

Mobile Application Affordances and Perceived Strategic Competitiveness in an Emerging Market: The Mediating Role of Customer Digital Engagement

Timothy Kwabla Zilevu^{1*}, Genevieve Sedalo¹, and Edith Dede Dongoyo¹

¹ University of Professional Studies, Accra, Ghana

* Corresponding Author Email: Timothy.Zilevu@upsamail.edu.gh

ABSTRACT

Mobile applications are important digital touchpoints between telecommunications operators and subscribers in emerging markets, yet less is known about how user-perceived application affordances relate to perceptions of operator competitiveness. This study applies Technology Affordances and Constraints Theory (TACT) because it focuses on the relational action possibilities that arise between technology features and users' goals, rather than only adoption intention or service-quality evaluation. Drawing additionally on the resource-based view (RBV), the study examines the association between mobile application affordances and subscriber-perceived strategic competitiveness in Ghana, with customer digital engagement as an intervening variable. A quantitative cross-sectional survey produced 256 usable responses from subscribers of the major mobile network operators in Ghana, and the proposed relationships were analysed using partial least squares structural equation modelling (PLS-SEM). The results show positive and statistically significant path relationships from mobile application affordances to perceived strategic competitiveness and customer digital engagement, and from customer digital engagement to perceived strategic competitiveness. The indirect path through customer digital engagement is also statistically significant, indicating partial indirect association. The study contributes by integrating a user-level affordance explanation with a strategic resource perspective and by identifying customer digital engagement as a pathway linking perceived application affordances with perceived competitive positioning. The findings are interpreted cautiously because the design is cross-sectional and because convergent-validity weaknesses remain for the MAA and CDE measures.

Keywords: customer digital engagement, Ghana, mobile application affordances, perceived strategic competitiveness, telecommunications, technology affordances and constraints theory

1. INTRODUCTION

Telecommunications markets are increasingly shaped by digital service delivery through mobile applications, self-service platforms and mobile financial services. In Ghana, the National Communications Authority (NCA) reported 43.50 million active mobile voice subscriptions in the first quarter of 2026, equivalent to 128.26 subscriptions per 100 inhabitants. The NCA defines this penetration measure as mobile subscriptions per 100 inhabitants rather than unique subscribers. The same report identified MTN, Telecel and AT as the three mobile network operators active in Ghana (National Communications Authority, 2026). These conditions make digital customer interfaces an important part of how subscribers experience and compare operators.

Mobile applications allow subscribers to perform service tasks such as checking balances, purchasing voice or data bundles, accessing support and completing digital transactions. Huang et al. (2015) show that mobile service quality includes dimensions related to efficiency, responsiveness, reliability and related service experiences, while Yi et al. (2024) identify quality factors that shape the success of mobile payment applications. These studies support the importance of application quality, but a function or quality attribute is not automatically an affordance. In TACT, an affordance exists when a user perceives a technological property as enabling a goal-directed action. Ease of use, responsiveness, reliability and security are therefore treated here as perceived enabling conditions for navigating, completing tasks, depending on the application and transacting with confidence. Existing technology-adoption research has focused mainly on acceptance and use intentions (Davis, 1989; Venkatesh et al., 2003; Alalwan et al., 2016), leaving less evidence on how user-perceived application affordances connect with engagement and subscribers' perceptions of an operator's competitive positioning in African telecom settings.

To address this gap, the study examines 256 usable responses from telecom subscribers in Ghana. It combines TACT (Majchrzak & Markus, 2013) with the RBV (Barney, 1991; Bharadwaj, 2000). TACT explains the user-technology relationship by focusing on the actions a mobile application enables or constrains for users with particular goals. The RBV provides a strategic interpretation of the broader digital capability bundle that supports the application, including software, backend integration, data, security routines, user-experience knowledge and organisational processes. The empirical model does not observe objective firm resources or firm performance. RBV is therefore used as an interpretive strategic lens for understanding why subscriber-facing digital capabilities may contribute to perceived differentiation. Customer digital engagement is proposed as the user-level pathway connecting perceived application affordances with perceived strategic competitiveness.

The Ghanaian setting is relevant because mobile connectivity and smartphone use support intensive digital service interaction. In the first quarter of 2026, smartphones represented 61.79% of connected devices recorded by the NCA, and the regulator reported a highly concentrated mobile voice market led by MTN, followed by Telecel and AT (National Communications Authority, 2026). These market conditions provide a useful setting for examining subscriber perceptions of digital service differentiation. The findings are not treated as statistically generalisable beyond the Greater Accra convenience sample, but they may be relevant to comparable urban and digitally active subscriber contexts. This article is organized in the following way: after summarizing current knowledge and formulating the study hypotheses, the methodology section presents the research design, the sampling and the methods of analysis used in the study. The results and their discussion, theoretical and practical implications, limitations and possibilities for future research follow.

