



## INFLUENCE OF TOE'S FACTORS AND TECHNICAL CAPABILITY ON ADVANCED IT ADOPTION AND COMPETITIVE ADVANTAGE IN TELECOMMUNICATION INDUSTRY

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### ABSTRACT

Advanced technology to achieve competitive advantage has become an essential strategic issue amongst telecommunications firms in the current global environment. The TOE contexts have been suggested in the literature as appropriate drivers of advanced technology adoption toward a firm's competitiveness. However, most of the current studies are concerned about the first-time of IT adoption but addressing the post-adoption of technological innovation toward competitiveness is missing in the literature. Furthermore, the literature argued that strong technical capability could influence firms' competitive advantage by enhancing internal and external communication efficiency and facilitating technical solutions for integrating advanced technologies. However, little is known in the current literature about the moderating role of technological capability in the relationship between IT adoption and competitive advantage. To fill this gap, this study discusses the role of TOE contexts on advanced IT technology adoption and thus on competitive advantage. Moreover, technical capability has been considered as a moderator to enhance technology adoption and competitive advantage. This conceptual paper reviews the relevant literature to put forth a research model using TOE's dimensions and technical capability toward competitive advantage. This article found that IT adoption is affected by contextual factors that shape a firm's technology adoption decision-making, grouped into technological, organizational, and environmental contexts.

## 1. Introduction

Advanced information technology (IT) to achieve competitive advantage has become an essential strategic issue amongst firms in changing globalization (Ajobo, 2016). The term "IT" is used to describe a wide range of digital technologies that enable data to be accessed, transmitted, stored, and modified through networks (Ezzaouia & Gidumal, 2020). For example, advanced technologies, such as the 5th generation of the mobile web, provide telecommunications firms with advanced data analysis capabilities and greatly facilitate firms' success (Chen, 2019). Therefore, firms adopt advanced technologies to improve their decision-making, improve customer services (Maroufkhani et al. 2020), enhance their competitiveness, and improve organizational performance (Ezzaouia & Gidumal, 2020).

However, evidence suggests that the IT adoption process is affected by contextual factors that shape a firm's technology adoption decision-making, grouped into technological, organizational, and environmental contexts. Technical context considers the technology in the firms and those outside the firm; organizational context examines factors associated with the size of the firm, managers' support, and financial readiness; and environmental context considers how environmental variables like competition pressures, business practice, and government interventions shape the firms (Maroufkhani et al. 2020, Chen, 2019; Eze et al., 2019; Grant & Yeo, 2018). Thus, Technology-organization-environment (TOE) framework (Okumus et al., 2017) is the most employed theory in technology adoption studies at the organizational level, and this is because these three contexts represent "both constraints and opportunities for technological innovation" (Kulkarni & Patil, 2020).

The TOE framework has been criticized for its inadequate theoretical explanation of innovation features of technology adoption (Ali et al., 2020). Currently, many of the studies that consider the advanced technologies adoption at the organization level draw upon either the TOE framework (Kulkarni and Patil, 2020; Eze et al., 2019; Cruz-Jesus, Pinheiro & Oliveira, 2019) or the DOI model (Ajobo, 2016; Lin and Chin, 2012). There is strong empirical support for the two models (Ali et al., 2020; Chen, 2019; Daradkeh, 2019). It has been recommended that when the TOE model and the DOI model are integrated, post-adoption of advanced technology can explain more effectively, compared to using them on their own (Chen, 2019; Daradkeh, 2019). The TOE and DOI can be integrated to establish variables that reflect the most widely used antecedents recognized in previous IT adoption studies. Both models can explain various aspects of technology adoption; for example, the TOE framework can explain the intra-firm technology adoption superior, while the innovative features of technology adoption can be better explained by the DOI theory (Ali et al., 2020).

The current literature has extensively studied the relationship between TOE context, advanced IT adoption, and competitiveness. However, these studies are fragmented and do not explain how TOE contexts can help create and enhance a firm's competitive advantage that copes with competition (Narwane et al., 2020; Maroufkhani et al. 2020). For example, most of the current studies are concerned about the first-time of IT adoption (e.g., Ezzaouia & Gidumal, 2020, Kulkarni and Patil, 2020; Eze et al., 2019; Daradkeh, 2019, Ajobo, 2016), but addressing the post-adoption of technological innovation is missing in the literature. Meanwhile, some other studies considered the relationship between technology adoption and a firm's competitive advantage (e.g., Chiu and Yang, 2019; Chang et al., 2019) without considering TOE context as determinants of technology adoption.

