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Navigating Factors of Cloud Computing Adoption for SMEs in Halal Food Industry

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Abstract
Purpose: This study investigates cloud computing adoption among small and medium-sized enterprises (SMEs) in Malaysia's halal food industry, focusing on the factors influencing adoption and its impact on organizational performance.
Design/methodology/approach: A qualitative approach was employed through semi-structured interviews with six halal food SMEs in the Klang Valley. Data were analyzed thematically to identify key drivers of adoption.
Findings: Six main factors were identified: streamlined operations and automation, cost efficiency and scalability, improved data management, enhanced customer experience, improved security, and remote accessibility. Cloud technology enabled SMEs to optimize processes, reduce costs, and strengthen customer relationships, improving competitiveness and growth.
Research limitations/implications: The study is limited to a small sample in one region, restricting generalizability. Future research should involve larger samples or mixed methods to validate findings.
Practical implications: The findings guide SMEs, policymakers, and service providers in promoting cloud adoption through affordable, scalable, and halal-compliant solutions.
Originality/value: This study is among the first to explore cloud computing adoption within halal food SMEs, offering insights into how digital solutions can support operational efficiency, compliance, and competitiveness in the halal economy.

Keywords: Cloud Computing, Adoption, SMEs, Halal Food Industry

Introduction

Cloud Computing

In recent years, cloud computing has emerged as a transformative force in the information technology landscape, redefining how individuals and organizations consume digital services. Often described as the fifth utility, cloud computing parallels traditional infrastructure services such as water, electricity, gas, and telecommunications by offering on-demand, subscription-based access to essential IT resources (Buyya et al., 2009). This shift has significantly altered the delivery and utilization of software and infrastructure, enabling users to access computing power and storage remotely over the internet without the need for physical hardware.

The widespread adoption of cloud computing has been driven by its scalability, flexibility, and economic efficiency. Academic institutions, government agencies, and businesses across industries have embraced cloud technologies for their capacity to support innovation, reduce operational overhead, and facilitate global expansion (Forbes, 2023; Hussin et al., 2019). By

streamlining access to computing resources, cloud computing has shortened time-to-market for startups, enhanced enterprise agility, and accelerated scientific research through high-performance data processing.

Cloud services are generally categorized into three primary delivery models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). IaaS allows users to rent virtualized computing infrastructure such as storage and servers on a pay-as-you-go basis, while PaaS provides a comprehensive environment for application development without requiring users to manage the underlying hardware. SaaS, on the other hand, offers complete software solutions over the internet, accessible via web browsers and managed entirely by service providers (Hussin et al., 2019).

Beyond these technical capabilities, emerging trends are further reshaping the cloud computing landscape. The rise of the citizen developer a concept that empowers individuals with minimal coding experience to build customized digital tools is democratizing innovation within organizations (Forbes, 2023). Moreover, advancements in artificial intelligence (AI) and machine learning (ML) are increasingly integrated into cloud platforms, allowing businesses to harness vast datasets for automation, analytics, and improved decision-making. As reliance on these systems grows, the emphasis on cloud security, resilience, and regulatory compliance has intensified, especially considering evolving cybersecurity threats (Khanzode & Sarode, 2020).

As this technological paradigm continues to evolve, it raises pressing challenges and opportunities that demand ongoing scholarly attention. Issues such as service scalability, cost transparency, and performance optimization remain critical areas for research, alongside ethical considerations related to data privacy and sovereignty.

In the era of digital transformation, cloud computing has emerged as a pivotal technology reshaping the operational landscape of businesses worldwide. For small and medium-sized enterprises (SMEs), particularly in the halal food industry in Malaysia, cloud computing offers a compelling value proposition enhancing scalability, reducing IT costs, and improving supply chain transparency. As Malaysia positions itself as a global halal hub, the integration of cloud-based solutions becomes increasingly vital to ensure compliance, traceability, and competitiveness in a market driven by both religious obligations and consumer trust.

