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A Revised Technology–Organisation–Environment Framework for Brick-and-Mortar Retailers Adopting M-Commerce

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Abstract: This paper argues that brick-and-mortar retail Small and Medium Enterprises (SMEs) can benefit significantly from the capabilities of mobile commerce (m-commerce) to respond to the unpredictable changes in the business environment, accommodate new consumer experiences, boost sales of products/services, and achieve a competitive advantage. Consequently, this study explored the potential application of the Technology–Organisation–Environment (TOE) framework for m-commerce by brick-and-mortar retail SMEs. The study adopted the positivist paradigm and followed a cross-sectional study design. A structured questionnaire was used to collect data from a sample of 263 retail business personnel. The Analysis of Moment Structures (AMOS) software was used to analyse the data. The findings unveil that all the proposed constructs associated with the organisational context and technological context are critical for the use of m-commerce. The proposed framework provides a fresh set of contextual variables which align with brick-and-mortar retailer operations and mobile commerce practices. It is envisaged that the extended framework may help conventional businesses to understand and identify the requisite factors in the adoption and use of m-commerce and assist business supporters in the process of technological innovation transfer.

Keywords: brick-and-mortar retailer; mobile commerce (m-commerce); mobile technology; retailer; retailing; Small and Medium Enterprises (SMEs); Technology–Organisation–Environment (TOE); Angola; Luanda

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1. Introduction

Brick-and-mortar retail Small and Medium Enterprises (SMEs) have been compelled to consider new electronic commerce (e-commerce) channels such as web commerce and mobile commerce (m-commerce) as strategies to respond to continuous uncertainty and unpredictable changes in a dynamic business environment, to accommodate new consumer experiences (Kamble et al. 2019; Prasanna et al. 2019; Finotto et al. 2020; Kaatz 2020), and to remain competitive (Gavrila and de Lucas Ancillo 2021). However, they continue to struggle to incorporate a digitalised business model into their traditional sales channels (Ngongo et al. 2019; Singh et al. 2019; Gavrila and de Lucas Ancillo 2021). Records on the above reveal that brick-and-mortar retail SMEs do not have a comprehensive understanding of all the aspects involved in delivering complex and scalable m-commerce systems (Siwundla 2013; Muzima and Gallardo 2017; Singh et al. 2019). Although the complexities of digitalised business models have decreased due to third-party software providers offering affordable and customised solutions to SMEs (Gavrila and de Lucas Ancillo 2021), these enablers are not immediately obvious. Making effective and efficient use of m-commerce for electronic retailing requires a comprehensive understanding of the role of each underlying factor involved and the existence of connections between those factors. It requires a detailed structural design within the level of alignment of retailer operations and m-commerce practices (EY 2015; Verhoef et al. 2015; Chen 2017; Kamble et al. 2019; Kaatz 2020).

Thus, this explored the use of a framework for mobile commerce by brick-and-mortar retailers. In dealing with the complexities surrounding businesses' adoption and use of new

technologies, the Technology–Organisation–Environment (TOE) framework and the Task–Technology Fit (TTF) model have been widely used as fundamental theories in different fields, including Information Systems and Marketing (Goodhue and Thompson 1995; Gebauer and Shaw 2004; Zhu and Kraemer 2005; Zhu et al. 2006a; Lu et al. 2015; Wang et al. 2016; Chatterjee et al. 2021). Although technology adoption models advanced by prior research have provided useful information, they also tend to cover limited determinants of new technology adoption and use (e.g., m-commerce) at a business level (Shih and Chen 2013; Gangwar et al. 2015; Wang et al. 2016; Justino et al. 2021). We believe that adding contextual variables into a basic theoretical model or integrating two relevant models would better explain how brick-and-mortar retailers can adopt m-commerce. Thus, the study applies the TOE framework to investigate the different contexts of inter-related components that create the right environment for the use of m-commerce by brick-and-mortar retailers in developing countries. The TOE framework explains how the components of the business environment hold substantial sway on the business technology innovation decision-making (Tornatzky and Fleischer 1990; Lippert and Govindarajulu 2006; Baker 2011; Chau et al. 2020; Chatterjee et al. 2021). It segments the business environment into three variables or contexts, i.e., the organisation, the technology, and the environment, which lead to technology adoption decisions. Thus, it considers which variables in the business environment would play a part in the use of m-commerce for brick-and-mortar retailers. The following discussion concerns the theoretical foundation and factors that align with the retail sector.

2. Literature Review

2.1. The Technology–Organisation–Environment (TOE) Framework

Previous studies adopted the TOE framework to attempt to match the characteristics of technology and those of the internal and external environment of the organisation to bring about a good explanation of the use of new technology (Zhu et al. 2006b; Wang et al. 2016; Chau and Deng 2018; Eze et al. 2019; Chau et al. 2020; Chatterjee et al. 2021).

The environmental context: The environmental context of the TOE framework reflects the external characteristics of the business environment that accounts for the use of the innovation (Tornatzky and Fleischer 1990). It defends the idea that the environment in which the entrepreneur conducts business would determine their technology-adoption decision. That is, the adoption of technology is associated with certain combinations of environmental characteristics that would play a part in the technology integration process. However, constructs of the environmental context in TOE research have been analysed as dependent-partner readiness (Lippert and Govindarajulu 2006), business partner support (Lu et al. 2015), or critical mass (Wang et al. 2016) and customer pressure (Chau et al. 2020) to describe customer demand or readiness for the uptake of the proposed technology. Other evaluated constructs include competitive pressure (Zhu and Kraemer 2005; Lu et al. 2015; Wang et al. 2016; Eze et al. 2019; Chau et al. 2020; Chatterjee et al. 2021); and regulatory influence (Lippert and Govindarajulu 2006), regulatory support (Zhu and Kraemer 2005; Lu et al. 2015), or government support (Chau et al. 2020) to describe government policies and regulations' intervention.

