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Smart Service: Implementation Internet of Things (IoT) in Modern Service Business Transformation

Shifa Regita[1], Jaka Samudra[2]

Tarakanita University[1], Bina Nusantara University[2]
Billy & Moon Complex, Pondok Kelapa, East Jakarta[1],
Kebun Jeruk Main, Kemanggisan, Palmerah, West Jakarta[2]

e-mail: shifa@utarki.ac.id[1], e-mail: jaka.samudra@binus.ac.id[2]

Abstract

Digital transformation has driven significant changes in various service business sectors, particularly through the utilization of the Internet of Things (IoT). This study aims to describe the implementation of IoT in various service business sectors and analyze its impact on operational efficiency and customer experience. The research employs a descriptive method with an observation approach, focusing on digital service system in sectors such an transportation, logistics, healthcare, hospitality, and small-scale service businesses. Data were collected through system documentation and a review of relevant literature. The findings indicate that IoT implementation enhances operational efficiency through real-time monitoring, process automation, and system integration. Furthermore, IoT improves service transparency and customer experience by enabling faster, more accurate, and data-driven interactions. In small service businesses, such as laundry service, IoT supports machine control, operational management, and customer communication more effectively. However, challenges such as limited technological infrastructure, high implementation costs, and low digital literacy remain significant barriers, particularly for small and medium enterprises. This study highligth the strategic role of IoT as a key enabler in transforming conventional service into smart services that are more adaptive, responsive and data driven.

Keywords: Internet of Things, Smart Service, Digital Transformation, Service Business

Abstrak

Transformasi digital telah mendorong perubahan signifikan dalam berbagai sektor bisnis jasa, terutama melalui pemanfaatan Internet of Thing (IoT). Penelitian ini bertujuan untuk mendeskripsikan implementasi IoT dalam berbagai sektr bisnis jasa serta menganalisis dampaknya terhadap efisiensi operasional dan pengalaman pelanggan. Metode penelitian yang digunakan adalah deskriptif dengan pendekatan observasi terhadap berbagai platform layanan digital yang mengadopsi teknologi IoT. Data dikumpulkan melalui dokumentasi sistem layanan dan studi literatur terdahulu. Hasil penelitian menunjukan bahwa implementasi IoT mampu meningkatkan efisiensi operasional melalui monitoring real-time, otomatis proses, serta integrasi sistem layanan. Selain itu, IoT juga meningkatkan transparansi layanan dan kualitas pengalaman pelanggan melalui akses informasi yang lebih cepat, akurat dan berbasis data. Pada pengusaha kecil seperti binatu, IoT mendukung kontrol mesin, pengelolaan operasional, dan komunikasi pelanggan secara lebih efektif. Namun demikian, tantangan seperti keterbatasan infrastruktur, biaya implementasi, serta rendahnya literasi digital masih menjadi hambatan utama, khususnya bagi UMKM. Penelitian ini menegaskan bahwa IoT berperan sebagai enabler utama dalam transformasi menuju smart service yang adaptif, responsif, dan basis data.

Kata Kunci : Internet of Things. Smart Service, Transformasi Digital, Bisnis Jasa

INTRODUCTION

The development of digital technology over the past few decades has brought significant changes across various industrial sectors, including the service sector, which is fundamentally characterized by direct interaction between service providers and customers. Digital transformation not only affects the technological aspect but also fundamentally changes the way organizations create, deliver, and manage value for customers. In today's digital era, customers no longer merely demand quality services but also expect services that are fast, transparent, responsive, and capable of providing personalized and integrated experiences. This condition encourages service organizations to continuously innovate in order to remain relevant and competitive amid increasingly complex market dynamics.

Digital transformation in the service sector is marked by a shift from conventional service systems toward integrated technology-based service systems. Conventional service systems, which previously relied on manual processes and direct interactions, are now gradually being replaced by digital systems that enable automation, data integration, and more efficient communication between service providers and customers. This transformation not only improves operational efficiency but also opens opportunities for organizations to create new business models that are more innovative and adaptive. In this context, digital technology is no longer viewed merely as a supporting tool, but rather as a strategic factor determining the long-term success of an organization. One of the key technologies driving this transformation is the Internet of Things (IoT). IoT is defined as a paradigm in which physical objects, devices, and systems are interconnected through internet networks to exchange data, perform monitoring, and enable continuous remote control (Alaba et al., 2025). This technology bridges the physical and digital worlds, creating a service ecosystem that is not only reactive to customer demands but also proactive in predicting customer needs.

The growth of the global IoT service market has shown a rapid increase. According to recent reports, the market value has grown significantly due to its ability to improve efficiency and create new business models. In Indonesia, this transformation has become highly relevant considering that the service sector contributes significantly to the Gross Domestic Product (GDP), although its level of digital maturity remains diverse. Transportation, logistics, healthcare, and hospitality sectors have increasingly adopted this technology; however, implementation among micro, small, and medium enterprises (MSMEs) remains very limited despite its substantial development potential (Trinugroho et al., 2022).