A critical issue in the current literature is understanding the moderating role of technical capability in the relationship between advanced IT adoption and competitive advantage. Past studies have empirically confirmed that environmental context moderates the relationship between TOE factors and IT adoption. However, little is known about the moderating role of organizational-level factors such as technical capability in the relationship between IT adoption and competitive advantage (Chen, 2019; Shehata & Montash, 2019). Strong technical capability can influence firms' competitive advantage, improve the overall quality of employees, enhance internal and external communication efficiency, facilitate the delivery of technical solutions for integrating advanced technologies, and then achieve firms' objectives (Chen, 2019). Thus, technical capability can be considered a facilitator to enhance the overall technology adoption and the competitive advantage of the firms (Shehata & Montash, 2019; Chen, 2019).

In an attempt to fill this research gap, this article addresses the influence of TOE factors on competitive advantage directly and indirectly through the mediating role of advanced IT adoption. Further, this study discusses the moderating role of technical capability in the relationship between advanced IT adoption and competitive advantage. Discussion of the mediating effect of technology adoption on the relationship between TOE contexts and competitive advantage will explain the mechanism through which TOE factors transfer their impact to the firms' competitive advantage. Moreover, addressing the moderating effect of technical capability in the relationship between advanced IT adoption and competitive advantage will contribute to the TOE's theories and the current literature by explaining the conditions under which the firm can maximize the effect of TOE's factors on competitive advantage.

The remainder of this article is organized as follows. The first section provides relevant information related to previous studies. Then, the model is developed in two stages. First, the TOE, which is the core model, and DOI are presented. In the second stage, the technical capability is introduced, and the new conceptual model is presented. The new conceptual model can be adopted to examine the influence of TOE and the influence of technical capability on the advanced IT adoption and post-adoption, reflecting in this article the firm's competitive advantage. Finally, the paper presents a conclusion and suggestions for future research.

## **2. Related literature**

Current literature shows that advanced technology adoption and competitive advantage have received considerable attention from scholars in technology adoption literature (Saeed, Bekhet and Dhar 2017); (Saeed, and Bekhet 2018). This study will review and discuss the TOEs contexts as determinants of advanced IT adoption and the subsequent competitive advantage from the relevant literature. According to the literature, those determinants can positively enhance advanced IT adoption (Kulkarni and Patil, 2020) and competitive advantage (Chiu and Yang, 2019; Chang et al., 2019). Studying determinants of advanced IT adoption will help shed light on what firms need to improve their competitiveness.

Most scholars have studied the relationship between TOE contexts and advanced IT adoption. For example, Kulkarni and Patil (2020) surveyed 409 bank managers and bank employees and found BCT infrastructure, BCT knowledge, relative advantage, and transaction cost significantly affect BCT adoption. Further, they also found that perceived security, organizational scope, consumer readiness, competitive pressure, government policies, and bank partner readiness significantly affect Blockchain technology adoption. In an online survey of 289 managers and engineers from major Chinese telecom companies, Chen (2019) found that the adoption of artificial intelligence (AI) is significantly related to relative advantage. This significant relationship includes complexity, compatibility, managerial support, government involvement, and vendor partnership. However, competitive pressure and Market uncertainty are not significantly related to AI adoption. In another online review of 1,320 reviews for six platforms, Daradkeh (2019) found that technology adoption at the organizations' level is not merely based on the technological, organizational, and environmental factors but other factors. He argued that financial variables which are more critical have significant influences on technology adoption with highly technologically advanced industries.

Other scholars have focused their attention on the relationship between advanced IT adoption and competitive advantage. For example, Chiu and Yang (2019), in their survey for 281 professional technicians, found that IT Adoption to have a negative consequence on competitive advantage. Further, they found that a high level of environmental factors is more likely to decrease the negative impact of IT adoption on competitive advantage. Chang et al. (2019) conducted an online survey for 165 IT executives in managerial positions. It found that cloud absorptive capacity plays a vital role in securing competitive advantage when a firm owns cloud absorptive capacity. This indicates that it has the IT capability to build

the cloud environment and the organizational capability for operation. Thus, cloud usage influences a firm's competitive advantage.

### **3. TOE Model**

Technology-organization-environment (TOE) framework (Tornatzky and Fleischer, 1990) is the most employed theory in technology adoption studies at the organizational level. This is because these three contexts represent "both constraints and opportunities for technological innovation" (Kulkarni & Patil, 2020). According to Eze et al. (2019), the TOE framework demonstrates the features of factors that stimulating technology adoption, this framework presents a broad range of factors that can help in identify managers' behavior for advanced technology adoption. The TOE framework comprises three contextual factors that shape a firms' technology adoption decision-making processes. These factors are: (i) technological context, (ii) organizational context, and (iii) environmental contexts. Technological context considers the technology in the firms and those outside the firm. Organizational context examines factors associated with the firm's size, managers' support, and financial readiness. Environmental context considers how environmental variables like competition pressures, business practice, and government interventions shape the firms (Maroufkhani et al. 2020, Chen,2019; Eze et al., 2019; Grant & Yeo, 2018).