Technological context: TOE suggests that a business should consider the characteristics of the technological structure of its internal and external settings (Baker 2011; Martín et al. 2012; Wang et al. 2016; Eze et al. 2019; Chau et al. 2020). The entrepreneur should take cognizance of the important technology the business already has and that is available in the external environment before adopting and using new technology. However, taking cognizance of the existing technological structure would help the firm define its limitations and easily identify the relevant technology in the market (Baker 2011). In previous research, some divergence between constructs of the technological context can be detected. Constructs discussed in the literature include relative advantage (Jain et al. 2011; Picoto et al. 2014; Gangwar et al. 2015), data security or security of data capturing and sharing, reliability (Lippert and Govindarajulu 2006; Lu et al. 2015; Chau et al. 2020), and the complex nature of technology (Gangwar et al. 2015; Lu et al. 2015; Chau et al. 2020). However, similarities between

constructs in the technological context are also identifiable in deployability (Lippert and Govindarajulu 2006), compatibility (Wang et al. 2016; Chau et al. 2020), and adaptive capability (Eze et al. 2019), proposed to describe a good match or good fit between the new technology and the firm's existing capability and technological structure.

Organisational context: The organisational context considers the characteristics of the firm and its resources, including the quality of the employees' technology usage expertise, managerial structure, amount of resource slack (Lippert and Govindarajulu 2006; Baker 2011; Matikiti et al. 2018; Eze et al. 2019), and firm's size (Zhu and Kraemer 2005; Lippert and Govindarajulu 2006; Baker 2011; Lu et al. 2015; Wang et al. 2016). Most of the variables analysed in previous research are related to human and technological resource characteristics. Empirical research such as that of Picoto et al. (2014) and Wang et al. (2016) classify the technological competence construct of the organisational context as a critical influential factor in the adoption decision. In their analysis of the organisational setting, some authors focused on top management support (Gangwar et al. 2015; Lu et al. 2015; Chau et al. 2020) and perceived benefits (Lippert and Govindarajulu 2006; Chau et al. 2020) as possible support dimensions. Furthermore, in their analysis, Chau et al. (2020) also emphasise the organisational aspects such as readiness and strategic orientation factors.

Use: The technological innovation adoption decision construct of the TOE framework has been analysed as e-business use (Zhu and Kraemer 2005), e-business adoption (Zhu et al. 2006a), m-business usage (Picoto et al. 2014), e-commerce adoption (Chandra and Kumar 2018), adoption of a mobile system (Wang et al. 2016), m-commerce adoption (Jain et al. 2011; Chau et al. 2020), and mobile marketing adoption (Eze et al. 2019). Research on the TOE adapts this construct to the use/adoption of the technological innovation (i.e., m-commerce in the present study) under investigation. The use construct in TOE research has been proposed as a dependent variable, affected primarily by the technology, organisation, and environment constructs. According to Zhu and Kraemer (2005) and Picoto et al. (2014), the use context reflects how technological innovation is deployed in executing a firm's activities.

2.2. Contextual Variables

Prior study of m-commerce adoption or use has paid little attention to some contextual variables in the retail business environment. For example, brick-and-mortar retailers', especially grocery stores', readiness for electronic distribution systems may be critical for m-commerce adoption decisions. The operations of online retailers' distribution systems, particularly grocery stores, are usually perceived to be complex since the systems must be designed to ensure same-day delivery to multiple destinations but at low costs of carrier services (EY 2015; Hübner et al. 2016; Song et al. 2019). However, use decisions can be affected by the complexities surrounding the design of distribution systems (EY 2015) and/or conventional businesses' unwillingness to engage in m-commerce activities. The study presumes that a conventional business's readiness to engage in m-commerce distribution systems may be tenable for the use of m-commerce (EY 2015; Song et al. 2019; Caro et al. 2020).

Furthermore, other relevant technology support infrastructure may also encourage businesses to try new technology (Tornatzky and Fleischer 1990). Other studies have highlighted that, before the adoption of m-commerce, businesses are required to evaluate the national mobile operators' network quality (Maritz 2014; Poulson 2014; GSMA 2015; Chatterjee et al. 2021), the availability of electronic payment gateway systems (Masihuddin et al. 2017; Yang and Lin 2018; Chatterjee et al. 2021), and the availability of government and/or nongovernment technological co-operative institutions in the economy (Chatterjee et al. 2021). This suggests that there should be at least a: nationwide public mobile operator available, able to overcome the long distances by providing timely access to mobile services; payment gateway that plays a central role in the interaction between the stakeholders involved in the mobile electronic payment systems; and technological co-operative institutions that exercise elements of control and online arbitration, and provide support or direct subsidies towards ICT infrastructures and training of personnel of the business (The Earth Institute & Ericsson 2016).

3. Conceptual Framework

This study proposes an extended TOE framework for the use of m-commerce by brick-and-mortar retailers. Figure 1 shows the extended framework for explaining and determining the use of m-commerce. The framework also incorporates some relevant determinants of the use of m-commerce identified in the literature. The study assumes that the proposed framework will provide the necessary window through which the phenomenon under investigation will adequately be understood and interpreted for the following reasons: the constructs of the organisational context are used to determine the factors in the brick-and-mortar retailer's internal environment that is requisite for the use of m-commerce; the constructs of the technological context are adapted to explore the m-commerce technological characteristics that are requisite for the use of mobile channels in brick-and-mortar retailers; and the environmental context is proposed to determine the elements within the business's external environment that are requisite for the use of m-commerce by brick-and-mortar retailers. Each proposed construct is discussed below.

