to study how QR code technology can be applied to optimize service quality control processes and support human resource management in small and medium-sized service enterprises with a case study of Hoan My Company Limited. By integrating theoretical perspectives from the Technology - Organization - Environment (TOE) framework, Learning

Organization theory, Diffusion of Innovation and Lean Service principles, the study has demonstrated that even simple, low-cost digital tools can bring about meaningful change to an organization when they are strategically aligned with operational needs and supported through appropriate training, leadership commitment and cultural adaptation. This outcome directly supports the central argument of the TOE framework, which emphasizes that successful technology adoption is shaped by technological suitability, organizational readiness, and external environmental conditions.

This research contributes to the theoretical understanding of technology adoption and operational optimization in SMEs in several ways. First, by applying the Technology–Organization–Environment (TOE) framework, the study demonstrates that effective adoption of even simple digital technologies depends on the interplay between technological compatibility, organizational readiness, and external pressures. The findings reinforce that technology adoption is not solely a technical decision, but one shaped by culture, leadership support, and workforce adaptability. This aligns with the TOE model's view that technology alone cannot drive change unless the organization and its environment collectively enable it.

Second, the study complements the Diffusion of Innovations theory by highlighting how perceived usefulness, ease of use, and visible benefits influence employees' willingness to adopt new tools. The results show that QR code technology exhibits high relative advantage and compatibility but requires strong communication and continuous reinforcement to overcome resistance among older workers. This reflects core elements of the Diffusion theory, which explains that different employee groups move through the adoption process at varying speeds depending on their perception of the innovation.

Third, the use of Learning Organization and Lean Service principles provides theoretical insight into how continuous learning, process standardization, and waste reduction can be achieved in service-based operations through low-cost digital transformation. Together, these theoretical implications highlight that meaningful organizational improvement does not require advanced technology, but rather the strategic alignment of simple tools with learning-oriented work culture and process discipline. This is consistent with Learning Organization theory, which emphasizes continuous improvement and shared learning as key drivers of organizational development. Similarly, the reduction of manual reporting and unnecessary supervision observed in this study reflects Lean Service concepts focused on eliminating waste and improving workflow efficiency.

The findings of this study provide evidence that the implementation of QR code technology has significantly improved operational efficiency at the company. Replacing manual monitoring and paper reporting with digital verification has reduced administrative workload, reduced errors, and processed data faster. For frontline workers, the system has increased transparency and fairness in timekeeping and performance evaluation, thereby encouraging greater accountability and participation in daily work. For managers, supervisors can move from direct field monitoring to technology-based monitoring, allowing them to monitor multiple projects at the same time. At the organizational level, continuously updated, automated data reporting has supported timely, informed decision-making and increased accountability for project work. These findings reinforce the practical value of Lean Service principles by demonstrating how streamlined processes and reduced waste directly contribute to overall efficiency

At the same time, the study also highlighted some of the challenges associated with technology adoption in SMEs. Limited technology usage among older employees, unstable network conditions, and the need for ongoing technical support were major challenges in the adoption of technology. These challenges highlight the importance of structured, specific training programs, clear communication of the purpose and benefits of the technology, and consistent leadership support throughout the implementation process. The findings also highlight that technology adoption in service businesses is not simply a technical transformation, but also a cultural transformation, requiring organizations to foster learning, openness, and adaptability. This reinforces the Learning Organization perspective, which stresses that organizational culture and shared learning capabilities are essential for sustaining new practices. The challenges also reflect the TOE model's emphasis on organizational readiness, showing that technological success depends heavily on human and structural factors.

The findings of this study also offer several practical recommendations for SMEs seeking to optimize operational management. First, the QR code system demonstrates that digital transformation can begin with small, low-cost solutions that replace manual supervision and paper records, leading to immediate improvements in transparency, efficiency, and accountability. Second, the study shows that successful implementation requires strong leadership engagement, including clear communication of purpose, provision of necessary devices and connectivity, and ongoing encouragement to support behavior change. Third, the research underscores the importance of structured training which is particularly for older or less tech-confident workers, in order to ensure that digital tools enhance, rather than

disrupt, workflow. Supervisors can also benefit from shifting from physical oversight to data-driven monitoring, reducing workload and increasing responsiveness. Finally, the system's scalability suggests that SMEs can expand from pilot sites to full organizational implementation by standardizing procedures, ensuring system stability, and reinforcing usage habits through performance evaluation and reward mechanisms. These recommendations align closely with the four theoretical frameworks, illustrating how coordinated organizational learning, supportive leadership, reduced process waste, and technology–organization alignment are essential for sustainable digital transformation.