Based on the TOE framework, a firm can adopt technological initiatives effectively if the technological, organizational, environmental factors can be identified (Maroufkhani, Wan Ismail & Ghobakhloo, 2020). The TOE framework has been used in numerous studies to assess advanced technology adoption such as big data analytics (BDA) adoption (e.g., Maroufkhani et al. 2020; Lai, Sun & Ren, 2018), Blockchain Technology (BCT) Adoption (e.g., Kulkarni and Patil, 2020), adoption of cloud-based services (e.g., Narwane et al., 2020; Ali et al., 2020; Chang et al., 2019; Asiaei & Ab. Rahim, 2019), artificial intelligence (AI) adoption (e.g., Chen, 2019), ICT adoption (e.g., Eze et al., 2019; Eze, Olatunji, Chinedu-Eze & Bello, 2018), IT adoption (e.g., Chiu and Yang, 2019) and digital information and technology adoption (e.g., Molinillo & Japutra, 2017). In most of these studies, the analysis of the direct effect of TOE contextual factors on IT adoption is well established.

The TOE framework can show how the appropriate drivers of advanced technology adoption influence a firm's competitiveness. TOE context can increase the sustainability of a firm's performance and competitive capabilities (product cost, quality, flexibility, or delivery) by adopting advanced technologies (Maroufkhani, Wan Ismail & Ghobakhloo, 2020). These arguments concur with Kulkarni and Patil (2020), who found that technological, environmental, and organizational factors significantly affect blockchain technology adoption at banks. It also agrees with Aboelmaged (2018), who examined the relationship between the TOE context, specifically the factors of technology and environment on sale growth as a strong performance indicator, and found that the environmental factor could significantly affect the development of sales in the service sector, as compared to the technological aspect.

The TOE framework has been criticized for its inadequate theoretical explanation of innovation features of technology adoption (Ali et al., 2020). Currently, many of the studies that consider the advanced technologies adoption at the organization level draw upon either the TOE framework (Kulkarni and Patil, 2020; Eze et al., 2019; Cruz-Jesus, Pinheiro & Oliveira, 2019) or the DOI model (Ajobo, 2016; Lin and Chin, 2012). There is strong empirical support for the two models (Ali et al., 2020; Chen, 2019; Daradkeh, 2019). It has been recommended that when the TOE model and the DOI model are integrated, post-adoption of advanced technology can be explained more effectively than using them on their own (Chen, 2019; Daradkeh, 2019). The TOE and DOI can be integrated to establish variables that reflect the most widely used antecedents recognized in previous IT adoption studies. Both models can explain various aspects of technology adoption. For example, the TOE framework can superiorly explain intra-firm technology adoption. In contrast, the innovative features of technology adoption can be better explained by the DOI theory (Ali et al., 2020).

Scholars asserted that methods used to more than one theoretical perspective should be integrated to comprehend the adoption of advanced technology (Ali et al., 2020). This is because the managers' decisions about adopting any advanced technology can be better understood by having a comprehensive understanding of the contextual factors, where the variables are customized to the specific technology adoption being analyzed (Ajobo, 2016). In doing so, this study integrates the TOE framework and the DOI theory to examine advanced IT adoption in a broader context beyond the technological factors.

### **4. DOI Theory**

In 1995, Rogers presented his DOI theory, which is considered as s one of the oldest social science theories. This theory explains how an idea, technology, or product gains momentum and spreads through a particular context over time (Chen, 2019). According to the theory, technological innovation should be widely adopted to achieve development and sustainability. Rogers (2003) also notes that technological innovation is communication using various channels within the social system. The diffusion process of innovations is influenced by innovation characteristics, such as relative advantage, complexity, compatibility, observability, and trialability (Rogers, 1995), and these five factors have varying degrees of effect in the organizational context. However, current studies have argued that relative advantage, complexity, compatibility are the most influential innovation characteristics in the organizational context (Ali et al., 2020; Daradkeh,

2019; Lai, Sun & Ren, 2018). Thus, the current studies that considered the DOI theory of Rogers (2003) examined that relative advantage, complexity, and compatibility as the most crucial innovation characteristics that affect technology adoption decisions (Chen, 2019). Relative advantage, complexity, and compatibility are well-supported by the theory (Ali et al., 2020). In the same vein, relative advantage, complexity, and compatibility are well supported by past studies. In contrast, complexity has conflicting results that support or reject the role of complexity in new technology adoption decisions.