Despite its potential, the adoption of cloud computing among halal food SMEs in Malaysia remains uneven. Challenges such as limited digital literacy, concerns over data security, regulatory ambiguity, and financial constraints continue to hinder widespread implementation. Moreover, the unique requirements of halal certification and the complexity of halal supply chains demand tailored cloud solutions that align with Islamic principles and local governance frameworks. Thus, this research aims to explore the current state of cloud computing adoption among halal food SMEs in Malaysia By doing so, it contributes to the broader discourse on digital inclusivity and sustainable growth in the halal industry.

Adopting Cloud Computing in SMEs

The emergence of web technology in the 1990s gave rise to cloud computing particularly among enterprise in Malaysia as the increasingly focus on enhancing core competencies and productivity. Today, SMEs play a crucial role in the global economy by driving innovation,

generating employment through creating job opportunities and contributing significantly to both local and national economic growth (Jain, 2024).

However, despite their importance, SMEs often encounter substantial barrier in scaling operations, accessing advanced technologies and competing with larger enterprises due to limited financial and technological resources. The rapid growth of digital technologies posed a barrier to SMEs by restricting access to sophisticated tools and scalable infrastructure (Ugbebor, 2024). Nevertheless, this challenge is increasingly being addressed through innovations such as cloud computing, which provides SMEs with cost effective and scalable solutions for sustainable growth and competitiveness.

Cloud computing allows SMEs to access enterprise-grade tools without dealing with heavy capital expenditure associated with on-premises infrastructure. These tools include advanced data analytics, customer relationship systems, collaborative platform and enterprise resources planning (Jain, 2024).

One of the most notable advantages of cloud computing for SMEs is the ability to scale operations efficiently and affordably. This platform offers flexibility, allows SMEs to adjust computing resources based on demands and avoid the cost of maintenance for unused capacity which reduce operational costs, and it makes cloud services an ideal solution for this market segments (Shetty & Panda, 2021). The advent of cloud computing has marked a transformative shift in how businesses of all sizes operate especially for small enterprise due to its low entry cost, reduced infrastructure requirements and pay-per-use pricing.

In developing countries, cloud computing opens up significant opportunities for SMEs to leapfrog traditional technology adoption barriers as in practice this technology offers seamless data accessibility, eliminating concerns related to hardware maintenance and platform dependency (Diaz et al., 2024). Cloud computing empowers SMEs to design unique IT assets and develop strategic capabilities that enhance competitiveness.

Besides, in the context of scalability of using clod computing allows SMEs to grow at their own pace, adapt to market demands, expanding business operations, and enter new markets without burden of high capital expenditures. Cloud computing also enables SMEs to collaborate more effectively, both internally and externally by providing seamless communication and data-sharing tools that enhance teamwork and business processes. Cloud platform offers robust analytics capabilities to allows SMEs collect, process and analyze large volumes of data in real time (Bradac Hojnik & Hudek, 2023). This advantage empowers decision-makers to uncover insights that drive marketing strategies and planning, improve customer satisfaction, customer engagement and product development meet market demands. Thus, SMEs able to compete more effectively with larger corporation by enhancing business agility, responsiveness and innovation capacity.

In conclusion, cloud computing has become a powerful enabler of sustainable for SMEs in the digital age. By providing scalable infrastructure, offering access to cutting-edge tools, reducing costs and digital transformation positioning SMEs to thrive in an increasingly competitive global market.

Research Methodology

The study was conducted using qualitative method. Six SMEs in halal food industry located in Klang Valley that adopt cloud computing in their business were chosen and contacted. The semi-structured interview sessions with the owners of these companies were conducted to examine the application of cloud computing and the factors influencing its adoption among businesses. The following are the brief backgrounds of the six companies, namely Kerepek Warisan (KW), Cruffee Crust & Coffee (CCC), WeStreet Resources Sdn Bhd (WSR), Genba Bakery (GB), Qahwa Salam (QS) & Barakah Frozen Food (BFF). The recorded interviews were transcribed and analyzed through content analysis to identify emerging themes.