6.2 Limitations and Future research

While this study provides valuable theoretical and practical insights, certain limitations should be acknowledged. The research was based on a single case study of a cleaning service enterprise in Vietnam, which may limit the generalizability of the findings to other industries or larger organizations. The study also relied primarily on qualitative data collected after the QR system implementation; therefore, quantitative data comparing pre- and post-implementation performance was not available. In addition, participants' feedback might reflect initial reactions rather than long-term behavioral change, as the system had only recently been introduced.

Future research and development directions include improving the stability of the system through upgrading the network infrastructure and integrating the QR system with human resource management, service quality management and customer reporting modules to extend its value. Further research can also quantitatively measure cost savings and productivity results across multiple project sites over a longer period. In addition, exploring support staff training models, especially for older workers – where technology adoption is likely to contribute to the sustainable operation of the enterprise. Future studies could also examine how technology–organization alignment (TOE), organizational learning readiness, and process standardization influence the long-term sustainability of QR-based systems in other SME contexts.

In summary, this study contributes both theoretical insights and practical guidance to the field of service operations management. The study demonstrates that when properly designed and supported, QR code technology can be an effective and scalable solution to optimize service quality control and human resource management in small and medium-sized enterprises (SMEs). The study affirms that the path to digital transformation does not always

require complex or expensive systems; instead, it starts with simple tools, a consistent innovative mindset from leaders at all levels, a willingness to learn from managers at all levels, and most of all, a strong consensus from the organization, staff, and employees committed to learning so that the business can grow in the general transformation trend of society. This conclusion aligns with all four frameworks, showing that successful transformation requires technological suitability (TOE), employee learning (Learning Organization), innovation acceptance (Diffusion of Innovation), and process efficiency (Lean Service).

References

- Al-Awlaqi, M., Alshurideh, M., & Al Kurdi, B. (2024). The role of technology in improving operational efficiency. *International Journal of Data and Network Science*, 8(3), 675–684. <https://doi.org/10.5267/j.ijdns.2024.3.008>
- Almashawreh, R., Talukder, M., Charath, S. K., & Khan, M. I. (2024). AI adoption in Jordanian SMEs: The influence of technological and organizational orientations. *Global Business Review*. Advance online publication. <https://doi.org/10.1177/09721509241250273>
- Baker, J. (2012). The technology–organization–environment framework. In Y. K. Dwivedi, M. R. Wade, & S. L. Schneberger (Eds.), *Information systems theory* (pp. 231–245). Springer. https://doi.org/10.1007/978-1-4419-6108-2_12
- Boxall, P., & Purcell, J. (2016). *Strategy and human resource management* (4th ed.). Palgrave Macmillan.
- Clarke, V., & Braun, V. (2018). Using thematic analysis in counselling and psychotherapy research: A critical reflection. *Counselling and Psychotherapy Research*, 18(2), 107–110. <https://doi.org/10.1002/capr.12165>
- Denso Wave. (n.d.). QR Code.com. <https://www.qrcode.com/en/>
- Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods* (2nd ed.). McGraw-Hill.
- Dessler, G. (2020). *Human resource management* (16th ed.). Pearson.
- Do, T. L. (2025). Digital transformation in small and medium enterprises (SMEs) in Vietnam. *International Journal of Advanced Multidisciplinary Research and Studies*, 5(5), 100–112. <https://www.researchgate.net/publication/395603593>
- Drew, J., McCallum, B., & Roggenhofer, S. (2004). *Journey to lean: Making operational change stick*. Palgrave Macmillan.
- Drucker, P. F. (1999). *Management challenges for the 21st century*. HarperBusiness.
- Dương, N. T. T. (2024). *Nghiên cứu mức độ chuyển đổi số trong các doanh nghiệp vừa và nhỏ...* [Doctoral dissertation, Thuongmai University]. <https://tmu.edu.vn/upload/news/files/toan-van-luan-an-duong-nguyen-thanh-thuy.pdf-1705657754.pdf>
- El Said, M. F. (2014). Barriers to e-commerce adoption in Egyptian SMEs. *Journal of Small Business and Enterprise Development*, 21(4), 574–593. <https://doi.org/10.1108/JSBED-12-2013-0193>
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>