## **5. Advanced IT Adoptions in the Telecommunication Industry**

Porter (1991) explained that competitive advantages are not fixed and long-lasting but temporary due to competition. Porter mentioned that IT innovation could change industry structure, alter competition rules, leverage new ways to outperform rivals and change the competitive environment. These arguments have been approved by Chang et al. (2019), who found in their online survey for 165 IT executives in a managerial position that clouds absorptive capacity plays a vital role for firms to secure competitive advantage. When a firm owns cloud absorptive capacity, it has both the IT capability to build the cloud environment and the organizational capability for operation. Thus, cloud usage influences a firm's competitive advantage. Similarly, Chang et al. (2019) found that cloud technology usage influences a firm's competitive advantage. Conversely, Chiu and Yang (2019) found in their case study at Taipei Water Department in Taiwan that IT adoption negatively affects competitive advantage. Further, they found that a high level of environmental factors is more likely to decrease the negative effect of IT adoption on competitive advantage. It's argued that the adoption of advanced technology can increase the operational performance of firms to stay competitive because technology adoption enhances the financial and market performance of firms (Maroufkhani, Wan Ismail & Ghobakhloo, 2020). Thus, advanced information and technology adoption allows firms to be more competitive (Molinillo & Japutra, 2017).

## **6. Technical Capability in the High Technology Industry Context**

Advanced IT adoption has been considered one of the essential factors for organization competitiveness (Chang et al., 2019). The impacts of IT adoption on competitive advantage can be moderated by several organizational-level factors (barriers of adoption) such as technical capability. The literature argues that t's essential to examine the moderating effects of organizational variables such as technical capability on the relationship between IT adoption and competitive advantage (Chen, 2019). Investigating such a moderating role of technical capability (technology adoption barriers) in the relationship between IT adoption and competitive advantage can better explain technology adoption and its merit to create distinctive competitive advantage (Shehata & Montash, 2019; Chiu and Yang, 2019).

Technical capability is defined as "the physical assets that are essential to adopt innovations, such as computer hardware, data, and networking" (Chen, 2019, p. 60). Its also defined as "a collection of hardware, software, shared services, management practices, and technical skills" (Kyriakou, & Loukis, 2019, p. 22). A critical issue in the current literature is understanding the moderating role of technical capability in the relationship between advanced IT adoption and competitive advantage. Studies such as Oliveira et al. (2019) and Lai, Sun & Ren (2017) empirically confirmed that environmental context moderates the relationship between TOE factors and IT adoption. Further, the study of Chiu and Yang (2019) empirically demonstrated that environmental context mediates the relationship between IT adoption and competitive advantage. However, scholars argued that the impacts of IT adoption on competitive advantage could be moderated by several organizational-level factors (barriers of adoption) such as technical capability (Shehata & Montash, 2019). little is known about the moderating role of organizational-level factors such as technical capability in the relationship between IT adoption and competitive advantage (Chen, 2019; Shehata & Montash, 2019).