2. LITERATURE REVIEW

2.1 Theoretical Framework

2.2 Technology Affordances and Constraints Theory (TACT)

Technology Affordances and Constraints Theory (TACT) was formalised by Majchrzak and Markus (2013) and draws on Gibson's (1977) ecological view of affordances and later information-systems work (Markus & Silver, 2008; Leonardi, 2011). TACT distinguishes a technology feature from an affordance. A feature is a property of the technological artefact. An affordance is a relational possibility for action that emerges between a user and the technology. Affordance perception concerns whether the user recognises the possibility for action, while affordance actualisation concerns whether the user enacts that possibility in practice. A constraint is a relational condition that restricts or makes goal attainment more difficult. This distinction is central to the present study because the same application feature may enable one user while constraining another, depending on goals, experience and capabilities.

The present study therefore does not equate technical features directly with affordances. Instead, it interprets user evaluations of ease of use, responsiveness, reliability and security as perceived action-enabling qualities. Ease of use reflects the perceived possibility of navigating and completing service tasks with limited effort. Responsiveness reflects the perceived possibility of completing tasks without disruptive delay. Reliability reflects the perceived possibility of depending on the application for consistent service completion. Security reflects the perceived possibility of transacting while feeling that personal and financial information is protected. This interpretation links established mobile-service-quality attributes to the relational logic of TACT while keeping the distinction between the underlying feature and the action it enables.

TACT also highlights an important measurement boundary. Affordances are relational and depend on users' goals and capabilities, yet the present survey captures general subscriber perceptions rather than modelling each respondent's specific task goals or digital capability as part of the affordance construct. The measures should therefore be interpreted as perceived action-enabling qualities rather than fixed properties of the application. This boundary is relevant when interpreting the findings and motivates future work that directly measures user goals, capability differences, affordance perception and affordance actualisation (Leonardi, 2011; Volkoff & Strong, 2013).

2.3 Resource-Based View (RBV)

The resource-based view (RBV) proposes that competitive advantage may arise from valuable resources and capabilities that are difficult for competitors to replicate or substitute (Barney, 1991). Bharadwaj (2000) extended this logic to information-technology capability. In the present context, the mobile application should not be treated as an isolated tangible resource. It is better understood as the visible interface of a broader digital capability bundle comprising software, backend integration, data, security architecture, organisational routines, user-experience knowledge and technical skills. These complementary elements, rather than individual app features alone, provide the strategic basis for potential differentiation.

TACT and the RBV address different parts of the argument. TACT explains how users perceive and act on the possibilities enabled by a digital interface, while the RBV provides a firm-level rationale for why an integrated digital capability bundle may support differentiation. The study does not directly test whether operator resources satisfy all RBV conditions or whether they create objective sustained competitive advantage. Instead, RBV is used to interpret how subscriber-facing digital capability may be reflected in perceived strategic competitiveness. Customer digital engagement provides the connecting user-level mechanism: perceived application affordances are

expected to encourage engagement, which is then associated with more favourable perceptions of the operator's strategic competitiveness.

2.2.1 Mobile Application Affordances

Drawing on mobile-service-quality research (Huang et al., 2015; Nysveen et al., 2005) and TACT, this study treats mobile application affordances (MAA) as an aggregate perception that an operator's application enables users to accomplish service goals with limited effort, delay, failure and security concern. The eight available indicators cover ease of use, responsiveness, reliability and security. These characteristics are not treated as affordances merely because they are technical or quality attributes. They are interpreted as affordance-relevant only insofar as subscribers perceive them as enabling goal-directed actions such as navigating the interface, completing transactions, obtaining dependable service and transacting securely. Because the available manuscript materials do not provide a defensible item-by-item higher-order specification for the four content areas, the empirical analysis retains MAA as an aggregate reflective construct and avoids claiming that the four areas were separately validated dimensions.

2.2.2 Customer Digital Engagement

Customer digital engagement (CDE) refers to self-reported involvement with an operator's digital service environment. The questionnaire contains behavioural, cognitive and emotional engagement items derived from established engagement research (Brodie et al., 2013; Hollebeek et al., 2014). In the present dataset, however, the cognitive and emotional item groups do not demonstrate adequate stand-alone reliability. The study therefore does not claim empirical validation of a three-dimensional higher-order CDE construct. CDE is analysed only as the aggregate construct estimated in the original model, and the indirect path is interpreted at that aggregate level. The weak dimensional reliability and convergent validity are treated as substantive measurement limitations rather than as minor reporting issues.

Engagement is shaped by the interaction between what technology enables and what users seek to accomplish (Hollebeek et al., 2014; Vivek et al., 2012). In a telecom application, different qualities may plausibly support different forms of engagement. For example, ease of navigation may facilitate repeated service use, while secure and reliable transactions may strengthen confidence and positive involvement. These examples are illustrative rather than separately tested dimension-specific propositions in the present model.

2.2.3 Perceived Strategic Competitiveness

This study defines perceived strategic competitiveness as a subscriber's evaluation that an operator demonstrates digital innovativeness, technological responsiveness, market responsiveness and distinctive digital-service capability relative to competitors. The construct therefore represents perceived competitive positioning rather than objective firm performance or sustained competitive advantage. Porter (1985) provides the strategic background for differentiation, while the survey items capture customer-facing perceptions of innovation, technology adoption, distinctive digital features and responsiveness to market trends. Because the items are perception-based, all empirical claims are framed at the subscriber-perception level.