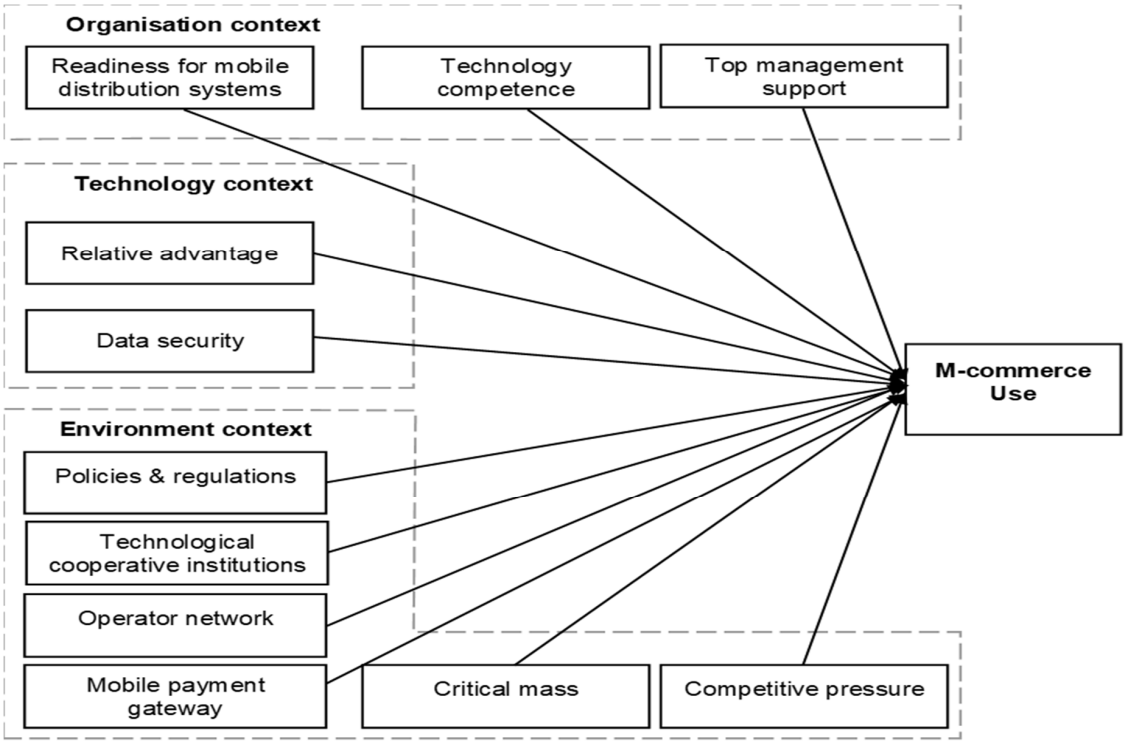

Figure 1. Conceptual framework.

Relative advantage and data security: Before adopting or using technology, businesses tend to evaluate the involved costs and benefits as determinants (Picoto et al. 2014; Wang et al. 2016). Relative advantage reflects the extent to which a technology is perceived to offer a business intrinsic value over the alternative or existing technology (Jain et al. 2011). Thus, this study presumes that the relative advantage construct of technological context influences retailers' use of m-commerce. The advantages include better profitability (Chandra and Kumar 2018), increased market share, speeding up a business process, helping to lower costs (Wang et al. 2016), helping to increase sales, reducing paperwork, and speeding up data capture/analysis (Picoto et al. 2014). Data security has been analysed in some earlier studies (Lu et al. 2015; Chau et al. 2020). Thus, data security reflects the extent to which the stored data/information and the transactions across the Internet are protected against crimes and threats (Lu et al. 2015). This study assumes that an m-commerce system with tighter security measures would influence brick-and-mortar retailers to trust it, adopt it, and use the system (Eze et al. 2019). The present study proposes the following Hypothesis 1 (H1) and Hypothesis 2 (H2):

Hypothesis 1 (H1). *The perception of the relative advantage of m-commerce has an impact on m-commerce use.*

Hypothesis 2 (H2). *The perception of m-commerce systems' data security has an impact on m-commerce use.*

Top management support and technology competence: The theoretical framework presumes top management support (i.e., senior management's favourable response or attitude towards the integration) of m-commerce as a predictor of use (Lu et al. 2015; Wang et al. 2016). Businesses are more likely to adopt m-commerce when top managers are interested in creating a vision that incorporates m-commerce adoption (Wang et al. 2016).

Top management support shows commitment to the integration. Factors such as top management's willingness to invest funds, take risks, and gain competitive advantage have been analysed to measure top management support for new technology (Wang et al. 2016; Prabowo et al. 2018; Chatterjee et al. 2021). The technology competence results from internal organisational resources, such as the technology infrastructure, personnel, and their associated characteristics that will facilitate the use of the innovation. The organisational resources associated with m-commerce use would be based on existing information systems' infrastructure, employees with m-commerce-related skills, and facilities for providing m-commerce-related training to employees (Zhu and Kraemer 2005; Picoto et al. 2014; Wang et al. 2016; Prabowo et al. 2018; Chau et al. 2020). Firms that reach a high level of technological competence, i.e., are endowed with IT professionals and IS, are believed to have the foundation for the mobile channel (Martín et al. 2012; Wang et al. 2016; Chatterjee et al. 2021). Therefore, the following Hypothesis 3 (H3) and Hypothesis 4 (H4) are proposed:

Hypothesis 3 (H3). *The top management support has an impact on m-commerce use.*

Hypothesis 4 (H4). *The business's technology competence has an impact on m-commerce use.*

Readiness for mobile distribution systems: Readiness for mobile distribution systems reflects a business's willingness or preparedness to engage in m-commerce delivery services and return of goods. Since the brick-and-mortar retailers must either develop grocery service delivery systems of their own (a new department) or outsource them (Goddard 2020; Finotto et al. 2020), the strategically ready retailer can configure its delivery system and take over responsibilities such as online stock, online delivery (e.g., home delivery, store pickup), return costs, return process, and delivery speed (EY 2015; Hübner et al. 2016). Thus, the following Hypothesis 5 (H5) is made:

Hypothesis 5 (H5). *Retailer's readiness for mobile distribution systems has an impact on m-commerce use.*

Policies and regulations and technological co-operative institutions: Policies and regulations reflect the demand for state and international laws that govern digital business operations (e.g., m-commerce) and the use and storage of data/information in each business sector or industry. The adoption and use of m-commerce would force a business to establish new relationships with its partners. Therefore, state laws should deal with businesses' digital operation issues such as legal obligations, partners' data, online transactions, and the use of devices such as credit cards and debit cards (Zhu and Kraemer 2005; Chau et al. 2020). However, the availability of technological co-operative institutions was deemed important, in that most retailers in developing countries fall mainly into the two categories—SMEs always have a limited number of workers and limited revenue and often lack financial resources or basic ICT infrastructure for the use of new technology (Siwundla 2013; EY 2015; Prasanna et al. 2019). Thus, these institutions are needed to subsidise the information systems or m-commerce infrastructure and training of business personnel and promote science, technology, and innovation to the business (The Earth Institute & Ericsson 2016;

Chatterjee et al. 2021). Therefore, the present study presumes that the availability of technological co-operative institutions in the market is a requisite factor for the use of m-commerce by retailers. Given the above, the following Hypothesis 6 (H6) and Hypothesis 7 (H7) are made:

Hypothesis 6 (H6). *State policies and regulations have an impact on m-commerce use.*

Hypothesis 7 (H7). *Technological co-operative institutions have an impact on m-commerce use.*

