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Adoption of contactless technologies for remote work in Ghana post-Covid-19: Insights from technology-organisation-environment framework

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ABSTRACT

The Covid-19 outbreak in early 2020 has changed people's way of life, work and access to information. This has led to the growth of contactless digital technologies for customers' and organisations' benefit. In this context, one specific area of interest is the remote work environment, especially the introduction of remote work systems (RWS) in organisations. Notwithstanding its growing importance, RWS implementation in developing countries has experienced several challenges. Thus, the purpose of this study is to empirically investigate the antecedents of RWS adoption in organisations among different industries in a developing country context. Using the technology, organisation and environment (TOE) framework, the study unearths the RWS antecedents through a quantitative method design (353 participants) in Ghana. Relative advantage, complexity, organisational readiness and competitive advantage had a significant impact on contactless digital technologies adoption while compatibility, top management support, competence and regulatory support were insignificant antecedents in a developing country context. Our study highlights the important role of RWS adoption factors in propelling users' interest in future innovations and new technologies. A successful convergence of the validated TOE factors would advance organisation's services, change traditional business models and transform business operations and social lives.

1. Introduction

The Covid-19 outbreak in early 2020 has changed people's way of life and access to information. This has led to the growth of contactless digital technologies for customers and organisation benefit (Pandey & Pal, 2020). However, few studies have investigated the adoption and diffusion of contactless digital technologies from a developing country context (Alabi, White, & Beloff, 2020). Consequently, research gaps exist in our understanding of why customers, employees or organisations adopt or do not adopt these innovations. For example, considering the surge in mobile money transaction (MOMO) and online banking in a developing country context such as Ghana, contactless services have become a reality in the banking industry. The evolving nature of platformisation of technologies for contactless services makes their adoption complex (Richardson, 2021), prompting leading information systems (IS) scholars to call for more research in this area by examining issues in technology adoption from different contexts (Barua & Mukherjee, 2021). Among the dominant contactless digital technologies during and after the pandemic (new normal), remote working systems (RWS) is one new area of interest for users and organisations. Remote working was not a widely used practice until the outbreak of the pandemic. Remote working systems in this study refer to the digital technologies that allow workers to work flexibly from remote locations other than their place of work. To justify the huge organisational investment in RWS and actualise the benefit, users must adopt the technology (Hoehle, Zhang, & Venkatesh, 2015).

Current studies on RWS adoption have focused on virtual work characteristics from a social perspective for shaping work experiences, social support and work performance or shared benefit (Golden & Gajendran, 2019; Wang, Liu, Qian, & Parker, 2021). This implies that research has been approached from a limited perspective in investigating adoption issues. Other scholars have applied the general adoption theoretical frameworks such as the technology acceptance model (TAM), unified theory of acceptance and use of technology (UTAUT), and diffusion of innovation without focusing on the RWS context with an organisation mindset of work-from-home policy.

Furthermore, the antecedents of RWS studied in developed countries differ from developing countries (Senyo, Effah, & Addae, 2016). The differences are not only economic but also social and political, as well as cultural factors. Conversely, the technological, organisational and environmental (TOE) factors also differ from both contexts, with the antecedents of RWS in developed countries well established in IS literature. Precisely, despite the government's efforts and lessons from Covid-19, the adoption of RWS by organisations in developing countries is still far behind developed country's adoption of remote work (Gallup, 2017; World Bank, 2016).

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Table 1
Selected studies on TOE framework and factors.

Author(s)	Theory	Country	Methodology	TOE factors
Gangwar, Date, and Ramaswamy (2015)	TOE and Technology Acceptance Model (TAM)	India	Questionnaire distributed to 280 companies Exploratory and confirmatory analyses; SEM	Compatibility Relative advantage Complexity Organisational readiness Top management commitment Training and education Perceived ease of use Perceived usefulness
Rahayu and Day (2015)	TOE framework	Indonesia	Surveyed 292 small-and-medium-sized enterprises (SMEs) Multiple Regression Analysis	Technology readiness Perceived benefits Owners' innovativeness Owners' IT experience Owners' IT ability
Senyo et al. (2016)	TOE framework	Ghana	Surveyed 305 firms Logistics regression analysis and confirmatory factor analysis	Relative advantage Security concern Top management Technology readiness Competitive pressure Trading partners
Abed (2020)	TOE framework	Saudi Arabia	Questionnaire distributed to 181 SMEs Structural Equation Modelling (SEM)	Perceived usefulness Security concern Organisational readiness Top management support Consumer pressure Trading partner pressure

This raises the question of the specific factors that influence organisations' adoption of remote work and systems. The answer to this question is important since organisations that include large companies and small-and-medium enterprises (SMEs) are considered the engine of economic growth of developing countries (Chege & Wang, 2020). Given our focus on contactless digital technologies and to better understand the factors that may affect remote work adoption, this study investigates the antecedents of RWS from a developing country context, specifically Ghana. For practitioners and organisations venturing into remote work, this study provides a fundamental understanding and factors that drive RWS. The successful convergence of these drivers of RWS would accelerate organisational services and transform the platform-based service landscape in developing countries (Ofosu-Ampong, 2021). Arguably, this knowledge gap is not available to organisations in developing countries. The following section focuses on the literature review, conceptual model, methodology, findings, and conclusion.

1.1. Literature review: remote working systems

In recent times, there has been a rapid growth of contactless technologies in education, health, work environment and payment systems (Karjaluoto, Shaikh, Leppäniemi, & Luomala, 2019). However, the use of RWS rose exponentially in 2020 due to the Covid-19 pandemic. While RWS have become common among organisations, research in this area is emerging and nascent in developing countries. RWS is the use of information and communication technologies with high-speed internet (Gupta, 2020). Technologies required for remote work include cloud computing technologies, unified communications, business apps, mobile tools, data backup and recovery and network security and malware protection. Without these cloud infrastructures, organisations might struggle to enhance their remote working environment.