Furthermore, in the hospitality industry, IoT is used to create smart service concepts through technologies such as smart rooms, enabling customers to automatically control various room facilities. In other service sectors such as banking and retail, IoT is also utilized to enhance customer experience through faster and more integrated digital-based services. This phenomenon indicates that IoT has become an integral part of modern service business transformation, where technology is used to improve service quality while simultaneously creating competitive advantages. Michel Porter & James Heppelmann (2025) stated that the integration of IoT technology into products and services has transformed the structure of industrial competition by creating new business models based on connectivity and data. Organizations capable of effectively adopting this technology will gain advantages in operational efficiency, innovation speed, and the ability to respond to customer needs. Despite its enormous potential, IoT implementation in service businesses still faces various challenges, particularly in developing countries such as Indonesia. Limited technological infrastructure, high investment costs, and low levels of digital literacy remain the main obstacles to adopting this technology. Hendrawan et al (2024) stated that most micro, small, and medium enterprises (MSMEs) in Indonesia are still at the early stages of digital transformation and therefore have not been able to

optimally utilize IoT technology. This condition indicates a gap between technological development and the level of implementation in practice.

On the other hand, digital technological developments have also begun penetrating small business sectors, including laundry businesses. Although classified as small-scale enterprises, laundry businesses have significant potential to adopt IoT technology in order to improve operational efficiency and service quality. IoT implementation in laundry businesses can be carried out in various ways, such as the use of digital applications for order recording, automatic customer notification systems, and sensor integration in machines for operational monitoring and control. This demonstrates that digital transformation is not limited to large companies but can also be applied to small businesses as part of a strategy to improve competitiveness.

In addition, the implementation of IoT in laundry businesses also provides opportunities to improve the efficiency of resource utilization such as water and electricity through more optimal machine control systems. The use of sensors and monitoring systems enables more efficient operational management while reducing the potential for machine failures. In the long term, this not only impacts operational cost efficiency but also supports business sustainability.

Various previous studies have discussed the implementation of IoT; however, most still focus on specific sectors separately. Monsreal & Carmona Benitez (2022)examined the impact of IoT on supply chains and logistics, Mohsen Marjani et al (2017)emphasized the role of IoT in remote healthcare services, while Shani et al (2023) studied its implementation in the hospitality industry. Although these studies provide valuable insights, they still have limitations because they do not provide a comprehensive cross-sector perspective and rarely integrate analysis for small-scale businesses. In addition, there are still very few studies that systematically compare the fundamental differences between conventional service systems and IoT-based smart service systems. Another research gap can be seen from the aspect of references and analytical depth. Many previous reviews still rely on relatively outdated literature, even though IoT technology has developed rapidly and continuously integrated with other technologies such as Artificial Intelligence and Big Data Analytics over the past five years(Liu et al., 2020). Therefore, this study aims to fill this gap by conducting an in-depth review using recent primary sources, comparing implementation patterns across various sectors, and formulating the impacts and challenges that arise. The following section presents an overview of the state of the art regarding IoT implementation in service businesses summarized from various scientific studies during the 2021–2026 period.

Tabel 1 Literature Review

No	Researcher	Main Research Focus	Research Findings	Research Limitations	Year
1.	Chen et al.	IoT & Supply Chain Efficiency	Increased transparency and reduced delays by up to 28%	Focused only on the logistics sector, not generalized to other sectors	2022
2.	Singh & Sharma	IoT in Healthcare Services	Enabled remote monitoring and early intervention	Did not sufficiently discuss cost and infrastructure barriers in developing countries	2023
3.	Wijaya & Pratama	IoT in Hospitality & Smart Services	Improved guest satisfaction and energy efficiency	Did not examine impacts on cost structures in small-scale businesses	2024

No	Researcher	Main Research Focus	Research Findings	Research Limitations	Year
4.	Wu & Li	IoT in MSMEs (Manufacturing & Physical Services)	Automation increased productivity by 20–30%	Limited case studies and no general implementation framework	2025
5.	Putra & Sari	Barriers to IoT Adoption in Indonesia	Main barriers: cost, literacy, and infrastructure	Did not compare operational impacts before and after implementation	2025
6.	Al-Fuqaha et al.	IoT Integration with AI & Data	Created predictive services with high added value	Did not deeply discuss data security challenges	2026

Source: Compiled from various scientific journal, 2021-2026

The table above clearly demonstrates the novelty of this study, as it combines cross-sector perspectives, provides deeper analysis on the MSME scale, and presents comparisons of service systems that have rarely been discussed in previous literature.

The main objective of this study is to describe how IoT is implemented across various modern service business sectors, analyze its impact on operational efficiency and customer experience, and identify the challenges faced, particularly in Indonesia. Scientifically, this study contributes by providing a comprehensive framework for understanding smart service transformation and serves as a practical reference for business actors and policymakers in planning inclusive and effective technology adoption strategies. This research also strengthens empirical evidence that IoT is not merely a supporting tool, but a strategic factor determining competitiveness in the digital era.