Kerepek Warisan

The company was established in the early 1990s that began with producing traditional homemade snack,starting with bahulu.As demand grew a small workshop was opened in 1993 and later expanded into a full-blown factory by 1995. By 2000, the business had added a showroom and retail outlet. The company grew into a wide range of traditional Malaysian snacks such as kerepek (chips) made from tapioca, banana and sweet potato as well as rempeyek, tumpi, dodol, and various biscuits. Today, Kerepek Warisan has been operating for over two decades and now runs three branch outlets, in addition to its main factory. They have a strong presence on online marketplaces.

Cruffee Crust & Coffee

Cruffee Crust & Coffee, Nilai is a charming hidden-gem café nestled at Taman Desa Kolej, Nilai, Negeri Sembilan. Known for its quaint, vintage-classic décor is complete with scooter and bicycle accents. This cafe projects a nostalgic, cozy atmosphere that's perfect for casual hangouts and OOTD shots. It quickly gained attention on social platforms for its blend of traditional Malaysian favourites and modern café offerings. Patrons rave about signature dishes like Mini Cruffles (croissant-waffle hybrids with diverse toppings), Croffle Bites, Spaghetti Carbonara, Spaghetti Buttermilk, Mee Rebus Daging, Mee Kari Ayam, and crowd-pleasing signature nasi ayam. Aside from full meals, the menu features a wide range of specialty coffees and beverages.

WeStreet Resources Sdn Bhd

WeStreet Resources Sdn Bhd was officially incorporated in year 2008.The company specializes in F&B management and catering, running restaurants, cafeterias, food courts, kiosks, fast food outlets, canteens, and full catering services. Alongside food operations, its portfolio extends to retailing staple foods (rice, sugar, flour), supplying raw materials (wet, dry, and frozen), general trading, and even delving into general construction and hardware supply activities.

Genba Bakery

Genba Bakery is a pastry café and bakery operated by the Entrepreneurship Centre at Universiti Sains Islam Malaysia (USIM), located in Nilai. The name "Genba" is derived from Japanese that combines "Gen" (generasi) and "Ba" (baru), which means 'new generation'. the existence of this cafe emphasizes its goal to nurture innovative entrepreneurship among students. It becomes a learning platform where students run day-to-day operations, including menu development and customer service. This hands-on approach is core to its mission of imparting real-world business insights and fostering practical skills in baking, management, and entrepreneurship.

Qahwa Salam
The business began initially by operating in small scale from house. It later participated in events and successfully obtained a grant from the Ministry of Finance (MOF). Following that, operations were expanded by setting up a coffee machine in the car boot and selling in front of the Nilai District Police Headquarters (IPD). Currently, the business has grown further with the opening of a physical café located at Universiti Sains Islam Malaysia (USIM), next to the Sports Centre.

Barakah Frozen Food
Barakah Frozen Foods was founded in 2007, specializing in the frozen food sector. Barakah supplies a wide range of halal-certified chicken products and organic poultry. Their offerings are available for bulk purchase and are aimed at food service outlets, retailers, and caterers. As both a manufacturer and distributor, Barakah Frozen Foods combines production capabilities with comprehensive supply logistics.

Findings: Factors of Adopting Cloud Computing in Halal Food Industry
Cloud computing has emerged as a revolutionary tool for SMEs, notably in halal food industry. By providing scalable, cost-effective, and adaptable solutions, cloud technology enables SMEs to enhance operational efficiency, optimize business operations, and deliver superior customer experiences. The use of cloud computing among SMEs in numerous industries, including food industry, is driven by multiple considerations, including operational needs, cost effectiveness, simplicity of integration, and data management.

Through an analysis of the mentioned SMEs, six key factors why these businesses have chosen to embrace cloud solutions were identified. The factors are (1) streamlined operations and automation, (2) cost efficiency and scalability, (3) improved data management and reporting, (4) enhanced customer experience, (5) improved security and reduced risk of data loss; and (6) flexibility and remote accessibility. The respondents' quotes are represented by KW for informant of Kerepek Warisan, CCC for informant of Cruffee Crust & Coffee, WSR for informant of WeStreet Resources Sdn Bhd, GB for informant of Genba Bakery, QS for informant of Qahwa Salam; and BFF for informant of Barakah Frozen Food (BFF).