One key area of IS research is technology adoption, which primarily focuses on antecedents of user intention. While prior studies examine the technology adoptions in educational and individual settings (Venkatesh, Thong, & Xu, 2016), recent studies have investigated the adoption of technologies in the organisation settings (Senyo et al., 2016), such as cloud computing, internet and business apps. However, our preliminary review of literature on the topic revealed two main issues. First, there have been limited studies on the topic since 2012, despite several contactless digital technologies being used by government agencies and organisations to improve customer relations. Second, studies from developing countries have focused on more generic technologies such as contactless payment or the internet. However, remote work or contactless technologies may encompass a number of technologies displayed to the user or organisation which may affect their attitude-intention behaviours and consequently research results and factors from developing countries. Also, research emanating from developing countries have examined the TOE from a different context other than remote work, especially in the advent of the Covid-19 pandemic. To support the relevance of TOE in this study, we summarise previous studies that adopt this theory (see Table 1).

1.2. The Ghanaian context

Ghana reported her first Covid-19 positive case on 12th March 2020. Since then, almost all aspects of our lives have been affected. Ghanaian businesses and institutions have not been spared the impact of the pandemic. This led to lockdowns of workplaces and the advancement of contactless services. Remote work systems adoption was the result of the shock caused by the Covid-19 pandemic. As of 20th February 2022, Ghana has recorded 158,159 confirmed cases of Covid-19 with 1431 deaths.[1] Most established businesses closed down during the partial lockdown which restricted economic activities in the two major capital cities (Accra and Kumasi). The lockdown affected firms that were not even in the restricted areas with fewer orders from customers. Sectors that were mostly affected by the closures were education, financial services and institutions, transport and manufacturing. The alternative to the lockdown was the uptake of digital solutions.

As reported by the World Bank and Ghana Statistical Service survey (Ghana Statistical Service, 2020), more than a third of Ghanaian firms increased their use of internet, digital technologies, and mobile money for business. Most organisations especially education institutions and financial services began operation by implementing remote work systems and work from home policy. Before the Covid-19 pandemic, remote work was not a viable option in Ghana for employees to work from home. However, the narrative changed, and the use of remote work systems rose exponentially

[1] See World Health Organisation Covid-19 data on Ghana https://covid19.who.int/region/afro/country/gh

in 2020. In this regard, policymakers, organisations and governments need research on remote work environments to establish the factors that promote or hinder RWS adoption in Ghana after the Covid-19 pandemic. The RWS adoption in Ghana is relatively new with interrelated complexity in organisation and work acceptance. Arguably, this study is the first to research RWS among Ghanaian firms with its associated TOE factors. As firms report uncertainty in future work systems and working environments, the expectation in Ghana is to commence research into digital technologies to make full use of remote work options. As stated by Jones (2020), other new pandemics will surely follow the Covid-19 with even greater disruption. That means firms in developing countries must not only manage this pandemic effectively but also plan well for future pandemics.

2. Conceptual model and hypotheses

Dominant adoption frameworks such as the unified theory of acceptance and use of technology (UTAUT), diffusion of innovation (DOI), technology adoption model (TAM), TOE framework, theory of reasoned action (TRA) and many more have been widely used to study contactless digital technologies from the individual or organisational level adoption. From the individual level adoption, the predominant frameworks include TAM and DOI, which considers less of organisational dimensions of innovation adoption than the technology. Since our study examines the antecedents of RWS in organisations in a pandemic period, the TOE framework is considered an appropriate framework to account for the technology, organisation and environmental factors. The TOE model was established to evaluate a firms' decisions to accept, implement and use innovative technologies (Tomás, Thomas, & Oliveira, 2018). Technology innovation adoption is seen as both enabled and inhibited by the three contexts—the contexts influence a firm's decision when evaluating, searching for, or adopting new technologies. Thus, aside from the technological and organisational determinants of adoption, the TOE framework can also explain external factors such as the environmental and social determinants (Wang, Wang, & Yang, 2010). Consequently, the TOE framework is appropriate for uncovering all the internal and external determinants for RWS adoption in an organisation in a developing country context. Extant literature suggests that an extended TOE framework is useful to identify RWS adoption determinants from the organisational, environmental, and technological perspectives (Tomás et al., 2018) since it has been successfully applied to a wide range of socio-environmental contexts. Hence, it provides a broad picture of RWS adoption, implementation and post-adoption behaviours, which influence business-technology adoption decisions to promote remote work and improve organisational capabilities using contactless digital technologies.

The proposed model consists of three technological (internal) and organisational variables, including relative advantage, compatibility and complexity, and two environmental or external variables which are competitive advantage and regulatory support. Fig. 1 shows the proposed conceptual model for RWS.

2.1. Technological characteristics (TC)

Prior studies show that firms with improved and sophisticated use of digital technologies' chances of implementing IS successfully are high (Lin & Lin, 2008). In this study, digital technologies refer to technologies that are a foundation for cloud computing and remote work-related activities in post Covid-19. Kylili et al. (2020) argue that remote work is unlikely to be an integral part of a firm's value chain in the new normal if technological innovation and infrastructure are lacking. Therefore, we hypothesise that increased contactless digital technology will increase the success of a firm's remote work-related activities.