Research Methods

This study employed a qualitative descriptive approach using observational methods to examine the implementation of the Internet of Things (IoT) in various service business sectors. The descriptive approach was selected because it enables researchers to systematically describe phenomena and analyze patterns of IoT implementation in real-world service environments without manipulating research variables.

The research focused on several service sectors that have adopted IoT-based technologies, including app-based transportation services, logistics, digital healthcare, hospitality, and small-scale service businesses such as laundry services. These sectors were selected purposively because they represent different levels of digital maturity and provide a broad perspective on IoT implementation in service business transformation.

Data collection was conducted through three techniques: direct observation, documentation, and literature review. Observation was used to identify the operational characteristics of digital service systems, including system connectivity, automation features, monitoring capabilities, and customer interaction mechanisms. Documentation involved examining digital service platforms, application features, system interfaces, and operational workflows related to IoT implementation. In addition, a literature review was conducted using reputable scientific journals, academic books, and relevant prior studies to support conceptual analysis and strengthen research findings.

The unit of analysis in this study was the implementation pattern of IoT technology in service operations, particularly its impact on operational efficiency, service transparency, and customer experience. The analysis focused on identifying similarities and differences in implementation practices

across sectors, as well as examining how IoT contributes to the development of smart service models.

Data analysis was carried out using qualitative descriptive analysis consisting of three stages: data reduction, data display, and conclusion drawing, following the framework of Miles and Huberman. Data reduction was performed by selecting and categorizing relevant observational and documentary findings. Data display was conducted through descriptive interpretation and comparative analysis across service sectors. Finally, conclusions were drawn to identify implementation patterns, opportunities, and challenges associated with IoT adoption in service businesses.

To enhance data validity, triangulation was applied by comparing findings from observations, documentation, and literature sources. This approach was intended to improve the consistency and credibility of the analysis. Through this method, the study provides a comprehensive understanding of how IoT supports service business transformation toward smart services.

RESULTS AND DISCUSSION

Transformation towards *smart service* is not only marked by the adoption of technology, but also by a paradigm shift in the delivery of services oriented towards customer experience (*customer experience*). In this context, IoT plays a key role in creating more interactive, adaptive, and user-driven services. Smart services no longer simply provide services passively, but are able to respond to conditions in real time based on data obtained from connected devices. Furthermore, the concept of IoT-based smart services enables organizations to develop a more proactive service approach. In conventional systems, services are generally reactive, with actions taken after a customer request or issue occurs. However, with IoT, organizations can anticipate customer needs before they explicitly arise.

In the transportation and logistics sector, IoT implementation also plays a role in creating a more transparent and integrated service system. Customers can access real-time information regarding service status, such as vehicle position or estimated arrival time. This transparency not only increases customer trust but also reduces uncertainty, which is often a source of dissatisfaction in service delivery. Ben-Daya et al (2019)stated that information transparency is a key factor in improving service quality in an IoT-based supply chain.

The implementation of the Internet of Things has fundamentally transformed the way service businesses operate. This transformation is not limited to technological aspects alone, but also includes a paradigm shift in value creation, process management, and customer relationships. In conventional systems, services are reactive, where actions are taken only after customers make requests or complaints. In contrast, IoT-based systems enable services to become proactive and predictive, where systems can detect needs or potential problems before they are recognized by users. This is in line with the service-dominant logic concept proposed by Vargo & Lusch (2016), which states that value in modern business is created through continuous interaction and resource integration, which in the digital context is greatly strengthened by data generated from connected devices.

The implementation of the Internet of Things (IoT) in the service industry demonstrates a fundamental transformation from conventional service systems to integrated digital-based service systems. This transformation extends beyond technology to encompass changes in business processes, customer interaction patterns, and increasingly data-driven decision-making models. In this context, IoT acts as a bridge between physical devices, information systems, and users, creating a more adaptive and responsive service ecosystem.

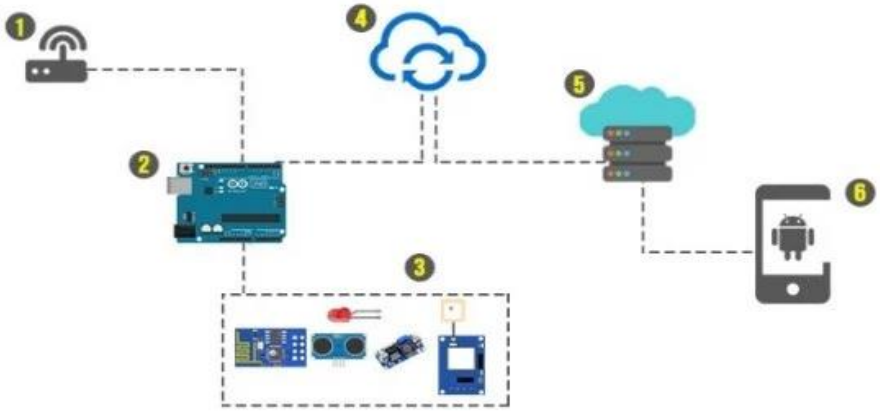

Figure 1 *Application of GPS SystemTrackerOn the Bus withInternet Of Things*
Source: Article University Widyatama, Implementation of a GPS Tracker System on City Buses with Internet of Things-Based Supporting Sensors

