

Point of Sale Systems

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ABSTRACT- A Point of Sale (POS) system serves as a vital asset for businesses, comprising both hardware and software components designed to facilitate transactions, manage inventory, and provide operational insights. This review paper navigates through the realm of POS systems, examining their evolution, technical functionalities, and common challenges encountered across various industries. Through an extensive literature review, it identifies critical elements such as hardware, software, transaction processing, inventory management, and security measures that characterize modern POS systems. The study further explores the implementation benefits, challenges faced, and the key factors influencing successful integration into business operations. By shedding light on future trends and emerging technologies, this research anticipates the future direction of POS systems, offering valuable insights for the development of innovative, adaptable, and feature-rich POS solutions that cater to the evolving needs of businesses. Drawing from existing knowledge, this review sets the stage for the development of a cutting-edge POS system tailored to meet the demands of modern businesses.

KEYWORDS -Sales, Integration, Management, Inventory, Payments.

I. INTRODUCTION

A Point of Sale (POS) system is a comprehensive solution comprising both hardware and software components, aiming to facilitate seamless transaction processing and optimize sales operations, particularly in retail environments. This integrated system typically involves a computer or terminal, along with various peripherals such as barcode scanners, cash registers, and card readers. The accompanying software plays a crucial role in enabling key functionalities like transaction processing, inventory management, and sales reporting. POS systems are instrumental in various business operations, including sales recording, inventory tracking, customer purchase monitoring, and processing diverse payment methods like cash, credit/debit cards, and mobile payments. Furthermore, they contribute to the generation of receipts or invoices, offering businesses efficiency, accuracy, and valuable insights into sales and inventory data for effective operational management.

A) Evolution of POS Systems

The evolution of Point of Sale (POS) systems began in 1879 with James Ritty's "Ritty's Incorruptible Cashier" and progressed with IBM's computer-driven cash register in

1973 [1]. In the 1980s, McDonald's introduced microprocessor-controlled cash registers, revolutionizing fast-food ordering. Touchscreen technology emerged in 1986, leading to solutions like View Touch by Gene Mosher. The 1990s saw the emergence of e-POS systems like Nisyst and IT Retail, adapting to Microsoft and Unix-based operating systems. The credit card industry saw changes with the introduction of the EMV standard in 1993. In the 2000s, cloud-based POS systems allowed any internet-connected device to function as a terminal, enabling mobile payment solutions and SaaS models, enhancing security and convenience. From 2010 onwards, modern POS systems integrated front-end and back-end operations seamlessly. Cloud-based POS systems saw widespread adoption, especially among franchise models. Mobile POS systems leveraging tablets and smartphones gained popularity for transactions and customer interactions. This progression showcases how POS systems evolved from cash registers to sophisticated, integrated solutions, transforming transaction management and customer interactions.

B) Scope and Objectives of POS Systems

- **Scope:** Point of Sale (POS) systems encompass a broad range of functionalities aimed at facilitating sales transactions, managing inventory, and providing valuable insights for businesses. These systems handle transaction processing, inventory control, sales reporting, customer interactions, and seamless integration with various operational aspects.
- **Objectives:**
 - **Efficiency Enhancement:** Streamlining sales processes, reducing wait times, and minimizing errors for heightened operational efficiency.
 - **Customer-Centric Approach:** Enhancing customer experiences through faster transactions, personalized services, and streamlined interactions.
 - **Optimized Inventory Management:** Ensuring optimal stock levels, preventing shortages, and enabling informed inventory control and forecasting.
 - **Data-Driven Decision Making:** Providing comprehensive analytics and reports for informed decision-making, strategizing, and planning.
 - **Adaptability and Security:** Offering scalable solutions adaptable to evolving business needs while ensuring robust data security and compliance.