Relative Advantage is the degree to which new technologies are considered better than the idea it supersedes (Rogers, 2003). Extant literature articulates RWS to include increased productivity and business profitability, work and costs flexibility and scalability to meet business diversification and demand (Rodrigues, Ruivo, & Oliveira, 2021). Hence, relative advantage will significantly affect the adoption of RWS in a developing country context. In this regard, the relative advantage of using a remote system is that it enhances productivity, saves business time, offers the opportunity to use shared resources, and increases profitability (Alkhater, Walters, & Wills, 2018). Organisations are more likely to adopt cloud services like RWS in their operations if they perceive its relative advantage (Alshamaila, Papagiannidis, & Li, 2013). While some scholars have found little influence of relative advantages on the adoption of cloud learning services; others found that relative advantages are the essential factors that emerge when an organisation considers adopting new technology for business processes (Alhaimer, 2021). This study postulates that relative advantage has a significant relationship with adoption decisions especially, with RWS. This means that organisations that perceive RWS as beneficial and enhance their operations and processes are more likely to adopt remote working technologies.

H1: Relative advantage has a positive impact on RWS adoption.

Compatibility is the degree to which new technologies are consistent with the potential users' existing values and previous experiences (Rogers, 2003). Compatibility plays a critical role when an organisation evaluates new technologies to see if there is an overlap with perceived ease of use and usefulness of technologies as experienced in the past. Thus, users tend to use new technologies if it fulfils their values and matches their habitual needs. Prior studies have shown that a positive relationship exists between compatibility and users' adaption to new technologies. For example, Min, So, and Jeong (2019) found that consumers' adaption to a new mobile application was a significant factor in adoption and it revealed a positive attitude towards perceived ease of use. Consequently, we can assume that compatibility affects attitude towards new technologies. Heinle and Strebel (2010) conclude that compatibility issues are the main reasons organisations fail to adopt new technologies. In this regard, the study aims to examine how organisational compatibility influences the adoption of RWS following past experience and existing values in pandemic times. Therefore, we propose the following hypothesis:

H2: Compatibility has a positive impact on RWS adoption.

The organisational complexity concept originates from the tenants of TAM, i.e. ease of use of technology. In other words, complexity is the constraint and inconvenience towards a system usage. In the context of contactless digital technologies in the workplace, complexity is the extent to which an application is built on cloud computing, and organisation interest hovers on the time to perform an activity, the effectiveness and efficiency of intelligent decision-making and system functionality (Gangwar et al., 2015). To this extent, complexity is considered an organisational issue, especially time to process work activities in the Covid-19 era. In this regard, OCX is conceptualised as ease of use to mean that as ease of use decreases, the complexity in an organisation increases (Lin & Lin, 2008). Remote workers will experience challenges if there is a system complexity in the organisation which may lead to unintended benefit of the innovation (Lin & Lin, 2008).

H3: Complexity has a negative impact on RWS adoption.

2.2. Organisational characteristics

Organisational Characteristics is the next construct of the TOE framework. For technology to be accepted and maximised its full potential, it should fit the organisations' context of operation. Studies have recently identified top management support, organisational competence, and readiness as essential technology adoption constructs of organisational characteristics worth studying (Makena, 2013; Senyo et al., 2016).

Top management support is the degree to which senior management places importance on digital technologies or innovation. In summary, resource allocation determines the level of support of the innovation (Seethamraju, 2015). To advance remote work decisions, management

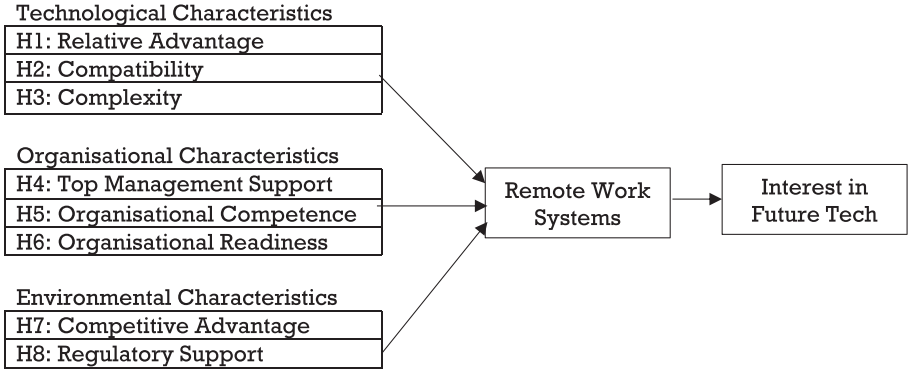

Fig. 1. Conceptual model for remote work systems.

support is an essential factor that can inhibit or progress RWS adoption. Moreover, studies (Low, Chen, & Wu, 2011; Wang et al., 2010) based on the TOE framework and technology adoption posit that top management support is an important and significant factor in firms' decision to adopt or not adopt innovation. In this regard, highly organised and strong top management organisations are more likely to adopt innovative technologies and RWS. Therefore, we propose the following hypothesis:

H4: Top management support has a positive impact on RWS adoption.

Competence is the skills, knowledge, and capabilities needed to perform a task. Competent employees improve the performance of a firm's profitability, and the TOE framework attests to its importance in an organisation (Rambe, 2018). In this context, competence refers to the employees' evaluation of self as a contributor to the organisational goals. Hence, competent personnel are required to ensure a performance-oriented culture in an organisation because competent employees bring about firm competency (Halabi, Esquivel, & Siles, 2017). It is easy to refer to a firm as competent when the employees in the organisation are competent to use a new system. However, employees will not perceive the system's usefulness when they are not competent to use it (Tam, Loureiro, & Oliveira, 2019). Therefore, we propose the following hypothesis:

H5: Competence has a positive impact on RWS adoption.