Ghana has three mobile network operators: MTN, Telecel and AT. NCA data for the first quarter of 2026 show that MTN accounted for 71.85% of mobile voice subscriptions, Telecel 20.99% and

AT 7.16% (National Communications Authority, 2026). The distribution indicates a concentrated market in which operators compete across network, price, brand and digital-service experience. The present study focuses specifically on the digital-application component of this competitive environment and does not assume that network coverage or pricing are equivalent across operators.

2.3 Hypotheses Development

TACT suggests that when an application enables users to complete valued service tasks with low friction, reliability and security, users should form more favourable evaluations of the digital service provider. In a competitive telecom setting, these perceptions may signal stronger digital-service capability and responsiveness. This reasoning supports the expected positive relationship between perceived application affordances and perceived strategic competitiveness.

Affordances become consequential when users perceive and actualise the possibilities for action offered by technology. Applications that make service goals easier to accomplish should encourage greater behavioural, cognitive and emotional involvement with the digital service environment. This provides the theoretical basis for the expected positive relationship between mobile application affordances and customer digital engagement.

Engaged customers devote more behavioural activity, attention and affective involvement to the operator's digital environment. Such engagement increases direct experience with the operator's digital capabilities and may therefore be associated with stronger perceptions of innovativeness, responsiveness and differentiation. This supports the proposed relationship between customer digital engagement and perceived strategic competitiveness.

Taken together, TACT and the engagement literature imply an ordered association in which perceived application affordances are related to engagement, which in turn is related to perceived strategic competitiveness. Because the data are cross-sectional, H4 is interpreted as a statistical indirect association rather than evidence of a temporal causal mediation process.

H1: Mobile application affordances are positively associated with perceived strategic competitiveness.

H2: Mobile application affordances are positively associated with customer digital engagement.

H3: Customer digital engagement is positively associated with perceived strategic competitiveness.

H4: Customer digital engagement carries a significant indirect association between mobile application affordances and perceived strategic competitiveness.

The conceptual framework depicting the hypothesised relationships is presented in Figure 1.

Figure 1. Conceptual framework

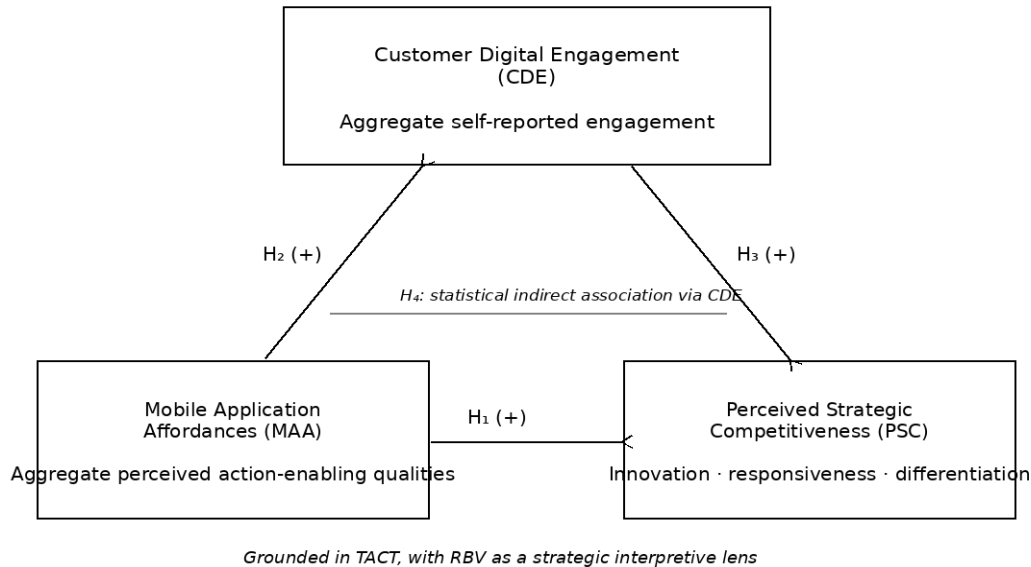


Figure 1. Conceptual framework: hypothesised associations among mobile application affordances, customer digital engagement, and subscriber-perceived strategic competitiveness.

Source: Authors' construct based on TACT (Majchrzak & Markus, 2013) and RBV (Barney, 1991; Bharadwaj, 2000).

3. METHODS

3.1 Research Design and Context

This study uses a quantitative, cross-sectional survey design. The target participants were subscribers of MTN Ghana, Telecel Ghana and AT, the three mobile network operators identified by the NCA for the January-March 2026 period (National Communications Authority, 2026). Eligibility required respondents to subscribe to a mobile operator and to use at least one operator digital channel, such as a mobile application, mobile money service or self-service platform. Ghana provides an appropriate setting because of its high level of mobile connectivity and growing use of smartphone-enabled digital services. The cross-sectional design supports analysis of associations among subscriber perceptions but does not establish temporal causality.