- European Commission. (2016). *User guide to the SME definition*. Publications Office of the European Union. <https://doi.org/10.2873/620234>
- Faiz, F., et al. (2024). *Determinants of digital technology adoption in innovative firms: Integrating TOE and DOI*. [Citation details incomplete]
- Faisal, C. N., Syafruddin, A. R. I., Zhafir, K. S., & Simanjuntak, E. R. (2025). The adoption of an integrated QR code payment system of Indonesian MSME: An extended TAM approach. *International Journal of Social Health*. <http://dx.doi.org/10.58860/ijsh.v3i3.167>
- FlowForma. (2023). *Business process automation statistics: Key insights for 2023 and beyond*. <https://www.flowforma.com/blog/business-process-automation-statistics>
- Gao, Z., Liu, Y., & Zhang, W. (2015). Applying QR codes to building facility management system. *International Journal of Facility Management*, 6(1), 1–10.
- García-Morales, V. J., Lloréns-Montes, F. J., & Verdú-Jover, A. J. (2008). The effects of transformational leadership on organizational performance through knowledge and innovation. *British Journal of Management*, 19(4), 299–319. <https://doi.org/10.1111/j.1467-8551.2007.00547.x>
- Garvin, D., Edmondson, A., & Gino, F. (2008). Is yours a learning organization? *Harvard Business Review*, 86(3), 109–116.
- Grover, V. (1993). An empirically derived model for adoption of interorganizational systems. *Decision Sciences*, 24(3), 603–640. <https://doi.org/10.1111/j.1540-5915.1993.tb01295.x>
- Hsu, P. F., Kraemer, K. L., & Dunkle, D. (2006). Determinants of e-business use. *International Journal of Electronic Commerce*, 10(4), 9–45. <https://doi.org/10.2753/JEC1086-4415100401>
- Hudson, M., Smart, A., & Bourne, M. (2001). SME performance measurement systems. *International Journal of Operations & Production Management*, 21(8), 1096–1115. <https://doi.org/10.1108/EUM0000000005587>
- Hung, R. Y. Y., Lien, B. Y. H., Fang, S. C., & McLean, G. N. (2010). Knowledge and innovation performance. *Total Quality Management & Business Excellence*, 21(4), 425–438. <https://doi.org/10.1080/14783361003606795>
- International Organization for Standardization. (2015). *ISO/IEC 18004:2015 QR Code bar code symbology specification*. <https://www.iso.org/standard/62021.html>
- Jerez-Gómez, P., Céspedes-Lorente, J., & Valle-Cabrera, R. (2005). Organizational learning capability. *Journal of Business Research*, 58(6), 715–725. <https://doi.org/10.1016/j.jbusres.2003.11.002>
- Kuan, K. K. Y., & Chau, P. Y. K. (2001). A perception-based model for EDI adoption in small businesses. *Information & Management*, 38(8), 507–521. [https://doi.org/10.1016/S0378-7206\(01\)00073-8](https://doi.org/10.1016/S0378-7206(01)00073-8)

