

IMPACTS OF CLOUD COMPUTING ADOPTION AMONG SMALL TO MEDIUM-SIZED ENTERPRISES (SMES) IN FOOD INDUSTRY

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Abstract: With increasing demand and technological advancements, there is a growing interest in applying cloud computing among SMEs in this industry. SMEs are attracted to use cloud computing due to its benefits, as it lowers entry costs and offers advanced computer applications. The current landscape of this industry is crucial for manufacturers to improve operations, cater to diverse consumer preferences, and stay competitive in the market. Based on literature, the readiness of manufacturers to adopt cloud computing may be influenced by various factors, including the availability of expertise, support from organization, and environmental influence. Thus, the conceptual paper aims to investigate cloud computing adoption among SMEs in the food industry.

Keywords: Cloud computing, SMEs, Food industry

CLOUD COMPUTING

Cloud computing is a revolutionary technology that has transformed the way businesses and individuals' access, store, and process data and applications. It involves the delivery of computing resources over the internet, eliminating the need for physical hardware and allowing users to access these resources on-demand. Major cloud service providers, such as Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure, and others, offer a wide range of services to cater to businesses of all sizes and industries (Forbes, 2023).

There are three types of cloud computing, namely IaaS, PaaS and SaaS (Hussin et al, 2019).

- Infrastructure as a Service (IaaS) provides virtualized computing resources over the internet. It allows users to rent virtual machines, storage, and networking infrastructure on a pay-as-you-go basis.
- Platform as a Service (PaaS) provides a complete development and deployment environment in the cloud. It offers a

platform that includes operating systems, development frameworks, databases, and middleware. PaaS allows developers to focus on building applications without worrying about the underlying infrastructure and its management.

Software as a Service (SaaS) delivers software applications over the internet on a subscription basis. In this model, the software is hosted and maintained by the service provider, and users can access it through a web browser without the need for local installation or management.

One of the major trends in cloud computing for 2023 is the rise of the citizen developer. This concept empowers individuals without coding backgrounds to connect popular APIs and create customized automation, fostering greater innovation within organizations. Additionally, better integration of Artificial Intelligence (AI) and Machine Learning (ML) in cloud services is expected. AI and ML services have become more cost-effective, allowing businesses to manage vast amounts of data and improve productivity in various sectors. Cloud computing is also anticipated to play a critical role in ensuring business resilience and security, prompting increased investment in cloud security and resilience to protect against cybersecurity threats (Khanzode & Sarode, 2020).

IMPACTS OF CLOUD COMPUTING ON SMES IN FOOD INDUSTRY

Mobile working is becoming more common in today's connected environment (Farkas and Nagy, 2020). Digital development has a huge impact on social and economic processes, affecting how we communicate, connect, do business, and work (Gutierrez, Boukrami, and Lumsden, 2015).

With rising market rivalry and a constantly changing business environment, SMEs are becoming more likely to adopt various information technologies such as the Internet of things (IoT), virtualization technologies, and cloud computing (Omoniwa, et al, 2019). Cloud computing has gained popularity as the

reputation of shared networks linking individuals from all over the world has grown (Surbiryala and Rong, 2019).

From a practical standpoint, the results are crucial for entrepreneurs because they allow them to identify the variables that are important for employees when they use cloud computing services. With SMEs as a growing market for cloud providers, it will help them identify the elements that influence cloud adoption.

Food manufacturing, like many businesses, has resorted to information technology to help them address these challenges. Cloud computing, the most recent trend in technological growth, has been used in recent years to assist food producers in acquiring and processing massive data sets without the need for their own servers (Fisher, et al. 2018).

Cloud computing has grown in popularity in the food business. Food producers are now using big data and analytics approaches to track and optimize their enormous production networks, which are represented by vast, dynamic data sets that can only be processed using advanced information theory results.

The food business may now analyze data to estimate market sizes, consumer behaviors, optimal product strategies, customer targeting, and marketing thanks to the development of cloud computing. This breakthrough, especially when combined with e-commerce and artificial intelligence (AI), allows food firms to access broader audiences at a reduced cost (Li & Mahalik, 2019).

Cloud-based platforms can help food companies avoid faulty or unhealthy food from reaching consumers in addition to supporting business objectives. Unsafe batches can result in costly recalls as well as severe reputational damage, which can harm a company's earnings in the long run. Mechanisms that collect, sift through, and evaluate multiple data points across the entire global manufacturing system in real time, on the other hand, could detect contaminated or substandard food before it reaches retailers (Rejeb, et al. 2022).

In reaction to the need to improve food safety, especially as food networks become more globalized, food producers are now using cloud-based sensors to collect real-time information on the location of food products and ingredients, their appearance through machine vision, and environmental factors such as ambient temperature. These sensors connect wirelessly and are an example of the so-called industrial internet of things (IIoT).

The cloud enables the efficient scaling of standardized labelling across the entire organization as well as business partners or suppliers. Cloud labelling technology is still in its early stages. Adoption will most certainly increase as more businesses realize the advantages of deploying a cloud solution over an on-premises one. Simply put, the cloud makes centralized label management accessible to everyone along the supply chain, including small firms with little or no IT skills (Parker, L. (2019). Food quality has been enhanced and new food products have been produced using big data ideas. Crowdsourced data, for example, can be utilized to construct rapid-response monitoring systems for intermittent outbreaks. Cloud computing was a crucial growth element for the food industry, with the ability to enable deep consumer engagement and expand company opportunities (Ferkoun, 2015).