3.2 Sample and Data Collection

A structured online questionnaire was administered between January and March 2026 to subscribers in the Greater Accra region. Convenience sampling was used because no complete sampling frame of active users of operator digital channels was available. This approach increased access to relevant digital-service users but also created a risk of over-selecting younger, urban and more digitally literate respondents. Recruitment targeted subscribers across the three operators and screened respondents for active digital-channel use. A total of 280 responses were received. Twenty-four incomplete or invalid responses were removed, leaving 256 usable cases. A power check for the perceived strategic competitiveness equation, which contains two predictors, used

the smallest reported direct effect size in that equation ($f^2 = 0.079$), $\alpha = 0.05$ and power = 0.80. This yields a minimum sample of approximately 126 cases for a two-predictor regression-equivalent test. The retained sample of 256 therefore exceeds this statistical requirement. This calculation addresses estimation power only and does not remove the representativeness limitations associated with convenience sampling.

3.3 Measures

All multi-item measures used five-point Likert-type response scales ranging from 1 (strongly disagree) to 5 (strongly agree). Mobile application affordances (MAA) were measured with eight items adapted from mobile-service-quality work, including statements such as "This company's mobile application is easy to use" and "I have found the mobile application from this company to be responsive" (Huang et al., 2015). The items cover ease of use, responsiveness, reliability and security and are interpreted as aggregate perceived action-enabling qualities in line with TACT (Majchrzak & Markus, 2013). Customer digital engagement (CDE) was measured with ten items adapted from established engagement research (Brodie et al., 2013; Hollebeek et al., 2014): five behavioural, two cognitive and three emotional items. Perceived strategic competitiveness (PSC) was measured with seven researcher-adapted subscriber-perception items covering digital innovativeness, speed of technology adoption, distinctive digital features and responsiveness to market trends. Porter (1985) and Hitt et al. (2020) provide the strategic conceptual basis for these items, but the present study does not present the seven-item PSC measure as a previously validated psychometric scale. Its measurement quality is assessed within the present sample. Demographic items covered gender, age, education, income, primary mobile operator, years of digital-service experience, digital literacy and most frequently used digital channel.

The questionnaire was piloted with 25 telecom subscribers to assess clarity, completion time and item wording. Minor wording changes were made before the main survey. The main survey then produced 280 responses, of which 24 were excluded because of incomplete or invalid entries, resulting in 256 usable responses. To reduce common-method concerns, respondents were informed that responses were anonymous, construct labels were not shown, and items were presented without revealing the hypothesised relationships. The questionnaire also separated substantive sections and used neutral instructions. Because the available manuscript materials do not document the exact wording and coding status of any reverse-worded items, no claim is made here about reverse coding. Single-source self-reported data nevertheless leave residual common-method risk (Podsakoff et al., 2003).

4. ANALYSIS

4.1 Analytical Procedure

PLS-SEM was used because the study estimates a latent-variable model with multiple indicators and an indirect path, with emphasis on explaining variance in customer digital engagement and perceived strategic competitiveness (Hair et al., 2022). The available indicators were estimated using Mode A reflective measurement in the original analysis. This specification is retained for reporting consistency, but it is not presented as proof that the conceptually distinguishable MAA content areas or CDE engagement facets form validated interchangeable reflective dimensions. The structural model was estimated with 5,000 bootstrap resamples and bias-corrected confidence

intervals for direct and indirect paths. The measurement limitations are therefore considered explicitly when interpreting the structural estimates.

The measurement model was assessed using outer loadings, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), the Fornell-Larcker criterion and heterotrait-monotrait (HTMT) ratios. The structural model was assessed using standardised path coefficients, R^2 , f^2 and variance inflation factors. The indirect association was evaluated with 5,000 bootstrap resamples. Descriptive statistics and bivariate correlations were also examined. Harman's single-factor test is reported only as a supplementary diagnostic and is not treated as evidence that common-method bias is absent. The manuscript does not rely on an unreported OLS robustness analysis, a common-latent-factor procedure, or Q^2 values whose exact computation procedure is not documented in the available analysis record.

5. FINDINGS/RESULTS

5.1 Demographic Profile of Respondents

Table 1 summarises the demographic characteristics of the 256 respondents. The sample was predominantly female (75.0%) and concentrated in the 18 to 24 age group (73.0%). These figures describe the achieved convenience sample and should not be interpreted as the demographic profile of Ghana's national digital-telecom user population. In terms of education, 59.4% held a bachelor's degree and 21.9% held an HND or diploma. MTN Ghana was the primary operator for 76.2% of respondents, followed by Telecel/Vodafone legacy responses (20.3%) and AT/AirtelTigo legacy responses (3.5%). More than half had used operator digital services for over five years, and 65.2% rated their digital literacy as advanced. The mobile money platform and mobile application were the most frequently used digital channels. The age and digital-literacy concentration is treated as a sampling limitation rather than evidence about the national user base.

Table 1. Demographic profile of respondents (N = 256).