IoT implementation in various service sectors has a relatively uniform pattern: the integration of sensor devices, network connectivity, cloud systems, and user interfaces. This pattern enables a continuous flow of data, which is then utilized to improve service quality. In the transportation and logistics sector, for example, GPS technology and tracking systems enable customers to monitor the location of vehicles or goods in real time. This not only increases transparency but also reduces uncertainty in the service process. This finding aligns with Gubbi et al (2013), who stated that real-time capabilities in IoT are a key factor in improving the efficiency and reliability of service systems. Furthermore, IoT implementation also encourages automation in various service processes. Automatic notification systems, digital payments, and application integration are concrete forms of automation generated by IoT. This automation not only reduces reliance on manual labor but also improves the consistency and speed of service. Michel Porter & James Heppelmann, (2025) explain that intelligent technology-based automation enables organizations to reduce operational costs while increasing productivity.

Comparison of Service Systems Before and After Iot Implementation

To provide a clearer picture of the impact of IoT implementation in service businesses, a comparison can be made between conventional service systems and IoT-based service systems. This comparison reveals significant changes in various operational and service aspects.

Table 2 *Comparison of Service Systems Before and After IoT Implementation*

Aspect	Before IoT (Conventional)	After IoT (Smart Service)
Operational Process	Manual, dependent on human power	Automatic and integrated
Monitoring	Not real-time	Real-time and data-driven
Customer Interaction	Limited, manual	Digital, fast and interactive
Decision Making	Based on experience	Data-driven
Efficiency	Relatively low	High
Transparency	Limited	High
Risk Error	High	Low

Source: Adapted from literature on Internet of Things (IoT) digital transformation and industrial smart

Based on the table above, it is clearly evident that IoT brings significant quality improvements

in almost all aspects. In IoT-based systems, data becomes the most valuable asset. The ability to monitor operational conditions directly enables managers to make faster and more accurate decisions. According to Gubbi et al., (2013), this real-time monitoring capability is a key factor that distinguishes smart systems from traditional systems, as it allows more agile responses to changes in market conditions or operational disruptions.

IoT Impact Analysis on Operational Efficiency

Operational efficiency is a key indicator of the success of technology implementation in service businesses. IoT enables organizations to optimize resource utilization through improved monitoring and control. Sensors embedded in devices allow for continuous data collection, which is then used to identify inefficiencies in operational processes.

In the service sector, IoT implementation has shown significant progress and has had a direct impact on operational efficiency and service quality. In the transportation sector, the use of GPS-based technology enables real-time vehicle tracking, increasing transparency and customer trust. In the logistics sector, IoT-based tracking systems allow customers to accurately and continuously monitor the status of their deliveries. Meanwhile, in the healthcare sector, wearable devices enable remote monitoring of patient conditions, thereby increasing the effectiveness of healthcare services. In the hospitality industry, IoT is being used to create smart room concepts that provide a more personalized and efficient service experience.

The implementation of the predictive maintenance concept is one of the major advantages of IoT that significantly impacts cost efficiency. Unlike routine maintenance based on fixed schedules or corrective maintenance performed only after failures occur, IoT systems are capable of predicting damage based on patterns of vibration, temperature, or machine performance data. Cheung C M and Lee Thadani (2020) explain that the implementation of this concept can reduce maintenance costs by up to 30% and extend equipment lifespan.

The same concept also applies to small-scale businesses such as laundry services. IoT implementation in this sector enables automatic control of washing and drying machines based on fabric type and level of dirtiness. Sensors embedded in the machines regulate the use of water, detergent, and electricity precisely, minimizing resource waste. Research by Liu et al., (2020)shows that operational cost savings in laundries implementing this system reach 18–22% per month, in addition to producing more consistent washing quality.

Besides resource efficiency, the automation of administrative processes also plays a major role. Order recording, scheduling, and even financial reporting can operate automatically without human intervention. This allows human resources to focus on higher value-added activities, such as improving service quality and business development.

This transformation is marked by a shift from traditional, static service models to dynamic, data-driven service models. Organizations no longer rely solely on direct interactions with customers, but also leverage data generated from IoT devices to gain a deeper understanding of customer behavior and preferences. This allows for more personalized and contextualized service delivery.

One of the significant impacts of IoT implementation is increased organizational agility in responding to change. In a dynamic business environment, the ability to adapt quickly is a key factor for success. IoT enables organizations to obtain real-time data, enabling faster and more accurate decision-making.

For example, in the transportation sector, companies can adjust travel routes based on real-time traffic conditions. In logistics, goods distribution management can be optimized based on continuously updated demand data. This demonstrates the role IoT plays in increasing operational flexibility and an organization's ability to cope with uncertainty.