Critical mass and competitive pressure: Critical mass is considered when the adoption of technology is at a tipping point and when the level of the adoption becomes self-sustaining (Wang et al. 2016). It considers the number of individuals who have adopted mobile technology, the popularity of online shopping, and the groups of potential online customers that are smartphone/tablet and internet users (Kapurubandara and Lawson 2006; Chau et al. 2020). The relationship between critical mass and the use of m-commerce has been supported (Wang et al. 2016). Competitive pressure refers to peer group pressure and its tendency to push members to use new technology and seek competitive advantage through innovation (Lu et al. 2015). Retailers may experience competitive pressure from competitive disadvantage, degree of technology influence, or degree of competition in local and national markets (Zhu et al. 2006a; Picoto et al. 2014). Furthermore, competitive pressure as an antecedent of the use of technological innovation has been supported (Picoto et al. 2014; Chau et al. 2020). Thus, the following Hypothesis 8 (H8) and Hypothesis 9 (H9) are proposed:

Hypothesis 8 (H8). *Critical mass has an impact on m-commerce use by retailers.*

Hypothesis 9 (H9). *Competitive pressure has an impact on m-commerce use by retailers.*

Operator network and mobile payment gateway: The operator network is concerned with the characteristics of mobile operators' network service at the national level. The mobile operators' network services should be of good quality and able to overcome the long distances by providing timely access to mobile services for subscribers in general independently of their local, national, and international positions (Maritz 2014; Poulson 2014; GSMA 2015). It should be able to effectively enable interconnectivity across different networks (Wamuyu and Maharaj 2011; GSMA 2015). Therefore, the provision of adequate availability of mobile bandwidth and efficient support service by mobile operator networks may contribute to the use of m-commerce (Picoto et al. 2014; Kamble et al. 2019). A mobile payment gateway is a third-party organisation that manages the payment mobile electronic systems. It strives to make the online financial transaction as accurate as possible and reports to all the parties involved, including the merchant, online client, merchant's bank, and online client's bank (Masihuddin et al. 2017; Kalbande 2019; Thangamuthu 2020). The mobile payment gateway ought to oversee the security architecture, reliability, and speed of seamless monetary transactions, which ensure the privacy and security of sensitive information (Bezovski 2016; Masihuddin et al. 2017; Naeem et al. 2020). Thus, the following Hypothesis 10 (H10) and Hypothesis 11 (H11) are proposed:

Hypothesis 10 (H10). *Mobile operator network has an impact on m-commerce use by retailers.*

Hypothesis 11 (H11). *Mobile payment gateway has an impact on m-commerce use by retailers.*

Mobile commerce use: Research on TOE has indicated that the use of m-commerce systems should reflect the extent to which the mobile system is used to support the firm-related technological processes. It has been suggested that the use should be derived from the rate or number of certain tasks (e.g., customers' orders, sales, businesses' orders) conducted

through using the mobile system (Zhu and Kraemer 2005), the system's immediate support to workers, and system support to sales activities (Picoto et al. 2014).

4. Research Methodology

This study was conducted in line with a positivist research paradigm and used a cross-sectional study design. Following the quantitative research approach, this study mainly relied on measures developed by prior studies to construct the questionnaire (see Appendix A). All items were rated on a 7-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree. Considering the population of 1867 formal, registered SMEs in Luanda province (INAPEM 2018) and the type of data to be analyzed (continuous data), the sample size was estimated at 171 respondents (Bartlett et al. 2001). Using the area sampling approach (Sarantakos 1998; Gravetter and Forzano 2009), the Luanda geographical region was stratified by districts, then by distinctive areas, and then by streets; consequently, the retail SMEs in six of the seven districts (i.e., Luanda, Viana, Cacuacu, Cazenga, Belas, and Kilambakiaxi) were identified. These businesses were first reached via email and/or telephone and then at their premises after arranging meetings to deliver and collect questionnaires. As such, the questionnaire was distributed to 263 retail business personnel in the Angolan province of Luanda. In total, 240 questionnaires were returned; therefore, the assessment of data screening for defect and incompleteness were performed using the randomisation and percentage of missing data principles (Gallagher et al. 2008), and 229 questionnaires were suitable for analysis (Bartlett et al. 2001). The descriptive analysis approach and Structural Equation Modeling (SEM) analysis were performed using Statistical Package for the Social Sciences (SPSS) software and Analysis of Moment Structures (AMOS) software.

Furthermore, the data were screened for the detection of outliers. The potential outliers were identified using both standardised (Z) scores and univariate detection. Since the potential outliers were not above the threshold for Z score (4), they were retained (Gallagher et al. 2008), and multiple regressions amongst the dependent variables and independent variables were performed to assess the model's collinearity. However, there were no independent variables with tolerance below 0.20 or Variance Inflation Factor (VIF) above 5. Thus, there was no concern about collinearity (Cohen et al. 2007).

Table 1 shows the model fit for the measurement model. Thus, the measurement model shows acceptable fit-indexes scores, except for the score of the Goodness-of-Fit Index (GFI), which was expected to be 0.90 (p-value > 0.05) (Schermelleh-Engel et al. 2003).

Table 1. Goodness-of-Fit for measurement models.

GOF Indices	TOE	Recommended Value
Chi-square per degree of freedom (X^2/df)	1.745	≤3
Probability (P)	0.000	>0.05
Comparative Fit Index (CFI)	0.940	>0.900
Incremental Fit Index (IFI)	0.941	>0.900
Goodness-of-Fit Index (GFI)	0.797	>0.900
Roots Mean Square Error of Approximation (RMSEA)	0.057	<0.080

For constructs' validity and reliability, Table 2 shows the factor loadings for each indicator and the composite reliability and AVE for each construct. The factor loadings ranged from 0.582 to 0.992 and the composite reliability ranged from 0.808 to 0.983. Thus, all constructs had achieved acceptable internal consistency reliability (Gallagher et al. 2008; Hair et al. 2011). Tests of the convergent validity and discriminant validity were also performed. The Average Variance Extracted (AVE) was assessed to determine the construct's convergent validity. All constructs scored above 50 for AVE, which is acceptable (Gallagher et al. 2008; Hair et al. 2011). For constructs' external validity, the discriminant validity was established by assessing the cross-loadings of observed variables (see Appendix B) and

determining the square root of a construct's AVE and comparing it with its correlations (see Table 2). Each observed variable's factor loading on the associated latent variable has exceeded all its factor loadings on dissociated latent variables, and each construct's squared root of AVE were greater than its correlations (Gallagher et al. 2008; Hair et al. 2011). Once the assessment of the measurement model and the constructs' internal consistency reliability, the convergent validity, and discriminant validity were carried out, the structural model was specified and run.