Variable	Frequency	Percentage (%)
Gender		
Female	192	75.0
Male	64	25.0
Age group		
18 to 24	187	73.0
25 to 34	65	25.4
35 to 44	4	1.6
Education		
Secondary/WASSCE	30	11.7
HND/Diploma	56	21.9

Variable	Frequency	Percentage (%)
Bachelor's degree	152	59.4
Postgraduate	18	7.0
Monthly income (GHS)		
Below 1,000	113	44.1
1,000 to 2,999	98	38.3
3,000 to 4,999	25	9.8
5,000 and above	20	7.8
Primary operator		
MTN Ghana	195	76.2
Vodafone Ghana	52	20.3
AirtelTigo	9	3.5
Years using digital services		
Less than 1 year	7	2.7
1 to 2 years	44	17.2
3 to 5 years	76	29.7
More than 5 years	129	50.4
Digital literacy		
Basic	10	3.9
Intermediate	79	30.9
Advanced	167	65.2
Most used digital channel		
Mobile application	94	36.7
Mobile money platform	106	41.4
Online/chat support	39	15.2
Self-service portal	17	6.6

Source: Field survey (2026).

5.2 Reliability and Measurement Model Analysis

Table 2 presents the reliability and convergent-validity results from the original aggregate measurement model. Three CDE indicators had weak outer loadings: Q15_4 = 0.485, Q16_1 =

0.477 and $Q17_3 = 0.280$. The loading of 0.280 is especially problematic. Trial deletion reported in the original analysis did not raise CDE AVE above 0.50, so deleting isolated items does not provide a defensible statistical repair. The present article therefore retains the original estimates for transparency but does not describe the CDE measurement model as satisfactory. Any structural inference involving CDE is treated as provisional and requires replication with a validated engagement instrument and a pre-specified dimensional or higher-order measurement model.

Cronbach's alpha was 0.779 for MAA, 0.729 for aggregate CDE and 0.837 for perceived strategic competitiveness. At the sub-dimension level, behavioural engagement was acceptable at 0.712, while cognitive engagement ($\alpha = 0.486$) and emotional engagement ($\alpha = 0.551$) were below conventional reliability thresholds. These values mean that the present data do not support separate empirical claims about cognitive or emotional engagement. The aggregate CDE score is retained only to report the originally estimated path model and should not be interpreted as evidence that all three engagement facets were measured reliably.

Composite reliability values were 0.840 for MAA, 0.802 for CDE and 0.877 for perceived strategic competitiveness. AVE was 0.504 for perceived strategic competitiveness, 0.399 for MAA and 0.296 for CDE. The latter two values indicate inadequate convergent validity in the present aggregate specification. Composite reliability does not compensate for this deficiency. Accordingly, the structural paths involving MAA and CDE are presented as results of the fitted model but are not treated as fully validated substantive estimates. The article's conclusions are restricted to tentative aggregate associations and explicitly call for replication using stronger measurement specifications.

Table 2. Construct reliability and validity (PLS SEM).

Construct	Items	Alpha	CR	AVE	Verdict
MAA	8	0.779	0.840	0.399	CR > 0.70
CDE	10	0.729	0.802	0.296	CR > 0.70
PSC	7	0.837	0.877	0.504	AVE > 0.50

Source: Field survey (2026).

5.3 Validity Analysis

Discriminant validity was examined separately from convergent validity. In the reported aggregate model, the square root of AVE for each construct (MAA = 0.631, CDE = 0.544, PSC = 0.710) exceeded the corresponding inter-construct correlations, and HTMT ratios were below 0.85. These results indicate separation among the aggregate construct scores, but they do not repair the weak convergent validity of MAA and CDE. Inner-model VIF was 1.320, indicating no problematic collinearity among the predictors of perceived strategic competitiveness.

5.4 Descriptive Statistics and Correlation Analysis

Table 3 reports means, standard deviations and correlations among the construct scores, with square roots of AVE on the diagonal. MAA ($M = 3.53$, $SD = 0.56$) was positively correlated with

CDE ($r = 0.493$, $p < 0.001$) and perceived strategic competitiveness ($r = 0.443$, $p < 0.001$). CDE was also positively correlated with perceived strategic competitiveness ($r = 0.479$, $p < 0.001$). The table is interpreted as a descriptive correlation matrix of the construct scores and not as additional evidence of causality.

Table 3. Descriptive statistics and Pearson correlations.

Variable	M	SD	1	2	3
1. MAA	3.53	0.56	(0.631)		
2. CDE	3.47	0.47	0.493**	(0.544)	
3. PSC	3.58	0.63	0.443**	0.479**	(0.710)

*Note: ** $p < 0.01$. Square root of AVE in parentheses on the diagonal. MAA = Mobile application affordances; CDE = Customer digital engagement; PSC = Perceived strategic competitiveness.*

Source: Field survey (2026).

5.5 Hypothesis Testing: Structural Model Results

Table 4 presents the structural path estimates based on 5,000 bootstrap resamples. The path from mobile application affordances to perceived strategic competitiveness was positive and statistically significant ($\beta = 0.271$, $t = 4.146$, 95% CI [0.145, 0.402]), supporting H1 as an association. The effect size ($f^2 = 0.079$) was small, indicating a modest direct contribution after customer digital engagement was included in the model.

The path from mobile application affordances to customer digital engagement was positive and statistically significant ($\beta = 0.493$, $t = 8.404$, 95% CI [0.380, 0.611]), supporting H2. The associated effect size was $f^2 = 0.320$. MAA explained 24.3% of the variance in CDE ($R^2 = 0.243$). These estimates indicate a strong path relationship in the fitted model, but interpretation remains subject to the convergent-validity limitations of the two constructs.