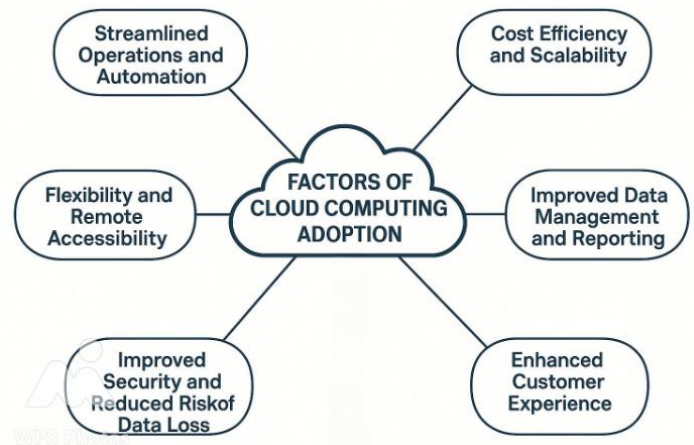

Figure 1: Factors of Cloud Computing Adoption among SMEs in Halal Food Industry

Streamlined Operations and Automation

One of the key reasons SMEs in halal food industry choose cloud solutions is to streamline operations and automate various tasks. For instance, Cruffee Crust & Coffee employs cloud-based technologies to automate order management with QR codes, decreasing the need for manual intervention and labor. This automation not only speeds up the process but also minimizes human mistake, which is vital in sustaining efficiency in a fast-paced sector. Similarly, Genba Bakery leverages cloud-based services for tracking sales and managing inventory, removing the need for manual record-keeping, therefore minimizing time and effort spent on administrative activities.

CCC: We realized that with cloud computing, we can reduce the needs of human resources and orders management.

GB: Our system can issue receipts..so its easy to monitor sales ever month.

Cost Efficiency and Scalability

Cloud computing provides SMEs substantial cost benefits, especially by removing substantial initial expenses for IT infrastructure. Kerepek Warisan selected a cloud-based system for its retail operations, facilitating sales tracking and inventory management without incurring more expensive software acquisitions. The system is cost-effective, featuring a minimal membership price, rendering it an appropriate choice for smaller enterprises with constrained resources. Furthermore, the cloud facilitates scalability, permitting organizations to broaden their operations without incurring substantial new expenses. Cruffee Crust & Coffee observes that the adaptability of cloud-based systems allows them to circumvent the substantial commissions usually imposed by third-party payment processors. WeStreet emphasizes the cost-effectiveness and adaptability of cloud solutions, indicating that enterprises in the food and beverage sector can seamlessly transition to superior service tiers as their operations expand.

QS: We change to this new system because it's free and user-friendly.

KW: The subscription of the system is RM 1000 plus, so the average cost is around RM 100 only.

CCC: We choose the provider based on the flexible payment structure.

BFF: The affordable cost is one of the most important criteria in choosing the provider of the system.

Improved Data Management and Reporting

Efficient data management is a significant rationale for cloud adoption among SMEs. Cloud solutions provide the secure storage and management of vast data volumes, thereby mitigating the risk of data loss. Genba Bakery utilizes Google Drive and OneDrive for the storage of documents, reports, and sales data, so ensuring that all information is securely backed up and readily available. The use of cloud technologies allows firms to provide comprehensive data on sales, inventory, and customer behavior, offering critical insights for decision-making. Cruffee Crust & Coffee utilizes cloud-based analytics to track sales patterns and client preferences, enabling them to refine their inventory and modify their offerings to align with demand. WeStreet utilizes cloud-based technologies to store essential data pertaining to supply chain management and production, providing transparency into product demand and inventory levels, hence facilitating inventory optimization and waste reduction.

KW: When everything is in the system, we can print and keep the report for audit purpose.

QW: It really helps a lot.it can helps us to monitor our stocks and sales. Easy to record.

CCC: Analyze sales and customer trends for more effective marketing strategies.