Table 2. Variables: loadings, composite reliability, and AVE.

Variable	Indicators	Factor Loading	Composite Reliability	AVE	Square Root AVE
Top management support	TMS1 TMS2	0.992 0.976	0.983	0.968	0.984
Readiness for mobile distribution systems	MDS1 MDS2 MDS3 MDS4 MDS5	0.915 0.933 0.853 0.919 0.821	0.949	0.790	0.889
Technology competence	TCO1 TCO2 TCO3	0.582 0.910 0.845	0.829	0.626	0.791
Data security	DS1 DS2	0.989 0.969	0.978	0.959	0.979
Relative advantage	RA1 RA2 RA3 RA4	0.790 0.850 0.807 0.763	0.878	0.645	0.803
Technological co-operative institutions	TCI1 TCI2 TCI3	0.806 0.854 0.782	0.855	0.663	0.815
Policies and regulations	PAR1 PAR2 PAR3	0.814 0.949 0.940	0.929	0.816	0.903
Mobile payment gateway	MPG1 MPG2 MPG3	0.615 0.872 0.794	0.808	0.590	0.768
Operator network	ON1 ON2 ON3	0.969 0.941 0.901	0.955	0.879	0.937
Critical mass factor	CMF1 CMF2 CMF3	0.687 0.943 0.895	0.883	0.721	0.849
Competitive pressure factor	CPF1 CPF2 CPF3	0.839 0.950 0.937	0.935	0.828	0.910
Mobile commerce use	MCU1 MCU2 MCU3 MCU4	0.877 0.816 0.852 0.798	0.902	0.699	0.836

5. Analysis

Demographic information: The demographic information in Table 3 indicates that there are proportionately more males (53.3%) than females (45%) amongst respondents. The results indicate that the large majority of respondents' ages range from 25 to 35 (39%)

and below 25 (34.5%). Most respondents have completed higher or secondary education. There was a slightly higher proportion of respondents who held at least a bachelor's degree (32%) than those who received a secondary school education (31%). Furthermore, results indicate that food products (33.2%) were the most retailed products by SMEs. After food products came shoes (25.3%) and clothing (18.3%), respectively. The other types of products largely found in the Angolan market were consumer electronic components, body care products, hair extensions, and alcoholic beverages.

Table 3. Demographic information.

Variables	Category	Percentage	Variables	Category	Percentage
Gender	Male	53.3	Age group	Below 25	34.5
	Female	45.0		25 to 35	38.9
Major product retailing	Food products	33.2		36 to 45	18.8
	Clothing	18.3		46 to 55	4.4
	Shoes	25.3		56 to 65	1.3
	Furniture	6.1	Education level	Primary school	8.7
	Music items	2.2		Secondary school	31.4
	Jewellery	2.6		Post-matric school certificate	20.5
	Other types	9.6		Bachelor's degree	32.3
				Postgraduate degree	3.5

The results of the empirical test of the model are summarised below.

Structural model—Technological context: The results in Figure 2 reflect that relative advantage (B = 0.265 ***) had a positive, strong, and significant effect on mobile commerce use. These results show that mobile commerce use fully depends on the technological context's relative advantage characteristics. The proposed relationship between relative advantage and mobile commerce use is completely supported (H1). Furthermore, the results show that the effect of data security (B = 0.174 **) on mobile commerce use is significant. These results indicate support for the proposed relationship between data security and mobile commerce use (H2). Therefore, the perception of the data security characteristics impacts the use of m-commerce.

Structural model—Organisational context: Results of the interactions shown in Figure 2 indicate that the effect of top management support (B = 0.199 ***) and technology competence (B = 0.322 **) on mobile commerce use were all positive and significant. The results show that the use of m-commerce is affected by and dependent on employees' perception of top management support and technology competence. Furthermore, the results show a negative score and significant regression (−0.126 *) for the interaction between readiness for mobile distribution systems and mobile commerce use. These results reveal that enthusiasm for mobile distribution systems increases when mobile commerce use decreases. Furthermore, these results could also mean that respondents who are willing to engage in m-commerce activities are more likely to get discouraged by their organisation's readiness to develop m-commerce distribution systems. These results support the proposed relationships between top management support and mobile commerce use (H3); technology competence and mobile commerce use (H4); and readiness for mobile distribution systems and mobile commerce use (H5).

Structural model—Environmental context: the results show that only one construct of the environmental context, the critical mass (0.347 *), had a positive and significant effect on mobile commerce use. These results support the proposed relationship between the critical mass factor and mobile commerce use (H8). The results show that policies and regulations, technological co-operative institutions, operator network, mobile payment gateway, and

competitive pressure factors did not have significant effects on mobile commerce use. These results indicate weak support for all the aforementioned insignificant relationships.