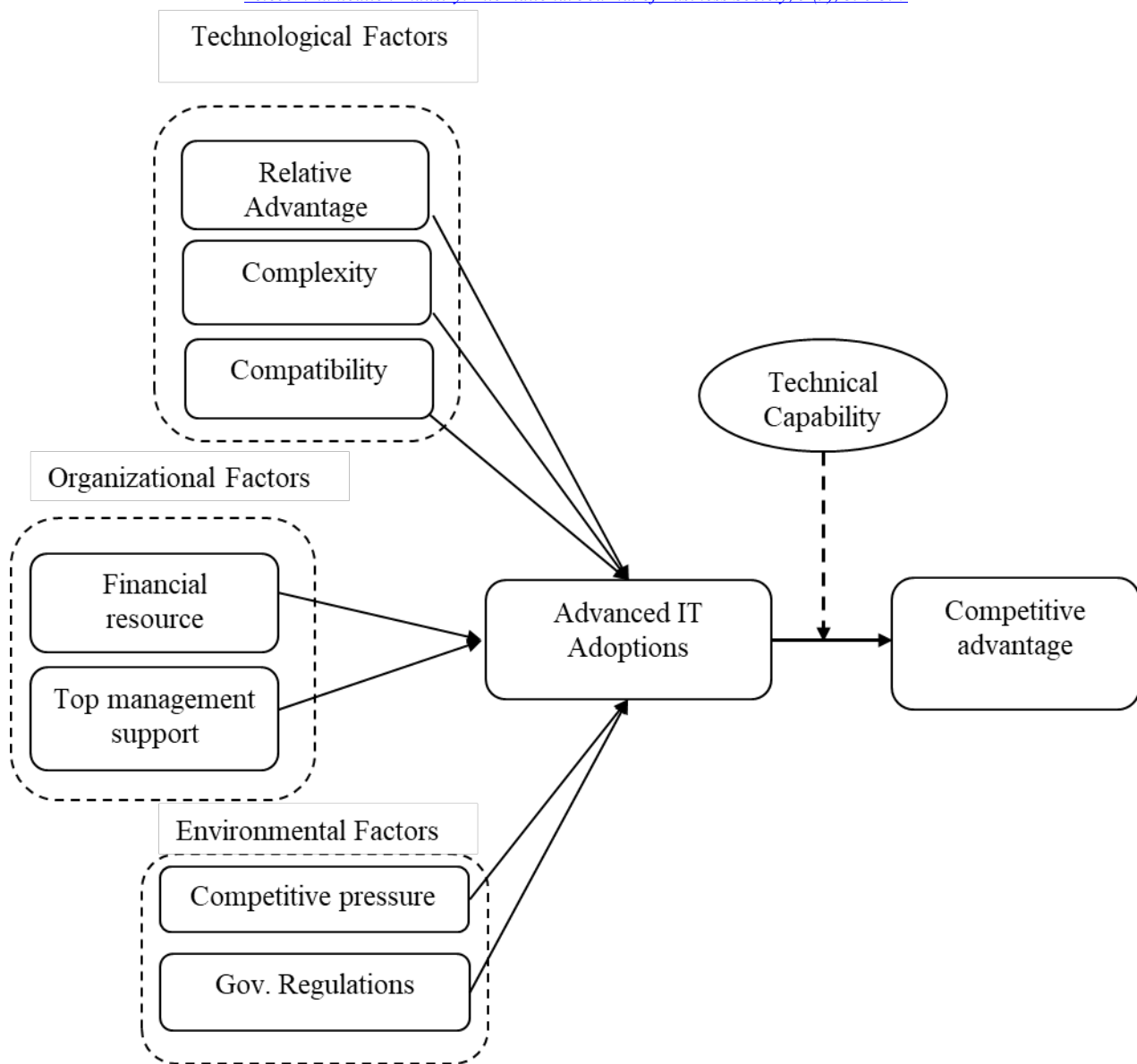


Figure: 1 Explaining competitive advantage Using TOE and technical capability

Table 1. Summary of Hypotheses

H1	There is a significant relationship between relative advantage and advanced IT adoption.
H2	There is a significant negative relationship between complexity and advanced IT adoption.
H3	There is a significant relationship between compatibility and advanced IT adoption.
H4	There is a significant relationship between financial resources and advanced IT adoption.
H5	There is a significant relationship between top management support and advanced IT adoption.
H6	There is a significant relationship between competitive pressure and advanced IT adoption.
H7	There is a significant relationship between government regulations and advanced IT adoption.
H8	There is a significant relationship between advanced IT adoption and competitive advantage
H9	Technical capability moderates the relationship between advanced IT adoption and competitive advantage.

## 7. Finding and Discussion

According to DOI theory, advanced technology lowers firms' operation costs, increases service quality, improves customer experiences, and promotes efficiency (Ali et al., 2020). Suppose a telecommunication firm encourages its employees to know how advanced technologies can create effective operations and reduce costs. In that case, employees can complete an understanding of the advantages that advance IT can offer. Once the level of awareness is raised, employees may accept and actively participate in the positive adoption of advanced technology. Furthermore, also based on DOI, telecommunication firms tend to assess new advanced characteristics; complexity is one of those characteristics that affect the firm's intention, either favorable or unfavorable toward the latest technology, and the subsequent decision to buy and adopt. Thus, firms' intention to adopt an advanced technology is influenced by the degree of innovation's complexity (Liu et al., 2019; Franceschinis et al., 2017). DOI also argued that technology compatibility with a firm's



experiences and requirements is positively related to innovation adoption (Rogers, 2003). Ali et al. (2020) found that compatibility had a statistically significant and positive impact on adopting cloud-based services.

Further, they state that compatibility affects the adoption of any new technology. Chen (2019) found that compatibility is significantly related to AI adoption. Maroufkhani, Wan Ismail & Ghobakhloo (2020) found that compatibility is one of the most critical determinants in the adoption phases of technology diffusion. Compatibility also was used in many previous studies as an essential factor from DOI theory to address the adoption of advanced technologies (e.g., Daradkeh, 2019; Lai, Sun & Ren, 2018; Puklavec, Oliveira & Popovič, 2017).

Daradkeh (2019) found that financial resources readiness was identified as the main determinant influencing advanced technology adoption from the organization's point of view. He further explained that financial readiness is mainly associated with the technology adoption decision. When adopting a new technology that has not been widely utilized, an organization must have adequate resources for the implementation process, and an exit strategy should the endeavor fail. Maroufkhani, Wan Ismail & Ghobakhloo (2020) found that lacking capital/financial resources can prevent the firms from fully exploit a new technological adoption. The other thing is that when adopting new technology, privacy, security, and governance considerations must be addressed proactively through all phases of research, development, and deployment. These factors have financial requirements that must be planned for before adopting new advanced technology (Chen, 2019). In the context of management support, when top managers feel optimistic about the results of technology adoption to the firms, they will be more likely to support adopting new technology (Maroufkhani et al. 2020). This argument has been supported by Chen (2019), who found that managerial support must be consistent and constant during technology adoption and implementation; otherwise, the technology adoption could fail. This is because that managers at the higher levels can designate key personnel to supervise the adoption project and allocate adequate financial resources to the adoption process; otherwise, the lack of top management support could negatively impact the adoption (Chen, 2019). Bhattacharyya (2017) found that Top management support playing a significant role in organizations' adoption of BDA. Maroufkhani, Wan Ismail & Ghobakhloo (2020) found that top management support is a substantial determinant of advanced technology adoption in the context of SMEs. Similarly, Kulkarni and Patil (2020) found that top management support positively impacts Blockchain Technology (BCT) Adoption.