II. LITERATURE REVIEW

A) *Technical Functionalities of POS Systems*

Point of Sale (POS) systems incorporate multifaceted technical functionalities that are instrumental in facilitating seamless business operations. This section delves into the intricate technical aspects defining these systems, encompassing:

B) *Transaction Processing*

A study by [8], sheds light on the absence of comprehensive transaction datasets from payment terminals, underscoring its impact on transaction management systems. The research delves into the potential of transaction data in refining risk management systems within the payment ecosystem. It offers detailed insights into card-present transactions, EMV standards, and transaction flows, highlighting the importance of transaction traces for law enforcement, marketing, and fraud detection. Furthermore, the paper explores context-aware systems and proposes contextual risk management in Electronic Funds Transfer (EFT) systems, outlining various approaches based on contextual factors like transaction history.

C) *Inventory Management:*

The research paper by [4], discusses the development of an Inventory Management System integrated with a Point of Sale (POS) for Windows operating systems. The study aims to streamline data management, enhance sales processing, and facilitate easy reporting through the integration of inventory management features within POS systems.

It explores the comprehensive inventory management features embedded within POS systems, focusing on real-time tracking, stock updates, and automated reordering processes. We have examined functionalities for inventory analysis, forecasting, and optimization, showcasing how POS systems aid businesses in maintaining optimal stock levels and preventing shortages.

D) *Integration Capabilities:*

The research paper [5], centres on implementing a Point-of-Sale (POS) system integrated with Business Intelligence (BI) capabilities tailored for Small and Medium Enterprises (SMEs) in Indonesia. It aims to address the challenge of efficiently managing and analysing substantial data volumes generated by SMEs during their operations. The integration involves a framework that combines the POS system, databases, and visualization tools, particularly Microsoft Power BI and its associated libraries.

Effectively managing and analysing this data is crucial for enabling better decision-making processes within SMEs. The integration of Business Intelligence (BI) tools is pivotal in this scenario, offering valuable insights to facilitate informed decision-making and aiding SMEs in gaining a competitive edge. The development of the framework aims to provide SMEs with a system that not only handles point-of-sale transactions but also offers robust data management and visualization through BI tools. Leveraging Microsoft Power BI and related libraries, the framework transforms raw data into meaningful insights, enabling SMEs to make informed decisions based on comprehensive and actionable information.

In summary, this research paper highlights the significance of integrating BI capabilities into POS systems for SMEs in Indonesia. Such integration empowers SMEs to efficiently

handle their operational data, extract valuable insights, and make informed decisions crucial for maintaining a competitive advantage in their respective markets.

E) *Feasibility of Web Bases POS System Implementation*

In the research paper [2], the feasibility of implementing a web-based Point of Sales (POS) system tailored for Small and Medium Enterprises (SMEs) in Bangladesh was meticulously explored. The study highlighted the crucial role SMEs play in Bangladesh's economy, contributing significantly to employment, poverty alleviation, and GDP growth. Despite their importance, SMEs encounter challenges such as poor infrastructure, limited technological integration, and a lack of entrepreneurship skills. The report emphasized the potential of web-based POS systems in empowering SMEs by providing real-time sales tracking, inventory management, and performance analysis. However, it underscored the prevalent barriers hindering technology adoption among Bangladeshi SMEs, including electricity scarcity, technical expertise gaps, infrastructure limitations, and high implementation costs. The research concluded by advocating for initiatives such as infrastructure development, awareness campaigns, cost reduction strategies, and skill enhancement programs to facilitate widespread technology adoption among SMEs in Bangladesh.

F) *Impact of POS Systems: -*

POS systems revolutionize business operations by offering a comprehensive suite of advantages, transforming the landscape in various aspects to enhance efficiency, customer experience, security, and overall profitability [7].

- **Better Inventory Management:** Enables real-time tracking, minimizing stockouts and optimizing inventory levels for improved operations.
- **Quick Payments:** Facilitates swift transaction processing, reducing wait times and enhancing customer satisfaction.
- **Enhanced Customer Management:** Enables personalized services, streamlined orders, and efficient management of customer information for improved interactions.
- **Improved Security:** Implements robust security measures safeguarding sensitive customer data and preventing fraud or breaches.
- **Efficient Employee Management:** Facilitates streamlined operations, leading to better task allocation and increased productivity among employees.
- **Increased Revenues:** Through enhanced efficiency, better customer experiences, and optimized operations, POS systems contribute to revenue growth.
- **Advanced Reports:** Provides comprehensive analytics and reports, empowering data-driven decision-making and strategic planning.
- **Simplification of Operations:** Streamlines business processes, reducing errors, saving time, and cutting operational costs.