Organisational readiness consists of digital technologies and the RW human resources of an organisation (Zhu & Kraemer, 2005). The digital technologies and infrastructure provide the platform for remote work technologies to thrive. At the same time, the RW human resources are the skills and knowledge to develop remote work applications (Oliveira & Martins, 2011). Digital technologies, infrastructure, and technical skills have become a fundamental part of a firm's value chain in new normal due to less contactless interaction and transaction. These organisation capacities and factors may influence a firm's decision to adopt RWS. For example, suppose an organisation human resource is not ready to adopt a new RWS. They will feel constraints in using the innovation and will not realise the usefulness of this new technology.

H6: Organisation readiness has a positive impact RWS adoption.

2.3. Environmental characteristics

The third construct of the TOE framework is *environmental characteristics*. Businesses operate in an environment conducive to thriving. Hence, a firm's environmental characteristics can promote or constrain its business operations. Due to the impact of Covid-19, modern business needs to consider their environment concerning technological advancement and adoption decisions. Many environmental characteristics may affect business. However, recent studies (Low et al., 2011; Oliveira & Martins, 2011; Senyo et al., 2016) have focused on competitive advantage and regulatory support as having a substantial impact on organisational success.

Competitive advantage is the competitive intensity among firms. It shows the pressure felt by a competitor to compete in the industry (Oliveira & Martins, 2011). The study by Porter and Millar (2010) shows that firms that adopt innovations are more likely to compete and leverage new ways to outperform competitors and alter the competition rules. Furthermore, organisations are adopting new technologies because they believe their employees and customers expect them to acquire them for business continuity. For instance, several studies (Chatzoglou & Chatzoudes, 2016; Nugroho, Susilo, Fajar, & Rahmawati, 2017) have investigated the impact of competitive pressure on technology adoption and found it to be significant. Hence, being competitive in meeting customers' demands and expectations can promote a positive RWS adoption among firms. Hence, this study suggests competitive advantage as an antecedent and powerful driver of RWS adoption. Therefore, we propose the following hypothesis:

H7: Competitive advantage has a positive impact on RWS adoption.

Regulatory support is the last determinant of RWS adoption in the TOE framework under environmental characteristics. To promote and protect industry players and firms, government regulations in the form of laws are made for the adoption of innovation (Makena, 2013). Remote work is accessible in both developed and developing countries to prove that remote work resists geographical boundaries. As laws vary from country-specific, it is essential to provide legal frameworks to support firms adopting remote work technologies, especially in this age of technology proliferation. Further, regulatory support from the government is found to be a significant determinant of IT success and positively correlates with IT adoption (Chen, Li, & Chen, 2021).

H8: Regulatory support has a positive impact on RWS adoption.

2.4. Technology organisation environment outcome

Interest in future related technologies or innovation: Beyond the TOE framework and its antecedents, this study investigates how organisational adoption of RWS will influence users' interest in future related technologies or innovation. Previous studies have found that satisfaction with existing innovation reduces the likelihood of adopting alternatives but increases the adoption of related new technologies (Venkatesh, Kruse, & Shih, 2003). Consequently, we expect the adoption of RWS in the post Covid-19 era to influence interest in future related remote work innovations because organisations devoted time, resources, and effort to such technologies in work deliverables.

H9: Adoption of RWS has a positive impact on interest in future related technologies.

3. Methodology

As stated earlier, the aim of the study is to examine the antecedents of contactless digital technologies, specifically remote work systems (RWS)

among different industries in a developing country context. In order to ensure the reliability and validity of survey instruments, the questionnaires for collecting data were in line with Straub (1989) design. We employed a non-probabilistic sampling strategy (Venkatesh, Brown, & Sullivan, 2016). Organisations in Ghana were the target population and a convenience sampling technique was adopted. These organisations were responsible for making technology decisions to support remote work and contactless digital activities in Ghana during the pandemic and beyond. Due to the dispersed nature of respondents across the 16 regions of Ghana, administering questions to various households was a problem.

Consequently, the use of convenience sampling approach ensured that respondents across the country were represented. Overall, questionnaires were distributed to organisations throughout Ghana via WhatsApp platforms, emails and self-administration to partake in the survey. Incomplete questionnaires were removed, while some respondents failed to fill the online version or return print copies. In all, 353 questionnaires were analysed. Of the 353 usable questionnaires, 201 were electronic copies, while 97 were print versions. The data analysis technique used is structural equation modelling (SEM). The analysis structure is as follows, demographic analysis, measurement model assessment and structural model assessment. The data was collected from June to July 2021. A data examination was conducted to check for outliers and missing data and run a normality test.

4. Findings

4.1. Demographic profile (353)

A total of 353 participants from different industries participated in the study: IT sector (10.5%), Banking and Finance (25.2%), Telecommunication (3.7%), Public sector (6.5%), oil and gas (14.4%), hospitality (8.2%), manufacturing (3.1%), real estate (6.8%), agriculture (7.1%), mining and quarry (6.0%) and marketing services (8.5%). The male represented 62.7% and 34.3% were female with a mean age of 41.2 years (SD = 3.31; 39–49 years). Approximately 90% (3/4) of the respondents had a university-level education (degree, 79.6%; masters, 11.1%) with 9.3% acquiring diploma education. Further, three-quarters of the participants (78.8%) had experienced the RWS in their first two years, indicating the surge of contactless digital technologies in the pandemic period. As shown in Table 2, other duration of RWS usage includes 3–5 years (13.9%) and 6 years and above (7.3%).

Table 2
Demographic information of respondents.