Maroufkhani, Wan Ismail & Ghobakhloo (2020) found that competitive pressure strongly affects IT adoption within TOE context. Meanwhile, Khayer et al. (2019) found that competitive pressure significantly predicts cloud computing adoption. Similarly, Bhattacharyya (2017) found that competitive pressure playing a significant role in organizations' adoption of BDA. Conversely, Chen (2019) found that competitive pressure does not find a positive relationship between competitive pressure and AI adoption. It's argued that adopting new technologies is often a necessary strategy for firms to compete in the marketplace (Chen, 2019). This is because when competitors adopt certain new technologies, firms feel pressure and tend to adopt these technologies immediately to maintain their competitiveness (Eze et al., 2019). Thus, competitive pressure is an important determinant for advanced technology adoption (Khayer et al., 2019). Government regulations also play an important role in stimulating advanced IT adoption (Eze et al., 2019). Chen (2019) found that government regulations can encourage IT adoption and set or remove barriers to introduce new advanced technology. Kulkarni and Patil (2020) also found that government regulations positively contribute towards BCT adoption in Indian banking and financial services. Asiaei & Ab. Rahim (2019) found that government laws and regulations can facilitate or hinder the adoption of cloud computing within businesses. Chen (2019) also found that government regulations are significantly related to Artificial intelligence (AI) adoption. Similar results have been presented by Ali et al., (2020), who found that government regulation is one of the critical environmental factors affecting IT innovation adoption. The regulations of governments "can be in terms of promotions and restrictions" yield firms to look for technological alternatives, these regulations may encourage firms to adopt a specific type of new technology, and it may prohibit firms from adopting innovations in certain areas (Maroufkhani, Wan Ismail & Ghobakhloo, 2020). Thus, the government's support can provide a favorable environment for advanced technology adoption and promote the diffusion of technologies.

The current literature has extensively studied the relationship between TOE context, advance IT adoption, and competitiveness. However, these studies are fragmented and do not explain how TOE contexts can help create and enhance a firm's competitive advantage that better copes with competition (Narwane et al., 2020; Maroufkhani, Wan Ismail & Ghobakhloo, 2020). For example, from one side, most of the current studies are concerned about the first-time of IT adoption (e.g., Ezzaouia & Gidumal, 2020, Kulkarni and Patil, 2020; Eze et al., 2019; Daradkeh, 2019, Ajobo, 2016), but addressing the post-adoption of technological innovation is missing in the literature. Thus, some scholars called that the actual adoption of advanced IT technology and its impact on competitive advantage should be studied (Sharma, Gupta, and Acharya, 2020). On the other side, some other studies considered the relationship between technology adoption and a firm's the performance/competitive advantage (e.g., Chiu and Yang, 2019; Chang et al., 2019), without considering TOE context as determinants of technology adoption. Accordingly, little is known about the mediating role of advanced IT adoption in the relationship between TOE contexts/ IT driver forces and the competitive advantage. More specifically, the literature has largely unexplained the mechanism by which TOE contexts impacts competitive advantage (Maroufkhani, Wan Ismail & Ghobakhloo, 2020).

Given that the relationship between TOE contexts/factors that affect innovation and competitive advantage require investigating technology adoption as a mediator variable (Narwane et al., 2020). A recent study by Narwane et al. (2020) empirically confirmed that innovation adoption could mediate key factors of innovation adoption and SMEs' performance. Another study by Maroufkhani, Wan Ismail & Ghobakhloo (2020) verified this result and found that Big data analytics (BDA) adoption mediates the relationship between technological, organizational, and environmental contexts and SMEs performance. However, the relationship between IT adoption and the resulting competitive advantage (post-adoption) still lacking empirical evidence in the current literature (Narwane et al., 2020; Maroufkhani, Wan Ismail & Ghobakhloo, 2020; Asiaei & Ab. Rahim, 2019; Grant & Yeo, 2018; Puklavec, Oliveira & Popovič, 2017). Furthermore, these studies of Maroufkhani, Wan Ismail & Ghobakhloo (2020) and Narwane et al., 2020 considered the mediating role of technology adoption in the manufacturing context. However, empirical evidence of technology adoption in the service context is still missing. Thus, the relationship between TOE factors, innovation adoption (as a mediator), and competitive advantage need further empirical research (Maroufkhani, Wan Ismail & Ghobakhloo, 2020; Narwane et al., 2020; Asiaei & Ab. Rahim, 2019). It's argued that TOE contexts/factors, as the predictors of organizational technology adoption, can improve the competitiveness of firms through helping the firms in identifying the most significant factors of successful adoption of advanced technology, and successful adoption of any IT/IS technologies can lead to effective business competitiveness.