- Kuvaas, B., Buch, R., & Dysvik, A. (2018). Individual and social learning. *Human Resource Management Review*, 28(2), 144–157. <https://doi.org/10.1016/j.hrmr.2017.06.001>
- Lai, M. K., Yeo, C. M. A., Tay, L. C., & Lim, K. G. (2025). Re-examining AI adoption antecedents. *Journal of Small Business Management*, 41(1b). <https://doi.org/10.59953/paperasia.v41i1b.337>
- Lê, V. L. T., Nguyễn, H. T., & Phạm, K.-D. (2023). What drives Industry 4.0 technologies adoption? *Sustainability*, 15(7), Article 5969. <https://doi.org/10.3390/su15075969>
- Lee, S., & Shim, J. (2007). RFID adoption in healthcare. *European Journal of Information Systems*, 16(6), 712–724. <https://doi.org/10.1057/palgrave.ejis.3000716>
- Leung, D., Lo, A., Fong, L. H. N., & Law, R. (2015). ICT adoption in hospitality. *Tourism Recreation Research*, 40(3), 391–406. <https://doi.org/10.1080/02508281.2015.1090158>
- Ledi, K. K., Ameza-Xemalordzo, E., & Amoako, G. K. (2025). Effect of QR code and mobile money on performance of SMEs in developing countries. *Cogent Business & Management*, 10, 2238977. <https://www.researchgate.net/publication/372586375>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.
- Liu, S., Wu, Y., & Wang, H. (2023). Business analytics: Definitions and challenges. *Mathematics*, 11(4), 899. <https://doi.org/10.3390/math11040899>
- Mirza, H., Bellaleme, F., & Mirza, C. (2023). *Ethical considerations in qualitative research*. ResearchGate. <https://www.researchgate.net/publication/370838199>
- Mishra, A. N., Konana, P., & Barua, A. (2007). Internet use in procurement. *Information Systems Research*, 18(1), 103–120. <https://doi.org/10.1287/isre.1070.0101>
- Nazir, O., Islam, J. U., & Rahman, Z. (2026). Customer and employee engagement in the era of artificial intelligence adoption. In *Customer engagement and digital business* (pp. 85-103). Routledge.
- Nguyen, N. P. (2016). Inter-firm collaboration in Vietnamese tourism SMEs. *Archives of Business Research*, 4(2), 127–137. <https://doi.org/10.14738/abr.42.1915>
- Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis trustworthiness. *International Journal of Qualitative Methods*, 16(1). <https://doi.org/10.1177/1609406917733847>
- Örtenblad, A. (2018). Meaning of a learning organization. *The Learning Organization*, 25(3), 150–158. <https://doi.org/10.1108/TLO-12-2017-0118>
- Oliveira, T., & Martins, M. F. (2011). IT adoption models review. *The Electronic Journal Information Systems Evaluation*, 14(1), 110–121.
- Pascal, D. (2007). *Lean production simplified* (2nd ed.). Productivity Press.

- Paiva, J., et al. (2024). *Exploring the drivers of AI adoption: A meta-analysis of technological, organizational and environmental (TOE) factors*.
<https://www.researchgate.net/publication/387089017>
- Pedrini, G., & Frederico, G. F. (2018). Digital transformation of SMEs. *Journal of Small Business Management*, 56(1), 30–45. <https://doi.org/10.1111/jsbm.12460>
- Pham, T. H. (2023). Digital transformation in Vietnamese SMEs: Managerial implications. *Journal of Small Business and Enterprise Development*.
- Prakash, C. (2025). Evaluating the TOE framework for technology adoption: A systematic review of its strengths and limitations. *International Journal on Recent and Innovation Trends in Computing and Communication*. <https://www.researchgate.net/publication/389208026>
- Ramdani, B., Kawalek, P., & Lorenzo, O. (2009). Predicting SMEs' enterprise system adoption. *Journal of Enterprise Information Management*, 22(1/2), 10–24.
<https://doi.org/10.1108/17410390910922796>
- Revathi, L., Vara Lakshmi, T., & Jaiswal, S. (2024). Enhancing operational excellence through quality management. *International Research Journal on Advanced Engineering and Management*. <http://dx.doi.org/10.47392/IRJAEM.2024.0268>
- Russell, R. S., & Taylor, B. W. (2023). *Operations and supply chain management* (11th ed.). Wiley.
- Senge, P. M. (1990). *The fifth discipline*. Doubleday.
- Shahzad, F., Arslan, A., Gupta, R., & Saleem, S. (2025). Work meaningfulness in immigrant-origin IT-sector gig workers. *Work in the Global Economy*.
- Shahzad, F., Shahid, M. G., Ghaffar, C., & Ferreira, J. (2025). Women artisan entrepreneurship: Challenges and barriers in volatile economies. *Journal of Enterprising Communities*.
- Sivathanu, B., & Pillai, R. (2020). Adoption of digital technologies in small and medium enterprises. *Journal of Enterprise Information Management*.
<https://www.researchgate.net/publication/340029849>
- Slack, N., Brandon-Jones, A., & Burgess, N. (2022). *Operations management* (10th ed.). Pearson.
- Suradi, A., et al. (2025). A theoretical extension of TOE in e-government. *Journal of Computer Science and Technology*.
- Temel, S., & Ayaz, M. (2019). Barriers to digital transformation in SMEs. *Procedia Computer Science*, 158, 811–818. <https://doi.org/10.1016/j.procs.2019.09.120>
- Thủy, N. T. B., Trần, N. T. B., & Sinh, D. P. (2020). Factors influencing continued ICT use. *Tạp chí Nghiên cứu Kinh tế*, 11(510), 70–79.
- Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington Books.