The path from customer digital engagement to perceived strategic competitiveness was positive and statistically significant ($\beta = 0.347$, $t = 5.080$, 95% CI [0.213, 0.480]), supporting H3 within the fitted model. Together, MAA and CDE explained 28.6% of the variance in perceived strategic competitiveness ($R^2 = 0.286$). For H4, the bootstrapped indirect estimate was 0.170 (SE = 0.036, $t = 4.699$, 95% CI [0.103, 0.244]). Because the confidence interval excludes zero, the model shows a statistically significant indirect association through aggregate CDE. This is not described as causal mediation because the variables were measured at one point in time and the CDE measurement model has material validity weaknesses. Approximately 39% of the total association was indirect and 61% remained direct in the fitted model.

Table 4. Structural model results (PLS SEM, 5,000 bootstrap resamples).

Path	Beta	SE	t	95% CI	Decision
MAA to CDE (H2)	0.493	0.059	8.404	[0.380, 0.611]	Supported

Path	Beta	SE	t	95% CI	Decision
MAA to PSC (H1)	0.271	0.065	4.146	[0.145, 0.402]	Supported
CDE to PSC (H3)	0.347	0.068	5.080	[0.213, 0.480]	Supported
Indirect MAA to PSC via CDE (H4)	0.170	0.036	4.699	[0.103, 0.244]	Supported

Note: All reported structural paths are statistically significant at $p < 0.001$. $R^2(\text{CDE}) = 0.243$; $R^2(\text{PSC}) = 0.286$. f^2 : MAA to CDE = 0.320; MAA to PSC = 0.079; CDE to PSC = 0.126. VIF = 1.320. Q^2 statistics are not reported because the available analysis record does not document the exact predictive-relevance procedure used. MAA = Mobile application affordances; CDE = Customer digital engagement; PSC = Perceived strategic competitiveness.

Figure 2. Structural model results (PLS-SEM, N = 256, 5,000 bootstrap resamples)

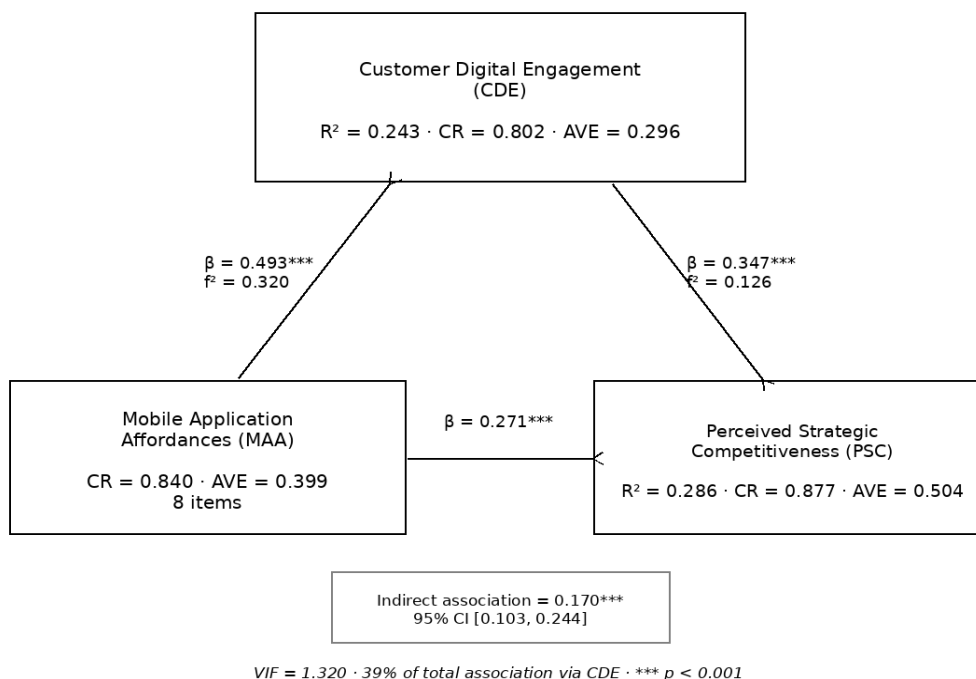


Figure 2. Structural model results: standardised path coefficients (PLS-SEM, N = 256, 5,000 bootstrap resamples). * $p < 0.001$. PSC denotes subscriber-perceived strategic competitiveness. The indirect path is interpreted as a statistical indirect association, not causal mediation.**

Source: Field data analysis (2026).

6. DISCUSSION OF RESULTS

The study examined how subscriber-perceived mobile application affordances are associated with perceived strategic competitiveness in Ghana's telecom market. Using TACT, the findings suggest that perceived action-enabling qualities such as ease of navigation, responsiveness, reliability and

security are positively related to subscribers' evaluations of an operator's digital competitiveness. The results extend the application of affordance reasoning to consumer-facing telecom services, while keeping the analysis at the level of subscriber perceptions rather than objective firm performance.