Demographic	Characteristics	Frequency	Percent
Gender	Male	232	62.7
	Female	121	34.3
Age	17–27	38	10.8
	28–38	129	36.5
	39–49	88	24.9
	50–60	98	27.8
Level of education	Diploma	33	9.3
	Degree	281	79.6
	Masters	39	11.1
Industry	IT sector	37	10.5
	Banking & Finance	89	25.2
	Telecommunication	13	3.7
	Public sector	23	6.5
	Oil & Gas, energy	51	14.4
	Hospitality	29	8.2
	manufacturing	11	3.1
	Real estate	24	6.8
	Agriculture	25	7.1
	Mining & quarry	21	6.0
	Marketing	30	8.5
Duration of remote work system usage	0–2 years	278	78.8
	3–5 years	49	13.9
	6 years and above	26	7.3

4.2. Assessment of measurement model

The internal consistency and reliability of the constructs were measured using the composite reliability and Cronbach alpha (CrA) while the average variance extracted (AVE) was used to measure the validity of the constructs. We also tested for multicollinearity issues by estimating the variance of inflation factor (VIF) of the constructs. The results show that all the VIF values are below 5. According to Hair Jr, Hult, Ringle, and Sarstedt (2016) VIF values below 5 indicate that the model can be considered free of common method bias with no pathological collinearity issue. Thus, as shown in Table 3, the constructs are reliable and valid with no multicollinearity issues.

4.3. Discriminant validity

The average variance extracted (AVE) was used to test the discriminant validity. As shown in Table 2, the AVE of each latent variable is greater than the square of the correlation coefficient of the constructs with other constructs (Hair Jr et al., 2016). Also, the Heterotrait-Monotrait Ratio (HTMT) was performed to support the AVE measure assessing discriminant validity. As shown in Table 4, the values range from 0.292 to 0.898, all below the 0.90 thresholds indicating adequate discriminant validity (Henseler, Ringle, & Sarstedt, 2015).

4.3.1. Assessment of structural model

After assessing the measurement model, the significance of the path coefficient was examined. A bootstrapping procedure with 5000 resamples was run using the Smart PLS to measure the PLS-Sem analysis (Henseler, Ringle, & Sinkovics, 2009). The goodness of fit (GOF) was estimated using the R^2 determination coefficient. According to Henseler et al. (2009), R^2 values can be classified as weak (0.25), moderate (0.50) or substantial (0.75). Table 6 shows a substantial value of 0.609 (approximately 61% endogenous factor variation). Fig. 2 also shows the PLS results of the structural model with its path coefficient values.

We further examined the goodness of fit indices with SRMR and NFI. Standardised root mean square residual (SRMR) is an absolute measure fit for establishing the approximate fit index. The SRMR ranged from 0.061 to 0.074. According to Hu and Bentler (1998), SRMR index between 0 and 0.08 with a comparative fit index (CFI) greater than 0.95 indicate an acceptable range. The incremental fit indices were obtained using the Normed Fit Index (NFI). The NFI results in values between 0 and 1. The closer the NFI values to 1, the better the fit (Henseler et al., 2015; Hu & Bentler, 1998). Table 5 shows the NFI values.

Path coefficient measures specific endogenous constructs, and its significance is determined by the t-value that corresponds to the associated p-value (significance level). Out of the eight independent variables, four (were the significant antecedent of RWS with *p*-values less than 0.05 (see Table 7). The significant antecedents include relative advantage, complexity, organisational readiness and competitive advantage. Also, RWS adoption significantly predicted users' interest in future technologies.

Table 3
Construct reliability and validity.

Constructs	Composite Reliability	VIF	rho_A	(AVE)	CrA
Competitive Advantage	0.947	3.390	0.888	0.899	0.888
Interest in Future Related Tech	0.902		0.853	0.755	0.840
Mgt Support	0.856	1.778	0.755	0.665	0.750
Compatibility	0.826	2.880	0.736	0.617	0.700
Organisational Competence	0.918	4.841	0.866	0.789	0.866
Complexity	0.897	2.699	0.850	0.745	0.828
Organisational Readiness	0.918	1.285	0.878	0.788	0.866
RWS Adoption	0.929	1.000	0.887	0.813	0.885
Regulatory Support	0.934	4.107	0.895	0.825	0.894
Relative Advantage	0.903	3.404	0.879	0.757	0.841

Table 4
Discriminant validity with Heterotrait-Monotrait Ratio (HTMT).

Factors	COA	IFT	MGT	ORC	OCO	ORX	ORR	RWS	RES	RAD
Competitive Advantage										
Interest in Future Tech	0.752									
Mgt Support	0.406	0.442								
Compatibility	0.540	0.533	0.859							
Competence	0.854	0.819	0.452	0.590						
Complexity	0.535	0.543	0.694	0.898	0.585					
Readiness	0.292	0.390	0.489	0.492	0.334	0.478				
RWS Adoption	0.712	0.890	0.407	0.471	0.754	0.527	0.392			
Regulatory Support	0.793	0.782	0.477	0.532	0.832	0.526	0.324	0.699		
Relative Advantage	0.781	0.799	0.442	0.518	0.895	0.521	0.368	0.741	0.836	

Table 6 also shows the effect size of each path in the model. Cohen's f^2 was used to assess the effect size and the idea is that less than 0.02 shows no effect (Chin, 1998). The f^2 values can be classified as small (0.02), medium (0.15) and large (0.35) effect sizes.