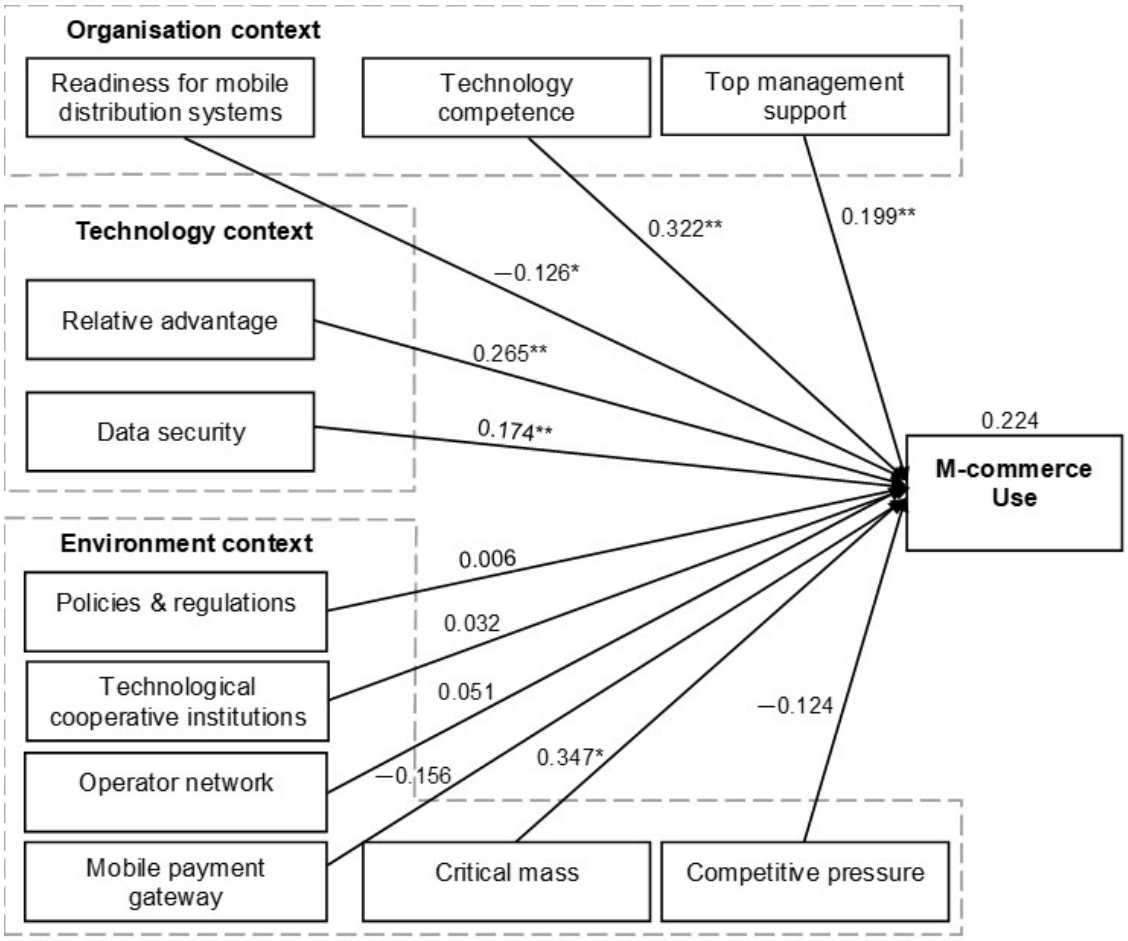

Figure 2. Structural model.

6. Discussion

The analysis presented above shows the different contexts of inter-related components that retail business personnel perceive to be helpful for creating the right environment for the use of m-commerce by brick-and-mortar retailers. This study found that the relative advantage effect on mobile commerce use in Angola is very strong and significant. This perception fully affects the use of m-commerce. These findings are consistent with prior research (Picoto et al. 2014; Chandra and Kumar 2018), which suggests that the more the retail business personnel recognise that m-commerce may help them to increase market share, lower business costs, increase the quality of customer service, or speed up the sales process, the more they will use the m-commerce systems. These added values suggest a positive synergy between m-commerce and retailer, which will outweigh a single traditional sales channel.

Furthermore, findings indicate that the effect of data security on mobile commerce use is significant. That is, when data security increases, so does mobile commerce use. Respondents are more likely to use the m-commerce systems when they feel that it operates in an encrypted way, uses authentication, and imposes strict control over information access. The findings indicate that the perception of relative advantage and data security of m-commerce is requisite for its use by retailers. Thus, Hypotheses 1 and 2 (H1, H2) are supported.

The above analysis shows that the top management support, technology competence, and readiness for mobile distribution systems significantly affect mobile commerce use. The strong relationship between top management support and new technology usage is supported by previous studies (Chandra and Kumar 2018; Chatterjee et al. 2021). These

results show that the higher the perception of the top management support, the more the technology will be used. It was found that when the organisation's top management is willing to confront the risks involved in using m-commerce, the employees are more likely to use it. The positive significant link between technology competence and mobile commerce use implies that when the organisation has the necessary resources and/or continuously focuses on the integration of new technologies and the employment of candidates who have technological skills, the possibilities of this organisation's employees to use m-commerce are high. These findings are consistent with prior studies (Zhu and Kraemer 2005; Wang et al. 2016; Chandra and Kumar 2018). Thus, Hypotheses 1 (H3) and 4 (H4) are supported.

However, the effect of readiness for mobile distribution systems on the use of m-commerce was negative and significant. These results suggest that respondents who thought very highly of mobile commerce use and rated it high were more likely to rate low in the readiness for mobile distribution systems. They may feel that their organisation is not fully prepared for m-commerce distribution services. These results further indicate that retail business personnel that are willing to accept the complexities of and engage in m-commerce delivery services and returns of goods are more likely to be caught unprepared for the adoption and use of m-commerce. Thus, Hypothesis 5 (H5) is supported.

The results revealed that the effect of critical mass on m-commerce usage is positive and statistically significant. These results are also supported by previous research (Picoto et al. 2014; Wang et al. 2016; Chau et al. 2020). In addition, the COVID-19 pandemic has also triggered a dramatic surge in customer demands for contactless store pick-up and home delivery (Finotto et al. 2020; Gamser and Chenevix 2020; Goddard 2020). The findings indicate that retail SMEs are under customers' compulsion to use m-commerce. Thus, Hypothesis 8 (H8) is supported. The other constructs of the environmental context, such as policies and regulations, technological co-operative institutions (i.e., technology business incubators, business advisory services, technical education institutions), operator network, mobile payment gateway, and competitive pressure, did not have significant effects on mobile commerce use. This means that the expected roles of these external variables in the business environment were perceived to be insignificant, that is, they are not supported. Overall, the findings indicate weak support for Hypotheses 6 (H6), 7 (H7), 9 (H9), 10 (H10), and 11 (H11).

As indicated in Table 4, the paths proposed for the extended TOE model show acceptable fit indexes (X^2/df 1.745, P 0.000, CFI 0.940, IFI 0.941, GFI 0.797, RMSEA 0.057). All the antecedents of the use of m-commerce account for 0.224 of variance in the extended model. Given the number of hypotheses that were empirically tested, and the hypotheses that were statistically significant and insignificant, the results reflect a potential explanation of the perception of retail business personnel of m-commerce in Angola (Schupbach 2011). The findings indicate that the use of m-commerce by retail business personnel in Angola depends more on constructs of the organisational context and technological context and less on the environmental context.

Table 4. Goodness-of-Fit for structural models.