In the context of moderating the role of technical capability, it's argued that strong technical capability can influence firms' performance. It also improves the overall quality of employees, enhances internal and external communication efficiency, facilitates the delivery of technical solutions for integrating advanced technologies, and achieves firms' objectives (Chen, 2019). Thus, technical capability can be considered a facilitator to enhance the overall technology adoption and the competitive advantage of the firms (Shehata & Montash, 2019; Chen, 2019). Scholars thus, suggested that technology adoption barriers can moderate the relationship between IT adoption and the resulting competitive advantages (Shehata & Montash, 2019). Such moderating role can explain the conditions under which the firm can maximize the effect of TOE driver forces on IT adoption and the subsequent competitive advantage (Chen, 2019; Chiu and Yang, 2019; Shehata & Montash, 2019). Further, it's can better explain the adoption of technology and its merit to create a distinctive competitive advantage (Shehata & Montash, 2019; Chiu and Yang, 2019).

## **8. Conclusion**

Adopting advanced information technology (IT) to achieve competitive advantage has become an essential strategic issue amongst firms in changing globalization (Ajobo, 2016). Literature has recognized and provided compelling arguments that advanced IT adoption and technical capability are crucial determinants for competitive advantage and organizational performance. It's argued that driver forces impact advanced IT adoption, which in turn is an essential driver of competitive advantage (Maroufkhani, Wan Ismail & Ghobakhloo, 2020). The term "IT" is used to describe a wide range of digital technologies that enable data to be accessed, transmitted, stored, and modified through networks (Ezzaouia & Gidumal, 2020). For example, advanced technologies, such as the 5th generation of the mobile web, provide telecommunications firms with advanced data analysis capabilities and greatly facilitate firms' success (Chen, 2019). Evidence suggests that the IT adoption process is affected by contextual factors that shape a firm's technology adoption decision-making, grouped into technological, organizational, and environmental contexts. The technology organization-environment (TOE) framework (Tornatzky and Fleischer, 1990) is the most employed theory in technology adoption studies at the organizational level. This is because these three contexts represent "both constraints and opportunities for technological innovation" (Kulkarni & Patil, 2020). Current literature argued that TOE factors (IT drivers forces) for adopting advanced technological innovations allow firms to be more competitive (Maroufkhani et al. 2020; Chang et al., 2019; Molinillo & Japutra, 2017). However, it's argued that TOE factors are not directly guaranteed to create a competitive advantage; it's claimed that technology adoption barriers can moderate the relationship between IT adoption and the resulting competitive advantage (Shehata & Montash, 2019).

## **9. Future Research**

Current literature has a clear gap. This gap is that the theoretical foundation for an integrative perspective for TOE factors advanced IT adoption and technical capability as determinants of competitive advantage is limited. More specifically, there is a lack of studies investigating the relationship between TOE factors, advanced IT adoption, and technical capability toward competitive advantage. In the same vein, there is a need to explore the moderating role of technological capability in the relationship between advanced IT adoption and competitive advantage. Such investigation will contribute to the TOE's theories and the current literature by explaining the conditions under which the firm can maximize the effect of TOE's factors on competitive advantage.