Furthermore, Michel Porter & James Heppelmann (2025) explain that the integration of IoT technology into products and services has changed the structure of industrial competition by creating new business models based on connectivity and data. This shows that IoT not only plays a role in increasing efficiency but also becomes a strategic factor in creating competitive advantage. Furthermore, Al-Fuqaha et al., (2015) emphasize that IoT's ability to provide real-time data enables organizations to make faster and more accurate decisions.

Figure 2 *The implementation of the Internet of Things (IoT) in the laundry business*
Source: Aplication bilas.id

The implementation of the Internet of Things (IoT) in the laundry business can also be applied directly to machine control systems. IoT integration with washing machines and dryers enables more efficient operational management through sensor-based automatic controls and internet connections. In this context, IoT serves as a link between physical devices (laundry machines) and digital systems that can regulate, monitor, and optimize machine performance in real time.

In conventional systems, laundry machine operation relies entirely on human effort, from setting wash times and water temperatures to drying. This is not only time-consuming and labor intensive, but also potentially leads to inconsistencies in service results. With IoT, machines can be programmed to operate automatically based on specific parameters, such as fabric type, soil level, and load capacity. Sensors installed on the machines detect operational conditions, such as temperature, humidity, and energy consumption, which are then transmitted to the system for analysis and optimal control.

According to research by Laudon & Laudon (2020), the use of sensors in IoT systems allows for continuous data collection that can be used to improve operational efficiency and optimize resource use. In the context of a laundry business, this means machines can operate with more efficient water and electricity consumption without compromising the quality of the wash results. Furthermore, IoT systems also enable the implementation of the concept of *predictive maintenance*, namely the ability to detect potential machine damage before operational failure occurs. Lee et al (2015) stated that IoT-based predictive maintenance can significantly reduce downtime and maintenance costs.

Implementing IoT-based machine control also enables centralized operational management through a digital dashboard. Business owners can monitor the performance of all machines, set operational schedules, and identify machines requiring maintenance through a single system. This is highly relevant for improving management efficiency, especially for larger-scale laundry businesses.

In terms of service quality, IoT-based machine control also has a positive impact through consistent washing results. Standardized, data-driven processes enable each service to achieve consistent quality, thereby increasing customer satisfaction. Ng & Wakenshaw (2017) emphasize that IoT-based services can create added value by improving service accuracy and consistency.

However, implementing IoT in machine control also faces challenges, particularly in terms of initial investment and technological readiness. Not all laundry businesses have the capacity to adopt this system immediately. Therefore, a phased approach to IoT implementation is necessary, starting with simple digitization and moving up to more complex system integration.

The Role of IoT In Improving Customer Experience

One service sector that has begun adopting the Internet of Things (IoT) in its real-time operations is the laundry business. Although categorized as a small- to medium-scale service business, the implementation of IoT technology in the laundry business shows significant potential for improving operational efficiency and service quality. IoT implementation in the laundry business is generally achieved through the integration of digital systems with operational processes, such as the use of applications for order recording, laundry status monitoring, and automatic customer notifications.

In conventional systems, the laundry service process is still carried out manually, from recording orders to notifying customers. This can potentially lead to recording errors, information delays, and a lack of transparency in the service process. With IoT, these processes can be automated and integrated into a single digital system that allows for real-time service monitoring. Customers can track the status of their laundry, from washing and drying to completion, without having to visit the location in person.

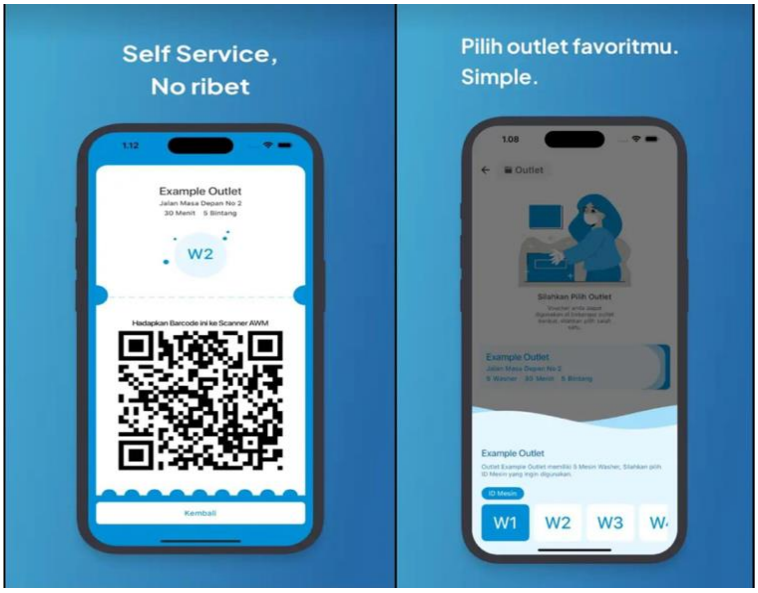

Figure 2. Customer Experience implementation IoT
Source: Aplication AWN by Rewash