- Vietnam Law Magazine. (2022, November 20). *Digital transformation an urgent need for SMEs*. <https://vietnamlawmagazine.vn/digital-transformation-an-urgent-need-for-smes-59216.html>
- Wang, Y. M., Wang, Y. S., & Yang, Y. F. (2010). Determinants of RFID adoption. *Technological Forecasting and Social Change*, 77(5), 803–815. <https://doi.org/10.1016/j.techfore.2010.03.006>
- Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the world*. Rawson Associates.
- Xie, L. (2020). Leadership impacts on learning organizations. *Leadership & Organization Development Journal*, 41(2), 220–236. <https://doi.org/10.1108/LODJ-09-2019-0406>
- Yong, S. M. (2023). Digital marketing adoption challenges in SMEs. *Information Management and Business Review*, 15(2), 152–172. [https://doi.org/10.22610/imbr.v15i2\(I\)SI.3429](https://doi.org/10.22610/imbr.v15i2(I)SI.3429)
- Zhong, Y., & Moon, H. C. (2023). Industry 4.0 technology effects: TOE model. *Systems*, 11(6), 277. <https://doi.org/10.3390/systems11060277>
- Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in e-business value. *Information Systems Research*, 16(1), 61–84. <https://doi.org/10.1287/isre.1050.0045>
- Zhu, K., Kraemer, K. L., & Xu, S. (2003). E-business adoption by European firms. *European Journal of Information Systems*, 12(4), 251–268. <https://doi.org/10.1057/palgrave.ejis.3000475>
- Zhu, K., Kraemer, K. L., & Xu, S. (2004). IT infrastructure and e-commerce capability. *Journal of Management Information Systems*, 21(1), 167–202. <https://doi.org/10.1080/07421222.2004.11045794>
- Zhu, K., Kraemer, K. L., & Xu, S. (2006). Innovation assimilation and technology diffusion. *Management Science*, 52(10), 1557–1576. <https://doi.org/10.1287/mnsc.1050.0487>
- Zondo, W. N. S., & Ndoro, J. T. (2023). Diffusion of Innovation in social media adoption. *Sustainability*, 15(5), 4017. <https://doi.org/10.3390/su15054017>

Appendix 1. Semi-Structured Interview Questions

This appendix presents the interview guide used in this thesis. The questions were organized according to three respondent groups which are senior executive supervision, supervisors, and frontline staff, in order to capture different perspectives regarding the adoption and implementation of QR code technology.

A. Interview Questions for senior executive supervision

1. Motivation and Integration (RQ1)

1. What were the main motivations behind the decision to pilot QR code technology for service quality control and human resource management?
2. How were operational procedures or work allocations adjusted to integrate QR codes into daily workflows?
3. To what extent did the QR system align with the company's existing management tools and processes?

2. Improvements and Outcomes (RQ2)

4. What benefits have been observed since implementing QR codes (e.g., efficiency, transparency, cost reduction, data accuracy)?
5. How has the QR system influenced performance evaluation, attendance tracking, and employee accountability?
6. Has the system affected customer trust or service satisfaction?

3. Challenges and Scalability (RQ3)

7. What challenges arose during implementation (e.g., technical issues, employee resistance, cost constraints)?
8. In your opinion, what key factors are required for successful scaling of the system across the company?
9. Does the company plan to integrate QR codes with other digital management tools in the future?
10. Do you believe this model can be applied more widely to other enterprises in the same industry?

B. Interview Questions for Supervisors

1. Integration into Daily Work (RQ1)

1. In what ways has QR scanning changed how you supervise and manage service quality?
2. How has the QR system affected your role and monitoring responsibilities?
3. Does the system integrate effectively with the management forms or tools you previously used?

2. Improvements and Outcomes (RQ2)

4. What changes have you observed in worker behavior or performance since using the QR system?
5. Has the QR-generated data helped improve the accuracy, reliability, or fairness of your reporting?
6. Has the system reduced your manual workload (e.g., less paperwork or fewer physical inspection rounds)?