GOF Indices	Structural Model	Recommended Value
Chi-square per degree of freedom (X^2/df)	1.745	≤3
Probability (P)	0.000	>0.05
Comparative Fit Index (CFI)	0.940	>0.900
Incremental Fit Index (IFI)	0.941	>0.900
Goodness-of-Fit Index (GFI)	0.797	>0.900
Roots Mean Square Error of Approximation (RMSEA)	0.057	<0.080

7. Conclusions, Limitations, and Scope for Future Research

The study successfully extended the TOE framework and assessed the critical components that create the right environment for the use of m-commerce by brick-and-mortar retailers in Angola. The extended framework provides a fresh set of contextual variables within the alignment of retailer operations and mobile commerce practices. It was found that the perceptions of relative advantage and data security constructs of the technological context, as well as top management support, technology competence, and readiness for mobile distribution systems constructs of the organisational context, fully affect the use of m-commerce. However, among the constructs of the environmental context, the critical mass is the only determinant of the use of m-commerce that was significant. This study found that the use of m-commerce in Angola is perceived to be dependent on constructs of the organisational context and technological context and less on the environmental context. Thus, we found that retail business personnel assert their readiness for mobile distribution systems, which reflects their willingness or preparedness to engage in m-commerce delivery services and return of goods.

The theoretical contribution is that this study successfully extended the TOE framework for the use of m-commerce by brick-and-mortar retailers. This study led to the development of instruments to measure readiness for mobile distribution systems and mobile payment gateway constructs. These constructs were validated in this study. The findings unveil that despite the reported constructs that significantly influence the actual use of m-commerce, the extended framework has also been a useful tool for understanding the constructs that are unavailable in Angola. Since this study followed a cross-sectional design to explore and understand the perception of m-commerce at a particular point in time, further study should focus on studying the use of m-commerce over time, to account for changes in the current situation.

The extended framework certainly has far-reaching implications for brick-and-mortar retailers to take into consideration the business personnel's views about m-commerce and understand the resources in line with m-commerce as well as a range of skills in the management of the digital business, and knowledge of the critical external components for the adoption and use of m-commerce in a developing country such as Angola. Furthermore, the extended framework may also assist business supporters in the process of technological innovation transfer, particularly in developing countries where the adoption or use of technology by SMEs is undervalued.

The study was delimited by investigating factors that are requisite for the use of m-commerce by retailers in the Angolan province of Luanda. It focused essentially on retail SMEs' personnel's perception of m-commerce usage in Angola. Thus, the findings of the study should not be generalised to other contexts. Therefore, future studies should focus on brick-and-mortar retail managers' views of m-commerce, i.e., by exploring their intention to integrate m-commerce with the existing traditional business model (Gangwar et al. 2015), as it may give additional insight into its use. Being aware that the use of m-commerce has also been a new sales channel for brick-and-mortar businesses in other developing countries, the framework established in this study should be further tested in different settings. However, due to the unavailability of some independent variables in a developing country such as Angola, it is envisaged that the proposed framework may further provide useful insight into m-commerce usage in other contexts, such as developed countries where each of the variables is normally available. Thus, future studies should consider the use of the proposed framework with multiple data collection sources to acquire in-depth knowledge about the external variables that were not supported in this study.

Furthermore, the proposed model was specially developed to explain the use of m-commerce by retail stores. Some of the variables developed and tested in the present study, such as readiness for mobile distribution systems, might not be compatible with other industries. For example, a construct such as readiness for mobile distribution systems would not fit into service industries such as financial and electricity. Therefore, future studies can explore other constructs that are compatible with the industry being evaluated.

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Data Availability Statement: The data presented in this study are available upon request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Survey Questionnaire

Q-1. Please tick the number that expresses the extent to which you agree with the statements below (where 1 = strongly disagree and 7 = strongly agree).

Table A1. Organisational context.

Item	Statements	Sources
	Top management support	
TMS1	My organisation's top management is very encouraging and willing to invest funds in m-commerce.	Wang et al. (2016)
TMS2	My organisation's top management is willing to confront the risks involved in using m-commerce.	
	Technology competence variables	
TCO1	Information and communication technology infrastructure is a requisite for the use of m-commerce.	Gangwar et al. (2015); Wang et al. (2016)
TCO2	In general, employees who have technological skills are requisite for the use of m-commerce.	
TCO3	Our organisation has the necessary resources (e.g., financial, staff, equipment) to use m-commerce.	
	Readiness for mobile distribution systems	
MDS1	My company has been prepared for the consolidation of online and offline inventories.	Hübner et al. (2016)
MDS2	My company is ready for anytime m-commerce home delivery.	*
MDS3	My company is willing to outsource some of the m-commerce home delivery services.	
MDS4	My organisation is prepared to receive customers returns of goods in the store they were bought.	
MDS5	Our organisation is prepared to receive customers returns of goods in any of our store, distribution centre, or return centre.	

* = item developed and proposed by the researcher.

Table A2. Technological context.

Item	Statements	Sources
	Relative advantage	
RA1	We expect m-commerce to help my organisation increase market share.	Wang et al. (2016)
RA2	We expect m-commerce technologies to help lower business costs.	Picoto et al. (2014)
RA3	We expect m-commerce technologies to help my organisation increase the quality of customer service.	*
RA4	We expect m-commerce to help my organisation speed up the sales process.	Wang et al. (2016)
	Data security	
DS1	We expect the m-commerce systems to operate in an encrypted way and use authentication.	Gangwar et al. (2015)
DS2	We expect the m-commerce systems to impose strict control over our organisation and business partners' (e.g., customers) information access.	

* = item developed and proposed by the researcher.

Q-2. Please, tick the number that expresses the extent to which you agree with the statements below regarding the factors of the external business environment that could influence your company to use m-commerce (where 1 = strongly disagree and 7 = strongly agree).

Table A3. Environmental context.

Item	Statements	Author
	Policies and regulations	
PAR1	The existing electronic business laws in the country.	Zhu and Kraemer (2005)
PAR2	Government incentive for the use of m-commerce.	
PAR3	Government online customer information security and privacy protection laws.	
	Technological co-operative institutions	
TCI1	The ready availability of institutions providing technological training and education programs.	Chau and Deng (2018)
TCI2	Promotion of technological innovation and awareness of m-commerce usage in the country.	
TCI3	The financial support or technological infrastructure subsidies from governmental co-operative institutions in the country.	
	Operator network	
ON1	The availability of mobile network bandwidth in the country.	Lippert and Govindarajulu (2006); Picoto et al. (2014)
ON2	The mobile operators' internet services or broadband data packages affordability.	
ON3	The mobile operators' network consistent performance or reliability.	
	Mobile payment gateway	
MPG1	The availability of secure digital payment systems for wireless financial transactions' security and privacy protection in the country.	*
MPG2	The availability of online payment options such as (credit cards, smart cards, debit cards, electronic cash) in the country.	
MPG3	The availability of organisations operating as payment gateways or providers of online payment methods in the country.	