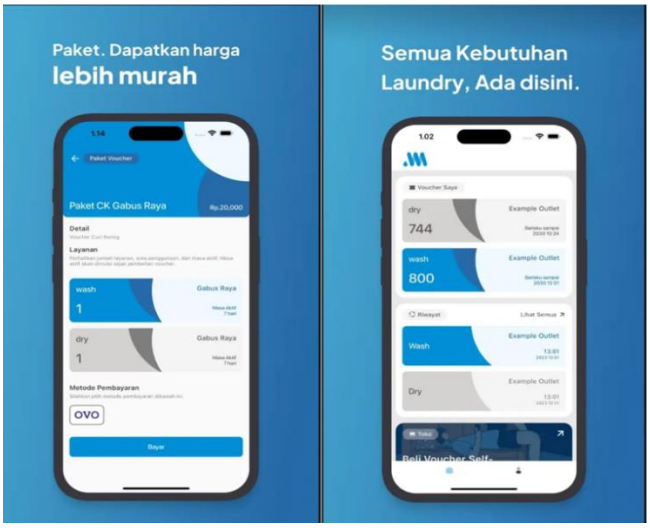

Figure 3. Customer Experience with Iot Implementation
Source: Aplication AWN by Rewash

From the customer's perspective, the main values provided by IoT-based services are transparency, certainty, and ease of access to information. In conventional systems, customers often experience uncertainty regarding service status, shipment locations, or when orders will be completed. This uncertainty is one of the main causes of customer dissatisfaction. With IoT, information becomes more transparent and accessible at any time through mobile devices.

In the online transportation sector, for example, customers can accurately track vehicle locations and estimated arrival times. In the logistics sector, the ability to monitor packages in detail increases trust and reduces concerns about lost goods. Ben-Daya et al)2019)emphasize that information transparency is a determining factor of service quality in the digital era because it creates a sense of security and trust between service providers and users.

In the case of laundry businesses, the impact on customer experience is highly noticeable. In manual systems, customers must visit the store directly or make phone calls to ask whether their clothes are ready. With IoT integration, the system automatically sends notifications to customers' devices during the washing, drying, and completion stages, as well as when the clothes are ready for pickup. Applications also allow customers to track the service process in real time. According to Ng & Wakenshaw (2017), the ability to provide relevant and timely information represents a very strong form of value creation in data-driven services.

Furthermore, IoT opens significant opportunities for service personalization. Data collected from previous interactions can be analyzed to understand customer preferences and habits. Service providers can then offer customized services, provide recommendations, or arrange service schedules according to customer preferences. This transforms ordinary transactional relationships into closer long-term relationships and significantly increases customer loyalty.

IoT Integration with Supporting Technology

IoT implementations in service businesses generally don't operate in isolation but rather are integrated with other technologies such as cloud computing, big data analytics, and artificial intelligence. This integration enables organizations to not only collect data but also process and analyze it to generate valuable insights. The combination of IoT and big data analytics enables organizations to identify customer behavior patterns and improve decision-making. Furthermore, cloud computing enables efficient storage and processing of large-scale data. This integration creates a smarter and more adaptive service ecosystem, which forms the basis for developing smart services (Belli et al., 2019).

Furthermore, the integration of IoT with artificial intelligence (IA) significantly enhances the capability of service systems in processing larger volumes of data into actionable insights. AI enables predictive analytics, which allows organizations to anticipate customer needs, detect anomalies, and optimize operational performance. In service businesses, this integration plays a crucial role in shifting decision-making processes from reactive to predictive and prescriptive approaches. According to I. Lee & Lee (2015), the combination of IoT and intelligent systems supports the development of cyber-physical environments where machines and systems can operate autonomously with minimal human intervention.

In addition, the integration of IoT with big data technologies allows organizations to manage and analyze structured and unstructured data generated from various sources. This capability is essential in understanding complex customer behaviors and service patterns. For instance, in the logistics and transportation sectors, data generated from IoT devices such as GPS trackers and sensors can be analyzed to optimize route planning, reduce delivery time, and improve service reliability (Ben-Daya et al., 2019). Similarly, in the healthcare sector, IoT devices integrated with data analytics enable continuous patient monitoring and early detection of potential health risks, thereby improving the quality of healthcare services (S.M. Riazul Islam et al., 2015).

Moreover, cloud computing serves as a backbone in IoT integration by providing scalable infrastructure and flexible data storage solutions. The use of cloud-based platforms allows real-time data synchronization across multiple devices and systems, enabling seamless communication between service providers and users. This not only enhances operational efficiency but also supports the development of integrated service platforms. Laudon & Laudon, (2022) emphasize that cloud-based systems facilitate the accessibility and scalability of digital services, which are critical in supporting business growth in the digital era.