Customer digital engagement carries a statistically significant indirect association between mobile application affordances and perceived strategic competitiveness. The measured CDE construct captures self-reported engagement rather than actual feature-use counts or transaction volumes. The result therefore indicates that subscribers who perceive stronger application affordances also report greater engagement, and greater engagement is associated with more favourable perceptions of operator competitiveness. The remaining direct path suggests that other unmeasured mechanisms may also connect application perceptions with competitive evaluations. Any signalling interpretation of this residual path should be treated as a post hoc possibility for future testing rather than as part of the present theoretical model.

The RBV helps interpret these findings without treating the subscriber data as direct evidence of firm-wide competitive advantage. A telecom application is supported by a wider bundle of software, backend systems, data, security routines and organisational capabilities. Subscribers experience only the customer-facing manifestation of this bundle. The positive paths observed here therefore support a perception-based argument: stronger digital service experiences are associated with stronger perceptions of strategic competitiveness. They do not establish the value, rarity or inimitability of any specific operator resource, nor do they identify firm investment as the causal source of the observed relationships.

The achieved sample was heavily concentrated among respondents aged 18 to 24 and among those reporting advanced digital literacy. This profile is consistent with the online convenience recruitment approach and limits the boundary of inference. The findings are most informative for the sampled urban, digitally active subscribers in Greater Accra. Replication with stratified samples covering older users, rural subscribers and lower digital-literacy groups is needed before broader population claims are made. In TACT terms, such comparisons would also help examine how user capabilities shape affordance perception and actualisation.

The model explained 28.6% of the variance in perceived strategic competitiveness. This indicates that application-related perceptions and engagement account for a meaningful but incomplete part of subscribers' competitive evaluations. Other factors, including network quality, pricing, brand history, customer service and social influence, were outside the model. The direct MAA-to-PSC effect size was small ($f^2 = 0.079$), while the MAA-to-CDE effect size was larger ($f^2 = 0.320$). These results are therefore best interpreted as evidence that digital application experience forms one component of perceived competitive positioning rather than as a comprehensive explanation of firm competitiveness.

The indirect estimate from MAA to perceived strategic competitiveness through aggregate CDE was 0.170 (95% CI [0.103, 0.244]), representing approximately 39% of the total association in the fitted model. This pattern is consistent with engagement research linking digital experience with behavioural, cognitive and emotional involvement (Brodie et al., 2013; Hollebeek et al., 2014). The present data, however, do not validate those three dimensions separately because the cognitive and emotional subscales have weak reliability and the aggregate CDE AVE is low. The finding is

therefore limited to a provisional aggregate indirect association and should be replicated with a validated multidimensional engagement scale.

7. CONCLUSION

The study finds positive associations between subscriber-perceived mobile application affordances, customer digital engagement, and perceived strategic competitiveness among the sampled telecom subscribers in Ghana. Customer digital engagement also carries a statistically significant indirect association between application affordances and perceived strategic competitiveness. These findings support the study's central argument that the value of telecom applications depends on the service actions they enable and the engagement they foster. Given the cross-sectional convenience sample and the identified measurement limitations for MAA and CDE, the findings should be interpreted as evidence of association rather than causal or firm-level competitive effects.

8. IMPLICATIONS

8.1 Theoretical Implications

This study offers three related contributions. First, it integrates TACT and the RBV by distinguishing the user-level mechanism from the strategic interpretation: TACT explains how subscribers perceive action possibilities in the application, while the RBV provides a lens for interpreting the broader digital capability supporting those experiences. Second, the study identifies customer digital engagement as a statistically significant indirect link between perceived application affordances and perceived strategic competitiveness. This is a construct-linkage contribution rather than evidence of objective firm-level competitive advantage. Third, the study extends this integrated argument to a Ghanaian telecom setting, where empirical applications of TACT to consumer-facing mobile applications remain limited. These contributions are qualified by the measurement limitations reported for MAA and CDE.

8.2 Managerial and Practical Implications

For telecom managers, the findings point to application experience and customer digital engagement as relevant components of perceived competitive positioning. Operators should evaluate whether users are able to complete common service goals efficiently, reliably and securely. Improvements to navigation, response time, transaction consistency and security communication should be assessed in terms of the actions they enable for users rather than as technical features alone. The study did not measure customer retention, so retention should not be treated as an observed outcome of the present analysis.

TACT also encourages managers to examine both affordances and constraints around specific service goals. User research, task-based testing and analysis of service failures may identify points where authentication, slow response, unclear error messages or complex navigation constrain goal completion. Features such as personalised dashboards, loyalty gamification or in-app service support are plausible managerial options identified in the wider digital-engagement literature, but they were not tested as interventions in this study. Their value should therefore be evaluated empirically before implementation decisions are made.

9. LIMITATIONS AND FUTURE RESEARCH

The findings have several limitations. First, the cross-sectional design does not establish temporal or causal ordering among mobile application affordances, customer digital engagement and perceived strategic competitiveness. Longitudinal or experimental designs are needed to test whether changes in perceived affordances precede changes in engagement and competitive perceptions. Second, the convenience sample is concentrated among young, urban, educated and digitally literate subscribers in Greater Accra. The findings should not be statistically generalised to the Ghanaian population or to other emerging markets. Future studies should use stratified or probability-based sampling across age, sex, rural-urban location, operator and digital-literacy groups.