Table A3. *Cont.*

Item	Statements	Author
	Competitive pressure factors	
CPF1	Competitive pressure in the local market.	Zhu et al. (2006b); Wang et al. (2016)
CPF2	To avoid experiencing a competitive disadvantage in the near future.	
CPF3	To avoid losing customers to our competitors.	
	Critical mass factor	
CMF1	The increasing popularity of retail online shopping in the market.	Picoto et al. (2014); Wang et al. (2016)
CMF2	Customers pressure on my company.	
CMF3	Most of our potential customers using smartphones.	

* = item developed and proposed by the researcher.

Appendix B. Discriminant Validity Test Results

Table A4. Correlation matrix for observed variables.

	TMS	TCO	MDS	RA	DS	PAR	TCI	ON	MPG	CPF	CMF	MCU
TMS1	**0.992**	−0.08	0.096	−0.039	−0.136	−0.043	−0.059	0.003	−0.059	−0.092	0.015	0.191
TMS2	**0.976**	−0.078	0.094	−0.038	−0.134	−0.042	−0.058	0.003	−0.058	−0.091	0.015	0.188
TCO1	−0.047	**0.582**	0.063	−0.007	0.034	0.141	0.073	0.051	0.074	0.073	0.06	0.122
TCO2	−0.073	**0.91**	0.098	−0.011	0.053	0.22	0.114	0.079	0.116	0.115	0.094	0.19
TCO3	−0.068	**0.845**	0.091	−0.01	0.049	0.204	0.106	0.074	0.108	0.106	0.088	0.176
MDS1	0.088	0.099	**0.915**	0.103	−0.012	0.055	0.089	−0.076	0.069	0.062	0.05	−0.072
MDS2	0.09	0.101	**0.933**	0.105	−0.012	0.056	0.09	−0.078	0.07	0.063	0.051	−0.074
MDS3	0.082	0.092	**0.853**	0.096	−0.011	0.052	0.083	−0.071	0.064	0.058	0.046	−0.067
MDS4	0.089	0.099	**0.919**	0.103	−0.012	0.056	0.089	−0.077	0.069	0.062	0.05	−0.073
MDS5	0.079	0.089	**0.821**	0.092	−0.011	0.05	0.079	−0.068	0.062	0.056	0.045	−0.065
RA1	−0.031	−0.009	0.089	**0.79**	−0.178	−0.052	−0.021	0.049	0.031	0.01	−0.036	0.137
RA2	−0.033	−0.01	0.095	**0.85**	−0.191	−0.056	−0.022	0.053	0.034	0.011	−0.039	0.147
RA3	−0.032	−0.01	0.09	**0.807**	−0.181	−0.053	−0.021	0.05	0.032	0.01	−0.037	0.14
RA4	−0.03	−0.009	0.085	**0.763**	−0.171	−0.05	−0.02	0.047	0.03	0.01	−0.035	0.132
DS1	−0.136	0.058	−0.013	−0.222	**0.989**	0.165	−0.048	−0.029	0.13	0.187	0.122	0.119
DS2	−0.133	0.056	−0.013	−0.218	**0.969**	0.161	−0.047	−0.028	0.128	0.183	0.119	0.116
PAR1	−0.035	0.197	0.049	−0.054	0.136	**0.814**	0.09	0.069	0.261	0.611	0.608	0.105
PAR2	−0.041	0.229	0.057	−0.063	0.158	**0.949**	0.105	0.081	0.304	0.713	0.709	0.123
PAR3	−0.041	0.227	0.057	−0.062	0.157	**0.94**	0.104	0.08	0.302	0.706	0.702	0.122
TCI1	−0.048	0.101	0.078	−0.021	−0.039	0.089	**0.806**	0.093	0.023	0.076	0.066	0.021
TCI2	−0.051	0.107	0.083	−0.022	−0.041	0.094	**0.854**	0.099	0.024	0.08	0.069	0.023
TCI3	−0.047	0.098	0.076	−0.02	−0.038	0.086	**0.782**	0.09	0.022	0.073	0.064	0.021
ONS1	0.003	0.085	−0.081	0.06	−0.028	0.083	0.112	**0.969**	−0.056	0.048	0.036	0.115
ONS2	0.003	0.082	−0.078	0.059	−0.028	0.08	0.109	**0.941**	−0.055	0.046	0.035	0.112
ONS3	0.003	0.079	−0.075	0.056	−0.026	0.077	0.104	**0.901**	−0.053	0.045	0.034	0.107

Table A4. *Cont.*

	TMS	TCO	MDS	RA	DS	PAR	TCI	ON	MPG	CPF	CMF	MCU
MPG1	−0.037	0.079	0.046	0.024	0.081	0.198	0.017	−0.036	**0.615**	0.206	0.171	−0.024
MPG2	−0.052	0.112	0.066	0.035	0.115	0.28	0.024	−0.051	**0.872**	0.292	0.242	−0.034
MPG3	−0.048	0.102	0.06	0.031	0.105	0.255	0.022	−0.046	**0.794**	0.266	0.22	−0.031
CPF1	−0.078	0.106	0.057	0.011	0.159	0.63	0.079	0.041	0.281	**0.839**	0.637	0.068
CPF2	−0.088	0.12	0.064	0.012	0.18	0.714	0.089	0.047	0.318	**0.95**	0.721	0.077
CPF3	−0.087	0.118	0.063	0.012	0.177	0.704	0.088	0.046	0.314	**0.937**	0.711	0.076
CMF1	0.01	0.071	0.037	−0.031	0.084	0.513	0.056	0.026	0.19	0.521	**0.687**	0.119
CMF2	0.014	0.098	0.051	−0.043	0.116	0.705	0.077	0.035	0.261	0.716	**0.943**	0.163
CMF3	0.014	0.093	0.049	−0.041	0.11	0.669	0.073	0.033	0.248	0.679	**0.895**	0.155
MCU1	0.169	0.183	−0.069	0.152	0.105	0.114	0.023	0.104	−0.034	0.071	0.152	**0.877**
MCU2	0.157	0.17	−0.065	0.142	0.098	0.106	0.022	0.097	−0.032	0.067	0.141	**0.816**
MCU3	0.164	0.178	−0.067	0.148	0.102	0.11	0.023	0.101	−0.034	0.069	0.147	**0.852**
MCU4	0.153	0.166	−0.063	0.138	0.096	0.103	0.021	0.095	−0.031	0.065	0.138	**0.798**

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