5. Discussion

This study investigated the antecedents of remote work systems from the TOE framework. The aim was to provide organisations useful insight

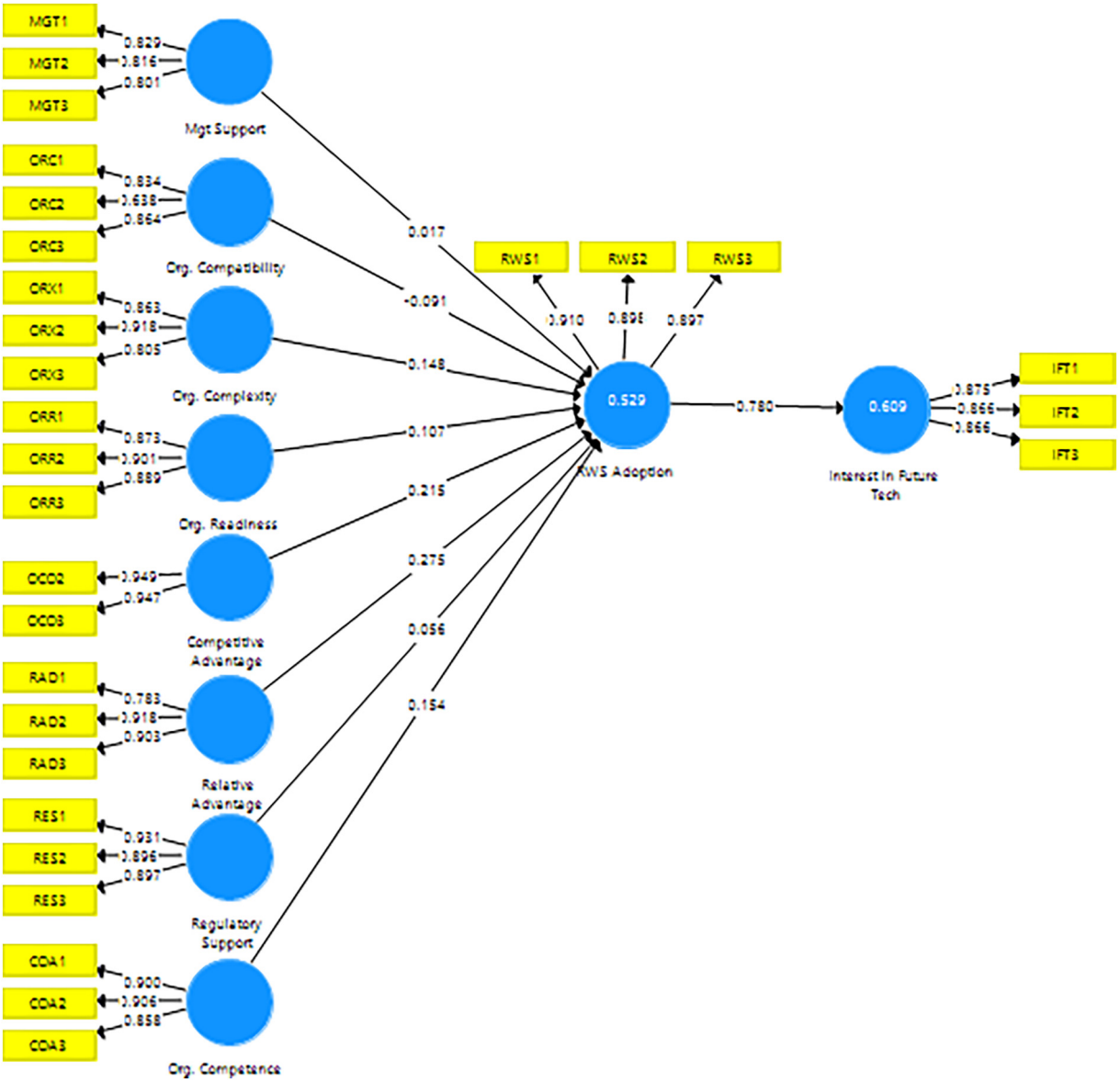

Fig. 2. Structural model with path coefficients values (PLS results).

Table 5
Model Fit.

	Saturated Model	Estimated Model
CFI	0.900	0.960
SRMR	0.061	0.074
NFI	0.883	0.875

Table 6
R Squared.

Dependent Variable	R Square	R Square Adjusted
Interest in Future Tech	0.609	0.608
RWS Adoption	0.529	0.518

into contactless digital technologies adoption during a crisis period. Fig. 3 shows the research model summary of the path coefficient of the antecedents of RWS. Among the determinants, relative advantage recorded the highest value, followed by competitive advantage. This shows that the most important factor of contactless digital technologies, i.e. RWS adoption in developing country context is relative advantage.

5.1. Technological characteristics

The initial components of technological characteristics were relative advantage, complexity and compatibility. However, after data analysis, compatibility was dropped remaining RAD and ORX. In remote work adoption, the significance of relative advantage has been established in literature (Chan, Fang, & Li, 2019). The positive relation may be due to the relatively new technology, technical know-how and how the innovation is perceived as useful in times of crisis. Further, the findings indicate that more RWS usage will be achieved if more advantages are derived from the RWS adoption. Hence, beyond adoption, usage is very critical to the success of remote work. Thus, organisations will realise the potential advantages of RWS once they patronise and engage its usage. According to Hester (2009), users who consistently use the implemented RWS are better placed to recognise the comprehensive understanding and functionalities of the system and advantages compared to the traditional systems. In this regard, organisations that meet their potential user's expectations of a system are more likely to achieve the maximum payoff from RWS adoption in a developing country context.

ORX also positively impacted the adoption of remote work systems, consistent with previous studies (Chatterjee, Rana, Dwivedi, & Baabdullah, 2021). This concept reveals that when users perceive RWS as not complex and challenging, they perceive the technology as useful and effortless. Further, Weber and Pliskin (1996) view that such virtual information systems are not isolated systems, and firms should incorporate it effectively with the business processes. Effective integration requires time and resources to be sufficiently understood. The findings revealed that managers and decision-makers from different industries in Ghana face difficulties in implementing RWS usage. As initially stated, the lack of necessary skills and know-how of the functions and tools of RWS can inhibit system utilisation. Consequently, to eliminate or minimise users' hostile attitudes towards RWS or encourage routine use, training programmes should be regular to serve as future payoffs for organisations interested in information systems.