Another important aspect of IoT integration is interoperability between systems. In a fully integrated environment, different devices and platforms must be able to communicate and exchange data effectively. This requires standardized protocols and robust system architecture. The lack of interoperability can hinder the effectiveness of IoT implementation and limit the potential benefits of integration. Therefore, organizations need to adopt appropriate technological standards and frameworks to ensure seamless system integration.

Furthermore, the integration of IoT with supporting technologies also contributes to enhancing service innovation. Organizations can develop new service models based on real-time data and advanced analytics, such as subscription-based services, predictive maintenance services, and personalized service offerings. Vargo & Lusch (2016) argue that value co-creation between providers and customers is increasingly facilitated by digital technologies, including IoT, which enable continuous interaction and feedback loops.

However, despite its advantages, the integration of IoT with other technologies also introduces new challenges. Issues related to data security, privacy, and system complexity become more prominent as the level of integration increases. Organizations must ensure that appropriate security measures are in place to protect sensitive data and maintain customer trust. Additionally, the complexity of integrating multiple technologies requires significant investment in both infrastructure and human resources.

Overall, the integration of IoT with cloud computing, big data analytics, and artificial intelligence forms a comprehensive technological ecosystem that supports the development of smart services. This ecosystem enables organizations to deliver more efficient, responsive, and personalized services while maintaining competitiveness in an increasingly digital business environment.

Managerial Implications of IoT Implementation

From a managerial perspective, IoT implementation has significant implications for organizational strategy. Management is not only required to adopt the technology but also to be able to integrate it into business processes holistically. Liu et al., (2020) state that the success of information systems implementation depends heavily on the alignment between technology, business processes, and human resources.

Furthermore, organizations also need to invest in developing their employees' digital competencies. Without adequate human resource support, IoT technology will not be optimally utilized. In this context, digital transformation is not just a matter of technology, but also a change in organizational culture.

Developing Digital Competence and Culture: Digital transformation requires management to invest significantly in developing employees' digital competencies. Without the support of technologically literate human resources, the full potential of the IoT will not be realized. Therefore, organizational culture change is absolutely necessary so that all elements of the company can adapt to a more automated and integrated work system.

IoT implementation also drives changes in service business models from those previously transaction-based to those based on continuous services (*service-based model*). Vargo & Lusch (2016) in the concept *service-dominant logic* explains that value in modern business is created through ongoing interactions between service providers and customers.

IoT enables these interactions to occur continuously through data streams generated by connected devices. For example, in the healthcare sector, the use of wearable devices allows service providers to continuously monitor patient conditions, thus providing more proactive and personalized services(S.M. Riazul Islam et al., 2015). Furthermore, research by I. Lee & Lee (2015) in the context of the service industry shows that IoT implementation can improve operational efficiency through process automation and service system integration. The results of this study indicate that organizations that adopt IoT tend to have higher levels of productivity compared to organizations that still use conventional systems. This is reinforced by Michel Porter & James Heppelmann (2025), who stated that IoT-based technology not only increases efficiency but also creates new, more competitive business models through the utilization of real-time data.

In the healthcare sector, research by S.M. Riazul Islam et al., (2015) shows that the use of IoT through wearable devices can improve service quality by enabling continuous patient monitoring. Meanwhile, in the logistics sector, research by Ben-Daya et al., (2019) found that implementing IoT in supply chain systems can improve transparency, information accuracy, and distribution efficiency.

Furthermore, recent research by Mohsen Marjani et al., (2017) emphasized the crucial role of IoT in creating integrated service systems through the use of cloud computing and big data analytics. This enables organizations to process data more effectively to support decision-making. Research by Solano & Cruz (2024) also showed that the integration of digital technologies, including IoT, significantly improves operational performance and service quality in modern businesses.

The implementation of the Internet of Things (IoT) in service businesses brings fundamental changes that require managerial readiness at various levels. Successful adoption of this technology depends not only on the sophistication of the devices used, but also on the alignment between technology, business processes, and human resources. Management must recognize that IoT is not simply a supporting tool but a strategic factor determining the organization's sustainability in the digital age.

Strategic Implications for Service Businesses

IoT implementation has significant strategic implications for service businesses. Organizations are not only required to adopt the technology but also to integrate it into their overall business strategy. Laudon & Laudon (2020) state that successful technology implementation depends heavily on the alignment between technology, business processes, and human resources.

Shifting Business Models Toward Continuous Service: Managers need to understand the shift from transaction-based business models to service-based business models. Through IoT, customer interactions no longer end with a single transaction but rather continue through data streams from connected devices. This enables companies to create long-term value and increase customer loyalty through more proactive and personalized service.

IoT Implementation Challenges and Risks

However, the implementation of IoT in service businesses, particularly in developing countries like Indonesia, still faces various challenges. Limited technological infrastructure, high investment costs, and low levels of digital literacy are major obstacles to the adoption of this technology, particularly in the small and medium-sized business sector. One key issue is data security, given that IoT systems involve the collection and exchange of large amounts of data. The risk of data breaches and cyberattacks is a significant concern in the development of IoT-based systems. Furthermore, not all organizations are equally prepared to adopt this technology. MSMEs in Indonesia still face obstacles in terms of digital literacy and limited resources. This has the potential to create a digital divide between organizations that are ready to adopt technology and those that are not. Most MSMEs are still in the early stages of digital transformation and have not yet fully utilized IoT technology optimally (Farah Qalbia & Reza Saputra, 2024).