G) **Personalization of Customer Purchases:** Allows tailored services and recommendations, enhancing customer satisfaction and loyalty.

H) **Multi-Store Functions:** Facilitates management across

multiple locations, ensuring consistency and coherence in operations.

In the ever-evolving realm of commerce, statistics reveal an impactful dominance of POS systems, representing a significant share in the market [3].

I) **Current State of POS Systems**

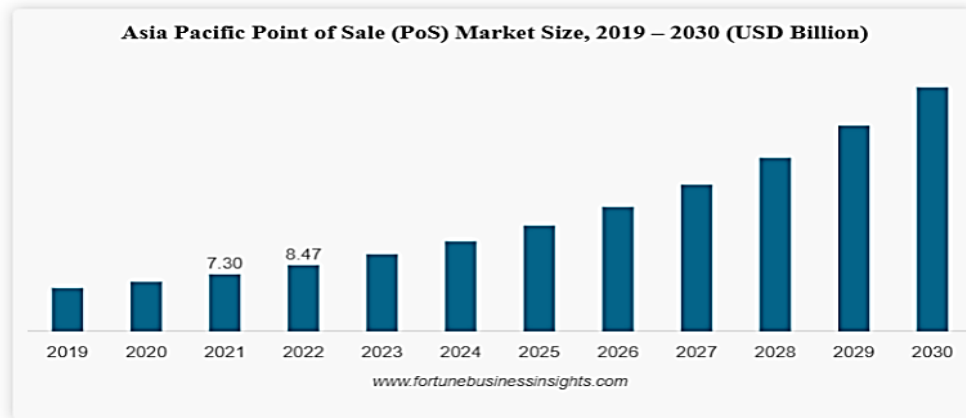


Figure 1: The estimated adoption of POS systems by 2030

Current POS technology has significantly evolved from its original sales transaction features. Today, businesses increasingly opt for all-in-one POS software solutions that integrate various services like accounting, customer relationship management, payroll, and operations into a single system. Expanded network access facilitates the setup of self-service POS kiosks in retail stores, capable of handling tasks such as barcode and coupon scanning,

payments, and receipt printing without employee assistance. The primary use cases of POS systems are prevalent in Small and Medium-Sized Enterprises (SMEs), where they cater to various sectors including retail, restaurants, entertainment, and others. The market share of the global POS system is divided across these sectors, as depicted in the figure below.

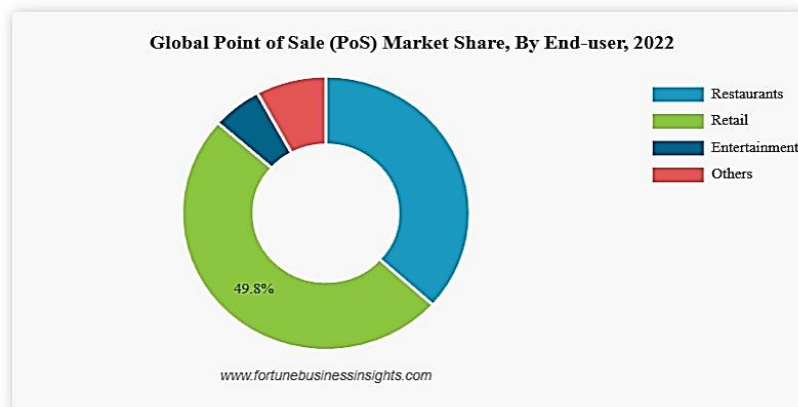


Figure 2: Global Market of POS Systems by the year 2022

III. **CHALLENGES FACED BY POS SYSTEMS**

Catalysing the paradigm shift in modern business transactions, Point of Sale (POS) systems stand as technological cornerstones [6], yet their seamless operation contends with a myriad of challenges. From connectivity concerns to security vulnerabilities and operational intricacies, the landscape of POS systems grapples with multifaceted obstacles that demand strategic solutions and meticulous management. These challenges intricately affect the reliability, data security, and overall efficacy of POS systems, highlighting the imperative for proactive measures in navigating these complexities within contemporary commerce.