## References

- Aboelmaged, M.G. (2018), "The drivers of sustainable manufacturing practices in Egyptian SMEs and their impact on competitive capabilities: a PLS-SEM model", *Journal of Cleaner Production*, 175, 207-221.
- Ajobo, T. R. (2016). *An Appraisal of the Motivators for and Inhibitors to Information Communication Technology (ICT) Use and Adoption by SMEs in Nigeria*. MRes thesis. The Open University.
- Ali, O., Shrestha, A., Osmanaj, V. & Muhammed, S. (2020). Cloud computing technology adoption: an evaluation of key factors in local governments. *Information Technology & People*, DOI 10.1108/ITP-03-2019-0119
- Asiaei, A. and Ab. Rahim, N. R. (2019). A multifaceted framework for adoption of cloud computing in Malaysian SMEs. *Journal of Science and Technology Policy Management*, (10) 3, 708-750, DOI 10.1108/JSTPM-05-2018-0053
- Chang, Y., Wong, S. F., Eze, U. & Lee, H. (2019). The effect of IT ambidexterity and cloud computing absorptive capacity on competitive advantage. *Industrial Management & Data Systems*, (119) 3, 613-638, DOI 10.1108/IMDS-05-2018-0196
- Chen, H. (2019). *Success factors impacting artificial intelligence adoption: perspective from the telecom industry in China*, PHD dissertation, OLD DOMINION UNIVERSITY, China.
- Chiu, C. N. & Yang, C. L. (2019). Competitive advantage and simultaneous mutual influences between information technology adoption and service innovation: Moderating effects of environmental factors. *Structural Change and Economic Dynamics*, (49), 192–205, <https://doi.org/10.1016/j.strueco.2018.09.005>
- Cruz-Jesus, F., Pinheiro, A. & Oliveira, T. (2019). Understanding CRM adoption stages: empirical analysis building on the TOE framework. *Computers in Industry* (109), 1–13, <https://doi.org/10.1016/j.compind.2019.03.007>
- Daradkeh, M. K. (2019). Determinants of visual analytics adoption in organizations Knowledge discovery through content analysis of online evaluation reviews. *Information Technology & People*, (32) 3, 668-695, DOI 10.1108/ITP-10-2017-0359
- Eze, S. C., Olatunji, S., Chinedu-Eze, V. C., Bello, A. O., Ayeni, A. and Peter, F. (2019). Determinants of perceived information need for emerging ICT adoption: A study of UK small service businesses. *The Bottom Line*, (32) 2, 158-183, DOI 10.1108/BL-01-2019-0059
- Eze, S. C., Olatunji, S., Chinedu-Eze, V. C. & Bello, A. O. (2018). Key success factors influencing SME managers' information behaviour on emerging ICT (EICT) adoption decision-making in UK SMEs. *The Bottom Line*, (31) 3/4, 250-275, DOI 10.1108/BL-02-2018-0008
- Ezzaouia, I. & Gidumal, J. B. (2020). Factors influencing the adoption of information technology in the hotel T industry. An analysis in a developing country. *Tourism Management Perspectives*, 34, 100675
- Grant, D. & Yeo, B. (2018). A global perspective on tech investment, financing, and ICT on manufacturing and service industry performance. *International Journal of Information Management*, (43), 130-145.
- Kulkarni, M. & Patil, K. (2020). Block Chain Technology Adoption Using TOE Framework. *International journal of scientific & technology research*, (9) 2, ISSN 2277-8616
- Kyriakou, N. & Loukis, E. N. (2019). Do strategy, processes, personnel and technology affect firm's propensity to adopt cloud computing? An empirical investigation. *Journal of Enterprise Information Management*, (32) 3, 517-534 DOI 10.1108/JEIM-06-2017-0083
- Lai, Y., Sun, H. & Ren, J. (2018). Understanding the determinants of big data analytics (BDA) adoption in logistics and supply chain management: An empirical investigation. *The International Journal of Logistics Management*, (29) 2, 676-703, DOI 10.1108/IJLM-06-2017-0153
- Maroufkhani, P. Wan Ismail, W. K. & Ghobakhloo, M. (2020). Big data analytics adoption model for small and medium enterprises. *Journal of Science and Technology Policy Management*, DOI 10.1108/JSTPM-02-2020-0018
- Molinillo, S. & Japutra, A. (2017). Organizational adoption of digital information and technology: a theoretical review. *The Bottom Line*, (30) 1, 33-46, DOI 10.1108/BL-01-2017-000
- Narwane, V.S., Raut, R.D., Mangla, S.K., Gardas, B.B., Narkhede, B.E., Awasthi, A. and Priyadarshinee, P. (2020), Mediating Role of Cloud of Things in Improving Performance of Small and Medium Enterprises in the Indian Context, *Annals of Operations Research*. <https://doi.org/10.1007/s10479-019-03502-w>
- Okumus, F., Bilgihan, A., Ozturk, A. B. & Zhao, X. (2017). Identifying and overcoming barriers to deployment of information technology projects in hotels. *Journal of Organizational Change Management*, (30) 5, 744-766, <https://doi.org/10.1108/JOCM-12-2015-0239>
- Saeed, M. A. Y., & Bekhet, H. A. (2018). Influencing Factors of Mobile Marketing among Young Malaysian Customers. *Australian Journal of Basic and Applied Sciences*, 12(9), 63-72.
- Saeed, M. A. Y., Bekhet, H. A., & Dhar, B. K. (2017). Constructing model to explore the influence of marketing audit on organizational performance—An innovative arena of marketing. *International Journal of Business Society*, 1(1), 37-47.
- Shehata, G. M. & Montash, M. (2019). Driving the internet and e-business technologies to generate a competitive advantage in emerging markets Evidence from Egypt. *Information Technology & People*, (33) 2, 389-423, DOI 10.1108/ITP-10-2017-0360