Laundry businesses, though often categorized as small-scale businesses, are a prime example of how IoT can be implemented to increase competitiveness through operational efficiency and improved service quality. Operational Digitalization and Service Transparency: In conventional systems, laundry processes are often hampered by manual record-keeping that is prone to human error and lacks transparency for customers. With IoT, the entire workflow, from order recording to laundry status, can be integrated into a single digital system that can be monitored in real-time. Customers can receive automatic notifications regarding the status of their clothes (washing, drying, or finished), which directly increases customer trust and satisfaction.

On the other hand, previous studies tend to focus on IoT implementation in a single sector, such as transportation or healthcare, thus failing to provide a comprehensive picture of IoT implementation across sectors in the service industry. However, a cross-sectoral approach is crucial for understanding general patterns of technology implementation and identifying key factors influencing the success of digital transformation toward smart services.

In the Indonesian context, several studies have shown that the adoption of digital technology in service businesses still faces various challenges. Research by Farah Qalbia & Reza Saputra (2024) revealed that service MSMEs still face limitations in implementing digital technology due to low technological literacy and limited resources. Another study by Pujiyanto et al (2025) shows that although IoT technology has significant potential to improve service efficiency, its implementation remains uneven across various service sectors in Indonesia.

Furthermore, relatively high implementation costs are also a barrier for many organizations, particularly MSMEs. Investments in devices, infrastructure, and system development require significant costs. Limited resources are one of the main factors hindering the adoption of digital technology by MSMEs in Indonesia(Farah Qalbia & Reza Saputra, 2024).

Another challenge is low digital literacy among business owners. Without adequate

understanding, IoT technology cannot be optimally utilized. Therefore, efforts are needed to increase human resource capacity through digital training and education.

Based on these various studies, it can be concluded that IoT plays a significant role in improving operational efficiency, service transparency, and customer experience. However, most studies still focus on a single sector, such as healthcare or logistics, thus not providing a comprehensive picture of IoT implementation across service business sectors. Therefore, this study seeks to fill this gap by presenting a descriptive analysis of IoT implementation in an integrated manner across various service sectors as a basis for developing a smart service concept.

CONCLUSIONS

Based on the research results and discussion, it can be concluded that the implementation of the Internet of Things (IoT) in various service business sectors has driven a fundamental transformation from conventional service systems to integrated digital-based service systems. This transformation is not only limited to technological aspects, but also includes changes in operational processes, customer interaction patterns, and increasingly data-driven decision-making models (*data-driven decision making*). IoT acts as a key link between physical devices, information systems, and users, thus creating a more adaptive, responsive, and efficient service ecosystem.

IoT implementations in service sectors such as transportation, logistics, healthcare, hospitality, and even small businesses like laundries demonstrate a relatively consistent pattern: the integration of sensors, network connectivity, cloud systems, and digital interfaces. This integration enables real-time data collection and processing, which is then utilized to improve operational efficiency and service quality. The results of this study demonstrate that IoT can increase service transparency, reduce uncertainty, and accelerate service processes through system automation.

Furthermore, IoT implementation has been shown to increase the efficiency of resource use, such as time, labor, and energy, through more optimal monitoring and control systems. In the context of a laundry business, for example, the use of IoT is not only limited to service monitoring and customer communication systems but also includes sensor-based machine control that enables automatic and efficient machine operation. This demonstrates the high flexibility of IoT for application to various business scales, including small and medium enterprises.

From a customer perspective, IoT implementation has a positive impact on the service experience (*customer experience*). Customers can access real-time information, receive automated notifications, and enjoy faster, more transparent, and more personalized services. Thus, IoT not only improves an organization's internal efficiency but also creates added value for customers by improving service quality.

Furthermore, this study confirms that the implementation of IoT plays an important role in encouraging the creation of the concept *smart service*, a technology-based service capable of responding to customer needs in real time and based on data. The transformation toward smart services is marked by a shift from reactive to proactive and predictive services. In this regard, IoT is a key foundation for creating smarter and more integrated services.

However, implementing IoT in the service industry still faces various challenges, particularly in the small and medium-sized business sector. Limited technological infrastructure, high investment costs, and low digital literacy are key barriers to adopting this technology. Furthermore, data security is a significant concern, given that IoT systems involve the exchange of large amounts of data. Therefore, a comprehensive strategy is needed to address these challenges to ensure optimal IoT implementation.

Overall, this research contributes to broadening the understanding of IoT implementation in service businesses across sectors and emphasizes IoT's role as a key enabler in the digital transformation

toward smart services. The results also demonstrate that IoT has significant potential to enhance the competitiveness of service businesses, both large and small.

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