Third, all principal constructs were measured through self-reported responses in a single survey. Procedural remedies were used and Harman's single-factor result did not indicate one dominant factor, but this diagnostic does not eliminate common-method bias. Future studies should combine survey measures with objective application indicators such as crash frequency, response time, transaction completion and observed usage. Qualitative task-based methods could also examine affordance perception and actualisation in real time. Fourth, the current measurement model has material convergent-validity weaknesses: AVE was 0.399 for MAA and 0.296 for CDE, and the cognitive and emotional engagement subscales showed weak reliability. These weaknesses reduce confidence in the structural estimates. The present article therefore treats the MAA and CDE path results as provisional aggregate associations. Future research should pre-specify and test validated multidimensional or higher-order measurement models before drawing stronger conclusions about specific affordance or engagement dimensions.

10. REFERENCES

- Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa. *Journal of Economic Perspectives*, 24, 207–232.
- Alalwan, A. A., Dwivedi, Y. K., Rana, N. P., & Williams, M. D. (2016). Consumer adoption of mobile banking in Jordan: Examining the role of usefulness, ease of use, perceived risk and self-efficacy. *Journal of Enterprise Information Management*, 29, 118–139.
- Asongu, S. A., & Odhiambo, N. M. (2019). Mobile banking usage, quality of growth, inequality and poverty in developing countries. *Information Development*, 35, 303–318.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99–120.
- Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: An empirical investigation. *MIS Quarterly*, 24, 169–196.
- Brodie, R. J., Ilic, A., Juric, B., & Hollebeek, L. (2013). Consumer engagement in a virtual brand community: An exploratory analysis. *Journal of Business Research*, 66, 105–114.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13, 319–340.
- Effah, J., & Nuhu, H. (2017). Institutional barriers to digitalization of government budgeting in developing countries: A case study of Ghana. *The Electronic Journal of Information Systems in Developing Countries*.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18, 39–50.
- Frempong, G. K., & Atubra, W. H. (2001). Liberalisation of telecoms: The Ghanaian experience. *Telecommunications Policy*, 25, 197–210.

- Gibson, J. J. (1977). The theory of affordances. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting and knowing: Toward an ecological psychology* (pp. 67–82). Lawrence Erlbaum.
- GSMA. (2024). *The mobile economy Sub-Saharan Africa 2024*. GSMA.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage.
- Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd ed.). Guilford Press.
- Hitt, M. A., Ireland, R. D., & Hoskisson, R. E. (2020). *Strategic management: Concepts and cases* (13th ed.). Cengage.
- Hollebeek, L. D., Glynn, M. S., & Brodie, R. J. (2014). Consumer brand engagement in social media: Conceptualization, scale development and validation. *Journal of Interactive Marketing*, 28, 149–165.
- Huang, E. Y., Lin, S. W., & Fan, Y. C. (2015). M-S-QUAL: Mobile service quality measurement. *Electronic Commerce Research and Applications*, 14, 126–142.
- Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly*, 35, 147–167.
- Majchrzak, A., & Markus, M. L. (2013). Technology affordances and constraints theory (of MIS). In E. Kessler (Ed.), *Encyclopedia of management theory* (pp. 832–836). Sage.
- Markus, M. L., & Silver, M. S. (2008). A foundation for the study of IT effects: A new look at DeSanctis and Poole's concepts of structural features and spirit. *Journal of the Association for Information Systems*, 9, 609–632.
- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. *MIS Quarterly*, 41, 223–238.
- National Communications Authority. (2026). *Quarterly statistical bulletin on communications in Ghana* (Vol. 11, Issue 1, January–March 2026). National Communications Authority.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.
- Nysveen, H., Pedersen, P. E., & Thorbjørnsen, H. (2005). Intentions to use mobile services: Antecedents and cross-service comparisons. *Journal of the Academy of Marketing Science*, 33, 330–346.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88, 879–903.
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. Free Press.
- Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, 87, 355–374.
- Teece, D. J. (2018). Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy*, 47, 1367–1387.
- Treem, J. W., & Leonardi, P. M. (2013). Social media use in organizations: Exploring the affordances of visibility, editability, persistence, and association. *Annals of the International Communication Association*, 36, 143–189.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, 425–478.

- Vivek, S. D., Beatty, S. E., & Morgan, R. M. (2012). Customer engagement: Exploring customer relationships beyond purchase. *Journal of Marketing Theory and Practice*, 20, 127–145.
- Volkoff, O., & Strong, D. M. (2013). Critical realism and affordances: Theorizing IT-associated organizational change processes. *MIS Quarterly*, 37, 819–834.
- Waverman, L., Meschi, M., & Fuss, M. (2005). The impact of telecoms on economic growth in developing countries. *The Vodafone Policy Paper Series*, 2, 10–23.
- Yi, J., Kim, J., & Oh, Y. K. (2024). Uncovering the quality factors driving the success of mobile payment apps. *Journal of Retailing and Consumer Services*, 77, 103641.