Enhanced Customer Experience

Cloud technologies markedly enhance the user experience by providing expedited and more efficient services. Cruffee Crust & Coffee leverages cloud-based solutions, enabling consumers to place digital orders and execute cashless payments, hence optimizing the transaction process and minimizing wait times. Loyalty programs implemented via cloud platforms, exemplified by Kerepek Warisan, augment customer retention by monitoring and incentivizing consumer fidelity. Cloud computing enables individualized marketing and promotions by granting firms access to real-time client behavior data, hence assisting in the development of targeted campaigns.

CCC: Our system includes customer order management through QR codes, payment systems, and customer loyalty programs. It is very effective in attracting repeat customers.

QS: This apps is easier… just use a phone to download the it… discount offers are provided through the customer database.

Flexibility and Remote Accessibility

Remote access to company data is a significant advantage of cloud computing. This adaptability enables proprietors and administrators to oversee and regulate their operations from any area, a characteristic especially advantageous for SMEs with several branches or enterprises where the owner may not consistently be on-site. Genba Bakery uses the apps to oversee sales and monitor inventory remotely, guaranteeing seamless business operations in the owner's absence. This remote access functionality is essential for enterprises aiming to expand operations or oversee distributed staff across multiple locations. WeStreet emphasizes the need of remote accessibility, particularly for SMEs that necessitate continuous monitoring of their activities across many locations. The capacity to oversee corporate data and operations remotely improves decision-making efficacy and guarantees the continuation of business functions.

GB: I use Google Drive to store event photos, sales records, and staff details.

KW: I can monitor through my phone. If I'm not at the shop, I can still oversee the business operations.

QS: Use Google Form for staff to punch in/out… can monitor from a distance who comes to work. This is important for evaluating their discipline and performance.

BFF: The main purpose of using cloud is to improve operational efficiency, simplify access to data from any location, and reduce dependence on physical infrastructure.

WSR: This year we want to establish our own app, using an online system… it's more flexible for us.

Improved Security and Reduced Risk of Data Loss

Remote access to company data is a primary advantage of cloud computing. This adaptability enables proprietors and administrators to oversee and manage their operations from any area, a characteristic especially advantageous for SMEs with several branches or enterprises where the owner may not consistently be physically present. Genba Bakery uses an app to oversee sales and monitor inventory remotely, guaranteeing seamless business operations in the owner's absence. The remote access feature is essential for firms aiming to expand operations or oversee distributed personnel across multiple locations. WeStreet emphasizes the need of remote accessibility, particularly for SMEs that necessitate continuous monitoring of their activities across many locations. The capacity to oversee corporate data and operations remotely improves decision-making efficacy and guarantees the continuation of business functions.

KW: If the device is damaged, the records can still be captured and the data will not be lost.

GB: Now we store everything in the cloud. No need for files, no need to organize papers anymore.

BFF: Technical support is our main concern to make sure our data are safe and we know with whom we should refer.

Discussion and Conclusion

The implementation of cloud computing in SMEs, especially within the halal food industry, has significantly transformed operational efficiency, minimized expenses, and enhanced consumer experiences. This study exemplifies how cloud technology facilitates SMEs in automating processes, managing data efficiently, and optimizing operations, so enhancing corporate competitiveness. The adaptability, scalability, and economic efficiency provided by cloud services render them essential instruments for SMEs aiming to expand and respond to evolving market requirements. As cloud technology advances, SMEs will gain increased chances to incorporate sophisticated AI systems and data analytics into their operations, hence enhancing growth and success in the halal food industry.

The adoption of cloud computing in halal food SMEs is primarily influenced by several key factors that enhance both operational and strategic performance. Cloud systems enable streamlined operations and automation, reducing reliance on manual processes while increasing efficiency. They also offer cost efficiency and scalability, allowing businesses to manage expenses effectively while expanding according to market demand. Moreover, the flexibility and remote accessibility of cloud platforms provide SMEs with the ability to access data and systems from any location, ensuring business continuity. Enhanced data management and reporting further strengthen decision-making processes, while improved security features minimize risks related to data breaches and loss, which is critical for safeguarding halal compliance records. Finally, cloud computing contributes to an enhanced customer experience by enabling faster, more reliable, and transparent services, thereby fostering greater customer trust and satisfaction.

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