On the contrary, previous studies found compatibility as a determining factor of remote work technologies. This study found that compatibility is not a significant factor for decision-makers to use when implementing RWS in Ghanaian industries. Although, the nonsignificant relationship is consistent with Low et al. (2011) and Chatterjee et al. (2021) results. There are many reasons to account for the nonsignificance of organisational compatibility. The first is that RWS is a sophisticated and innovative technology, and it is likely to be incompatible with organisational processes or potential users, especially with the sudden unexpected Covid-19 provision. Another possible interpretation

Table 7
Path coefficient and effect size.

Path	Coefficient β	Standard Deviation (STDEV)	T Statistics	f^2 Values	*P* Values	Support for Model
Relative Advantage - > RWS Adoption	0.275	0.084	3.278	0.047	0.001	Yes
Compatibility - > RWS Adoption	−0.091	0.068	1.345	0.006	0.179	No
Complexity - > RWS Adoption	0.148	0.063	2.341	0.017	0.020	Yes
Top Mgt Support - > RWS Adoption	0.017	0.066	0.258	0.001	0.796	No
Org. Competence - > RWS Adoption	0.154	0.094	1.646	0.009	0.100	No
Org. Readiness - > RWS Adoption	0.107	0.046	2.354	0.018	0.019	Yes
Competitive Advantage - > RWS Adoption	0.215	0.083	2.603	0.029	0.010	Yes
Regulatory Support - > RWS Adoption	0.056	0.089	0.621	0.006	0.535	No
RWS Adoption - > Interest in Future Tech	0.780	0.032	24.175	0.557	0.000	Yes

Table 8
Identified industry opportunities and challenges.

Firm Characteristics	Opportunities	Challenges
Technological	Improve compatibility between different contactless technologies i.e. RWS	How can organisations ensure that work performance and customer service be driven via contactless digital technology platforms?
	Expand contactless technologies and services to remote areas. *Reduce the poverty gap by minimizing the gap between online and offline activities in developing countries*	*Issues with access and system challenges must be resolved promptly*
Organisational	Promote education and training to propel top management support	How can contactless technologies create value for customers and employees through the RWS platform
	Organisational (technology) readiness (ORR) is critical to adoption. *ORR = customers and organisation mental orientation on new technologies (RWS)*	*Promote efficient and effective business model through RWS platform*
Environmental	Improve trust-building among stakeholders and regulatory support	The digital platforms are not mature enough in developing countries. Hence, firms should develop effective approaches to meet (non)-face-to-face customers and services.
	Enhance contactless technologies for providing training, service delivery and work performance	
	Safe environment that prevents loss of control over personal information	*The need for RWS regulations for remote services to reduce perceived privacy risks*

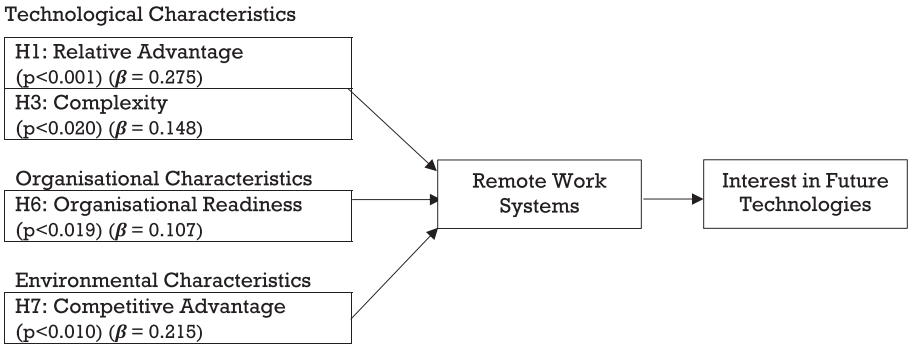

Fig. 3. Remote work adoption model. Technological Characteristics.

is that compatibility may not be directly related to RWS adoption in Ghana but indirectly via other mediating or moderating variables.

5.2. Organisational characteristics

The antecedents of organisational characteristics for RWS adoption constituted the management support, organisational competence and organisational readiness. However, only organisational readiness remained after data analysis, implying management support and organisational competence had no significant impact on RWS adoption. The positive impact of organisational readiness is consistent with prior studies (Pan & Jang, 2008; Ransbotham, Kiron, Gerbert, & Reeves, 2017) as it is considered a vital antecedent of technology adoption. In this regard, if appropriate remote work technologies are available with trained users, the likelihood of adopting RWS will be high with fewer impediments.

The non-significance of top management support and organisational competence in RWS adoption in developing countries may be due to many reasons. First, the non-significance of competence may be explained by users' prior experience, knowledge, skills and abilities with similar technologies in line with job-related performance. In most firms in Ghana, the minimum qualification for entry jobs is a first degree (79.6%), as shown in Table 2. Hence, the level of competence is available. With prior experience with similar technologies, employees find themselves competent in using RWS and other new technologies. Thus, the nonsignificant role of organisational competence can be attributed to the technical knowledge and proficiency to work with and understand RWS. Second, other studies have found the positive impact of top management support (Chatterjee et al., 2021; Senyo et al., 2016) on the adoption of RWS. This study found a nonsignificant relationship in this context. The reason associated with the non-significance may be due to the weak top management support and participation in championing the organisations' RWS agenda. Although top management participation in technology management is primarily based on their beliefs system and not the objective reality, Liang, Saraf, Hu, and Xue (2007) posit that a stronger top management belief about the remote work adoption would only lead to higher-level participation of top management in RWS processes. Thus, a higher level of participation and support from top management in the RWS process is required to lead to a greater extent of RWS adoption and integration within organisations in developing countries.