- **Internet Issues:** Fluctuating connectivity disrupts transactions, emphasizing the need for reliable

internet or backup systems to ensure uninterrupted operations.

- **POS Security:** The persistent threat landscape demands robust security measures to protect customer data and prevent breaches. This requires stringent security protocols and encryption methods to safeguard sensitive information.
- **Data Loss:** Vulnerabilities in data storage and management highlight the importance of regular backups and secure storage to prevent loss of critical information.
- **PCI Data Security Standard:** Challenges related to compliance with PCI DSS necessitate strict adherence to industry standards. Continuous monitoring and updates are essential to meet regulatory requirements and maintain data security.
- **Peripheral Issues:** Compatibility issues or

malfunctions with peripherals (printers, scanners) disrupt seamless operations, demanding regular maintenance and timely troubleshooting.

- **Power Outages:** Susceptibility to power disruptions underscores the need for backup power sources or surge protectors to prevent data loss and system failures.
- **Updates:** Regular system updates and patches are vital for enhancing security and functionality. Careful scheduling of updates is necessary to minimize disruptions during peak business hours and ensure uninterrupted operations.
- **Complex Interfaces:** Complex interfaces hinder user experience, emphasizing the need for user-friendly designs and comprehensive training for staff to navigate efficiently.
- **Hardware Failure:** Malfunctions or breakdowns in hardware components underscore the importance of reliable, durable hardware and proactive maintenance.
- **Multiple Configurations:** Managing various configurations across different locations or devices requires standardized processes and efficient management systems. This ensures consistency in operations and minimizes complexity in system management.
- **Insufficient Troubleshooting Support:** Inadequate support systems hinder timely issue resolution, highlighting the need for comprehensive troubleshooting and support services.
- **Inaccurate Reporting:** Errors in reporting can significantly impact decision-making processes. To ensure precise reporting, accurate data validation and system checks are essential to maintain data integrity and reliability.
- **POS System Failure:** Instances of system failures demand immediate troubleshooting measures and backup systems to minimize disruptions in business operations.

IV. FUTURE TRENDS AND IMPLICATIONS

A point-of-sale (POS) system is a crucial business tool that has transformed traditional cash registers with innovative, technology-driven solutions. Unlike traditional systems, modern POS systems offer more than just sales processing [7]. They have the capability to track inventory across various sales channels, manage employee schedules and clock-ins, and gather data for business intelligence and personalized customer service. Below, we will explore the evolving landscape of POS systems and their positive impact on businesses.

A) Mobile POS Solutions:

- Mobile POS (mPOS) systems redefine transactions, enabling sales beyond store confines.

- Projected to hit \$3.30 trillion in 2023, mPOS transcends location barriers, empowering curbside, trade show, and online sales.
- Anticipated growth to 94.7 million mPOS users by 2027, accentuating the trend towards untethered shopping.

B) Seamless Omnichannel Experiences:

- POS systems foster non-linear purchasing paths, merging in-person, mobile, and e-commerce sales.
- Expected e-commerce rise to nearly a quarter of total retail sales by 2027, emphasizing online presence importance.
- Click-and-collect strategies and diverse sales channels gain momentum, enhancing customer convenience.