THE PRACTICES OF CLOUD COMPUTING AMONG SMES IN FOOD INDUSTRY

Diffusion of Innovation Theory (DOI) is a theory that tries to discover the factors that influence the spread of a new idea or technology in a society. Rogers (2003) defined diffusion of innovation as “the process in which an innovation is communicated through certain channels over time among the members of a social system”. Any idea, process, product, or technology constitutes innovation, as long as it is perceived as new by individuals.

Rogers (2003) argues that each innovation has different attributes that influence its diffusion in society. Relative advantage, compatibility, complexity, trialability, and observability are the

five key attributes of innovation. DOI does not take into account the environmental and organizational aspects of the context; therefore, in this study I used the Technology Organization Environment (TOE) framework, which takes into account other aspects of enterprises’ context.

According to Chams-Anturi et al. (2022), cloud computing is not always reflected in this industry even while the food industry followed stringent standards and food safety regulations. In order to follow such rules and regulations as well as fostering innovation, the food industry should foster greater external knowledge behaviors by embracing new technologies such as cloud computing (Manzini et al. 2017).

It is suggested that if SMEs in the food industry adopt cloud computing, employees can expect to better translate relevant external knowledge by making it more implicit resulting in new behaviors to update and reclassify old information as skills increase Saratchandra et al. (2022) .

CONCLUSION

This conceptual paper revealed some important impacts and great values among SMEs and the government sector in order to improve and smoothen the management and operations in SMEs particularly in the food industry. It is also hoped this study would give some insights into the adoption of cloud computing among SMEs in food industry. However, many other variables such as factors from technological readiness, organizational support and environment that may contribute to a better understanding of the real context of SMEs in this industry should be explored by the business owners as well as the government.

REFERENCES

- Chams-Anturi, O., Moreno-Luzon, M. D., & Romano, P. (2022). The role of formalization and organizational trust as antecedents of ambidexterity: An investigation on the organic agro-food industry. *Business Research Quarterly*, 25(3), 243–264.
- Farkas, É. and Nagy, L.: Vezetői kihívások a

- virtuális környezetben. A technológiai lehetőségek és a vezetési gyakorlatok együttes fejlesztésének szükségessége. *Metszetek* 9(1), 27-48, 2020, <http://dx.doi.org/10.18392/metsz/2020/1/2>
- Ferkoun, M. (2015). Cloud computing helps the food industry grow. IBM. [Online] Available at: <https://www.ibm.com/blogs/cloud-computing/2015/03/16/cloud-computing-helps-the-food-industry-grow/>.
- Fisher, O., Watson, N., Porcu, L., Bacon, D., Rigley, M., & Gomes, R. L. (2018). Cloud manufacturing as a sustainable process manufacturing route. *Journal of manufacturing systems*, 47, 53-68.
- Forbes (2023) <https://www.forbes.com/sites/forbestechcolumnist/2023/03/27/cloud-versus-on-premises-advantages-and-disadvantages-of-both-models/>.
- Gutierrez, A.; Boukrami, E. and Lumsden, R.: Technological, organisational and environmental factors influencing managers' decision to adopt cloud computing in the UK. *Journal of Enterprise Information Management* 28(6), 788-807, 2015, <http://dx.doi.org/10.1108/jeim-01-2015-0001>.
- Khanzode, K. C. A., & Sarode, R. D. (2020). Advantages and disadvantages of artificial intelligence and machine learning: A literature review. *International Journal of Library & Information Science (IJLIS)*, 9(1), 3.
- Li, N., & Mahalik, N. P. (2019). A big data and cloud computing specification, standards and architecture: agricultural and food informatics. *International Journal of Information and Communication Technology*, 14(2), 159-174.
- Manzini, R., Lazzarotti, V., & Pellegrini, L. (2017). How to remain as closed as possible in the open innovation era: the case of Lindt & Sprüngli. *Long Range Planning*, 50(2), 260–281.
- Omoniwa, B., et al.: Fog/Edge Computing-Based IoT (FECIoT): Architecture, Applications, and Research Issues. *IEEE Internet of Things Journal* 6(3), 4118-4149, 2019, <http://dx.doi.org/10.1109/jiot.2018.2875544>
- Parker, L. (2019). Exclusive interview: Cloud-based labeling is the key to fighting foodborne illness. *Food Safety Magazine*. [Online] Available at: <https://www.food-safety.com/articles/658-exclusive-interview-cloud-based-labeling-is-the-key-to-fighting-foodborne-illness>.
- Rejeb, A., Keogh, J. G., & Rejeb, K. (2022). Big data in the food supply chain: a literature review. *Journal of Data, Information and Management*, 4(1), 33-47.
- Rogers, E. M. (1995). *Diffusion of Innovations* (4th ed.). New York: Free Press.
- Saratchandra, M., Shrestha, A., & Murray, P. A. (2022). Building knowledge ambidexterity using cloud computing: Longitudinal case studies of SMEs experiences. *International Journal of Information Management*, 67, 102551.
- Surbiryala, J. and Rong, C.: Cloud Computing: History and Overview. In: 2019 IEEE Cloud Summit. IEEE, 2019, <http://dx.doi.org/10.1109/cloudsummit47114.2019.00007>