5.3. Environmental characteristics

The environmental characteristics constituted competitive advantage and regulatory support. Competitive advantage had a positive impact on RWS adoption and proved to be a significant antecedent of contactless digital technology. This concept is supported by prior studies (Curran & Purcell, 2017; Wang et al., 2010). This indicates that the use of contactless digital technologies, i.e., RWS would provide a competitive advantage to organisations during a pandemic compared to organisations that do not use it. Also, the nonsignificant antecedent of competitive advantage reported in Alshamaila et al. (2013) conducted in a developed country shows the importance of context when examining technology adoption – organisations respond differently per the context of operation.

The insignificant role of regulatory support (government involvement) on RWS is inconsistent with Chen et al. (2021) study in telecom companies in China. There are many reasons that can be assigned to this finding. Importantly, contactless digital technologies highly sprung during the Covid-19 pandemic and therefore assume an infant status in developing countries yet to achieve policy regulation consideration as compared to China. Hence, its regulatory support system is not grounded in the organisational structures in Ghana, especially in a virtual work environment. Also, the rate at which remote work technologies and technology grew during the pandemic surpasses legislation. Consequently, adoption and associated regulatory support may be considered less important to organisations than their survival in pandemic times.

5.4. Interest in future related technologies/innovations

The adoption of RWS was a significant antecedent of users' interest in future technologies deployed by the organisation. This implies that adopters of contactless digital technologies are satisfied with the RWS innovation and are interested in adopting future innovation for organisational growth. With the outbreak of covid-19, users are more open to new technologies that offer solutions and reduce in-person contact, hence the interest in adopting future innovations in developing countries. Based on the results of the research model on the TOE framework, we summarise the opportunities and challenges that the pandemic has brought to firms in developing countries (see Table 8).

6. Conclusion

The study examined the factors that determine RWS adoption across Ghanaian industries through the TOE framework lens. Through a quantitative method design and the contextualisation of the TOE adoption model, our study provides different motivations for organisations deploying remote work technologies in developing countries to meet the new normal. Eight main constructs were employed in the study. Four (relative advantage, complexity, organisational readiness and competitive advantage) of the constructs had a significant impact on contactless digital technologies adoption. At the same time, the remaining four (compatibility, top management support, competence and regulatory support) were insignificant antecedents in a developing country context. The significance of the TOE framework recon the need that technology adoption cannot be approached only from a single context, especially in the new normal.

Similarly, when organisations are promoting work from the home policy with contactless digital technologies, such as RWSs, the adoption challenges should be approached from a context-based. Hence, organisations need to pay more attention to the positive influence of contactless digital technologies in developing countries.

6.1. Practical implications

Practically, this paper has proved that it is not enough for Ghanaian firms to focus solely on technological characteristics, mainly relative advantage and complexity of RWS. They must ensure the organisational readiness of the users, the processes, culture and systems, and consider the environmental characteristics (competitive advantage) as essential factors that can affect their investment in RWS. Furthermore, decision-makers and managers venturing into remote work are better positioned to understand and identify the resources and supports required in a developing country to attain maximum payoff from RWS adoption and usage within organisations. As organisations adopt a hybrid work due to Covid-19 protocols, this research contributes to Ghanaian firms' critical evaluation of virtual work climate and usage behaviour.

Also, as platform-based services increase in emerging economies like Ghana, the employee needs and the organisational competency must be balanced to fit the evolving digital climate. The evolving digital environment has shifted the delivery of platform-based services from physical settings to remote or digital spaces, as postulated by this study. As such, organisations seeking to adopt a remote work policy should be open to the evolving digital environment which may result in multiple organisational architectural models and adaptation challenges due to systemic and pandemic implications (Farrow, 2022). Remote work systems providers should make organisations aware of digital technologies and services and benefits that can promote their work processes through virtualisation. Importantly, adoption occurs when an organisation decides to use the RWS and services. In this regard, organisations' initial experience with the RWS services will have a significant impact on continual use intention and promotion of remote work as a viable option in developing countries post Covid-19. Thus, organisations must ensure the availability of RWS platforms and continuous improvement of the system quality to minimise early rejection.

Furthermore, our study demonstrates the lack of the traditional TOE framework to comprehensively address remote work adoption and systems decisions in developing countries in the new normal. Consequently, organisations and decision-makers need to consider practical standards and remote work catalysts along with the traditional TOE framework. Also, the nonsignificant factors in the traditional TOE framework may account for new factors to be considered by organisations. For instance, the technological characteristics may consider inherent innovativeness a critical dimension, especially with the rapid advancement of technology. The organisational characteristics may need to include training as a single dimension in the traditional TOE. In contrast, the environmental characteristics need to consider intrusion or malicious control of the computing environment or infrastructure.

6.2. Limitations and future research

Several limitations exist in this study which creates opportunities for future research. First, the study collected data from a developing country. Although Ghana is a fascinating country for the study of contactless digital technologies (given the recent technology penetration in the sub-region surrounding remote work), future studies from other developing countries should account for regional and cultural differences to validate our results. Second, future studies should employ a qualitative research method to test the antecedents for in-depth analysis and a deep understanding of organisational issues. Also, the proposed model was not tested in the organisations from the different industries in Ghana. Future studies can investigate whether the experience and remote work technologies are identical among the various industries.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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