C) Alternative Payment Methods:

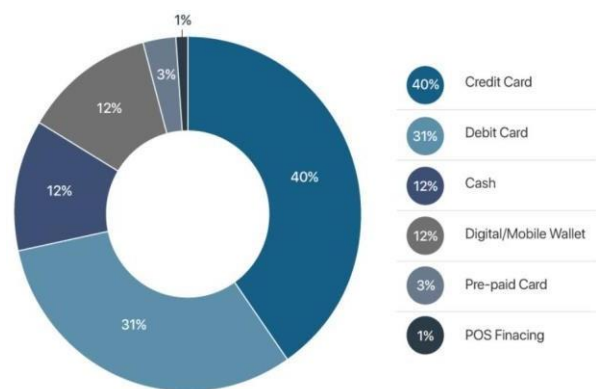


Figure 3: Alternative Payment Methods

- Transitioning from cash-based transactions, credit cards are expected to account for 40%, and digital wallets are projected to reach 15.5% by 2024.

D) **Emerging payment avenues**, including Amazon Pay, Buy Now Pay Later (BNPL), instalment payments, and cryptocurrency, are transforming the landscape of transactions.

E) Personalized In-store Shopping Experiences:

- Emphasis on personalization as a top priority, influencing buyer satisfaction and willingness to pay higher prices for enhanced service.
- POS systems enable customer data capture for tailored experiences, driving increased customer loyalty and satisfaction.

F) Rise of POS Data Analytics:

- Leveraging POS data for comprehensive retail analytics, optimizing inventory, pricing strategies, and customer insights.
- Integrating foot counters, payment processors, and time-tracking systems for enhanced business intelligence and decision-making.

G) Move to Cloud-based Software:

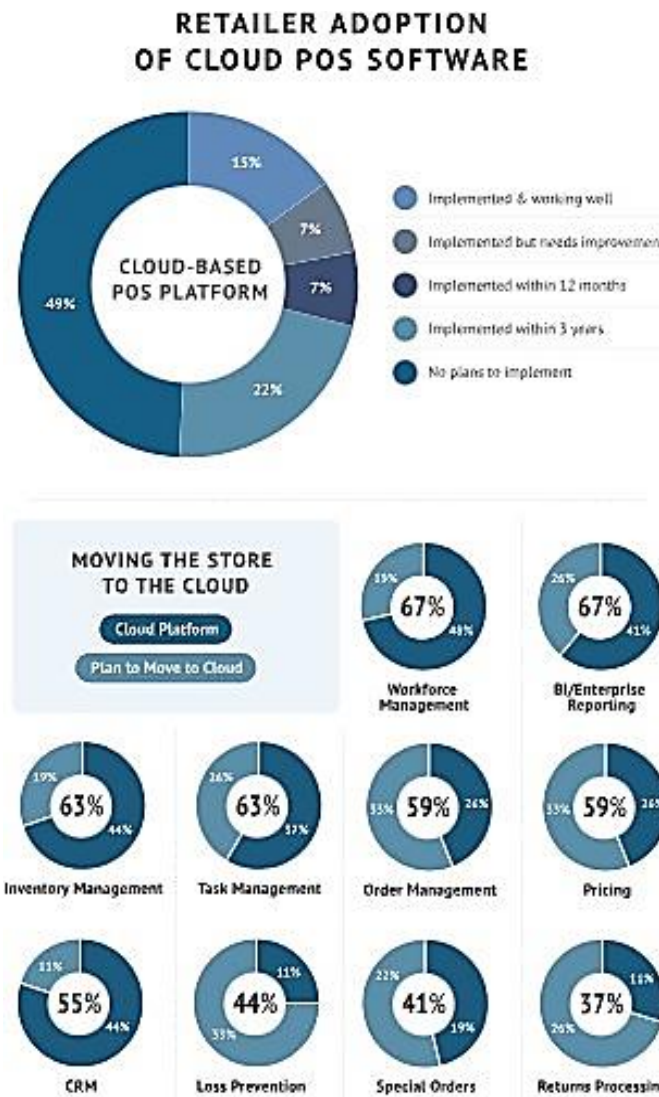


Figure 4: Migration to Cloud Based Software

- Transition towards cloud-based POS systems for enhanced data sharing, accessibility, and seamless updates.
- Predicted growth in the cloud POS market to \$10 billion by 2028, amplifying scalability and accessibility for businesses.