3. Challenges and Scalability (RQ3)

7. What difficulties did you encounter during implementation (e.g., weak network, worker unfamiliarity)?
8. What strategies helped encourage workers to adopt and use QR codes smoothly?
9. What do you consider the most important factor for successful large-scale adoption?

C. Interview Questions for Cleaning Staffs

1. Integration into Daily Work (RQ1)

1. Is scanning QR codes easy and convenient during your daily work?
2. How has QR use changed the way you carry out your assigned tasks?
3. Does the QR system fit well with your existing work tools and routines?

2. Improvements and Outcomes (RQ2)

4. Has QR use made your job faster, more organized, or less paperwork-heavy?
5. How do you feel about fairness and transparency in timekeeping and performance recognition when using QR?
6. Has the system influenced your motivation or work attitude?

3. Challenges and Suggestions (RQ3)

7. What problems do you encounter when using the QR system (e.g., scanning issues, lack of devices)?
8. What aspect of the QR system is most difficult or inconvenient for you?
9. What suggestions would you make to make the QR system easier and more helpful for everyday use?

Appendix 2: Data Management Plan

1. Description of thesis research data

The research data used in this thesis consist of qualitative interview data and internal company documents collected during the pilot implementation of a QR-code–based quality management system at Hoan My Co., Ltd.

Primary data were gathered through semi-structured interviews with six participants, including one executive manager, two supervisors, and three frontline cleaning staff. These interviews were conducted via Zoom in Vietnamese and audio-recorded before being transcribed into text for analysis.

The secondary data were provided by the commissioning company and include internal performance documents such as QR-based attendance logs, daily work reports, supervisor monitoring data, and descriptive statistics exported from the company's HMGROUP system.

The data exist in multiple formats, including audio files, text transcripts, PDF and JPEG image reports, and XLS/CSV numerical files generated from the company's reporting system.

2. Management and storage of the research data

All research data will be stored and processed exclusively on the author's personal password-protected computer during the thesis process. Backups of the recordings, transcripts, and company documents will be stored on a password-protected external hard drive, kept separately from the primary working files to prevent accidental loss or corruption. Because the dataset includes confidential company information and personal data, no materials have been uploaded to cloud services. Only the author has access to the full dataset, while the thesis supervisor may be granted access to anonymized excerpts if necessary for guidance. An agreement with the commissioning company ensures that all internal files are used solely for academic purposes and remain confidential throughout the thesis process.

3. Processing of personal data and sensitive data

This thesis involves the processing of personal data derived from both the interview materials and the internal company reports used during the research. The interview data

include limited personal information such as participants' age ranges, gender, job roles, and levels of digital experience; however, these are anonymized in the final thesis through respondent codes (R1–R6). The internal operational reports provided by Hoan My Co., Ltd. contain the real names of employees and supervisors, as these documents originate directly from the company's management system. Since these names appear in the internal reports included in the publicly accessible thesis, their publication is permitted on the basis of explicit, written consent obtained individually from each employee whose name appears. All individuals were informed about the purpose of the thesis, the type of information included, and the fact that the thesis would be publicly accessible. No sensitive personal data, such as health, political opinions, or religious beliefs, were collected at any stage. The processing and publication of personal data in this thesis comply with GDPR, ethical guidelines, and the principles outlined in HAMK's privacy notice for student theses.

4. Ownership of research data

The data was collected by the author in coordination with the commissioner; the owner of the collected data and results from this research is the author of this thesis, unless otherwise agreed. The data was collected solely for the purpose of the research and is not part of any HAMK project. No external commissioner or organisation has ownership rights to the data.

5. Further use of research data after the completion of the thesis

After the thesis is completed, the research data will not be reused or transferred for any further research or development purposes. The author will retain all data securely for one year from the date of thesis approval to allow verification of the research findings if necessary. After this retention period, all data which including interview recordings, transcripts, and internal company documents will be permanently and securely destroyed. The participants were informed before data collection that the materials would be used only for the purposes of this thesis and would not be archived or shared further. Because no further use will take place, no separate agreement is required beyond the permissions already granted by the commissioning company for the use of internal documents during the thesis process.