H) Upgraded POS Hardware:

- Evolving POS hardware trends prioritize mobile, flexible registers, self-service kiosks, and touchless payment technologies.
- Shift away from swipe transactions, advancing toward

Bluetooth technology and self-checkout stations.

I) Upgraded In-store Technology Overall:

- Focus on tech infrastructure upgrades to support POS advancements, including Wi-Fi networks, data cables, and improved connectivity.
- Increased adoption of self-checkouts and electronic shelf labels, optimizing labour and customer experience.

J) Savings-oriented Subscription Offers:

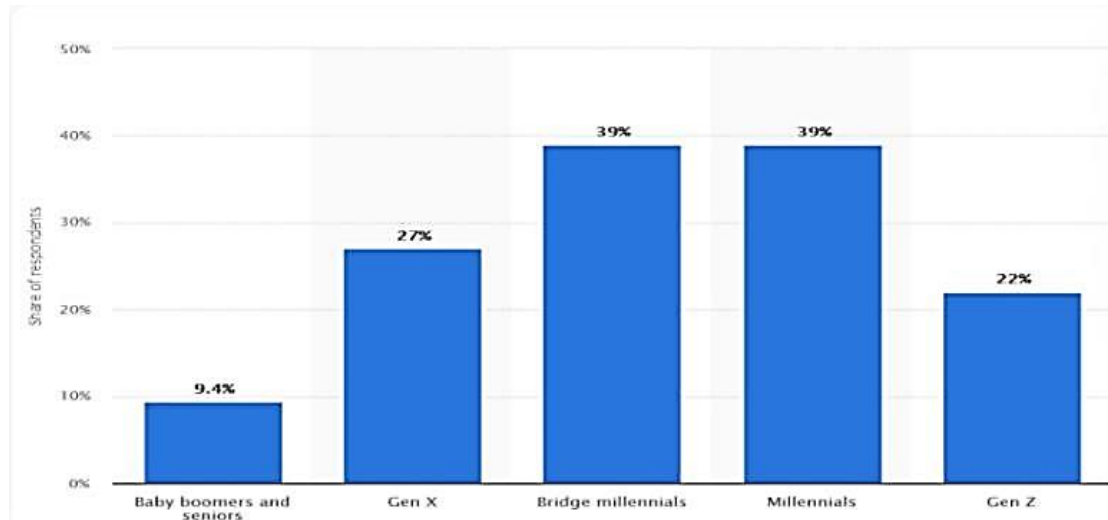


Figure 5: Share of US consumers in April 2023 with at least one retail product subscription by generation

- Retail product subscriptions gain traction, engaging customers through access, replenishment, and curation subscriptions.
- POS systems facilitate easy subscription management, enhancing customer retention and personalized offerings.

V. CONCLUSION

In conclusion, the evolution of Point-of-Sale (POS) systems reflects a remarkable journey of technological advancement and adaptation in the realm of modern commerce. From basic cash registers to AI-driven, cloud-based solutions, POS systems have continuously evolved to meet the dynamic needs of businesses and consumers. The research has shed light on pivotal trends reshaping the retail and service industries, emphasizing convenience, personalization, and enhanced customer engagement as driving forces behind the evolution of POS systems. Furthermore, the integration of data analytics and cloud technologies has ushered in an era of informed decision-making and scalability, providing businesses with actionable insights and streamlined operations. As AI continues to play a prominent role in POS functionalities, the future holds promise of heightened automation, intuitive customer service, and data-driven insights, enabling businesses to thrive in an ever-evolving market landscape. In essence, the journey through the evolution, challenges, and future trends of POS systems underscores the importance of adaptability, integration, and a deep understanding of consumer preferences for sustained success in the rapidly evolving realm of modern commerce. As businesses navigate this landscape, embracing technological innovation and prioritizing customer-centric strategies will be key to unlocking new opportunities and driving continued growth in the dynamic world of Point-of-Sale systems.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest

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