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## Product-Related Activities of the Value Chain and Competitive Advantage of Manufacturing Companies in Selected States of Northern Nigeria

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### **Abstract:**

*This study examined how product-related activities of manufacturing companies in Northern Nigeria affected competitive advantage. A survey was conducted in a cross-sectional examination of members of the Manufacturers Association of Nigeria (MAN), where a sample, obtained through the area sampling techniques, of 144 top management staff responded to the questionnaire on behalf of their organizations. Underpinning the study on the value configuration theory, the data collected were analyzed through the partial least squares structural equation modeling. It was discovered that inbound logistic, as well as operation activities, have significant effects on the competitive advantage, and the R2 value obtained for the full model was moderate at 0.325. These findings implied that managers of manufacturing companies can rely on the contributions of the product-related activities of their value chain towards the attainment of competitive advantage. It was therefore recommended that management should deploy more resources towards enhancing both inbound logistics and operation activities of their value chain, to take full advantage of competition.*

**Keywords:** Companies, competitive advantage, inbound logistics, manufacturing, operations, product-related activities, value chain

### **1. Introduction**

A company's competitive advantage is its ability to achieve a position superior to that of its competitors, which they achieve through better quality, timely reaction to the market, competitive pricing and delivery of customized products, and so on (Koufteros, Vonderembse, & Doll, 1997) and there is evidence that the effective management of these value chain elements could confer competitive advantage on manufacturing firms (Akenbor & Okoye, 2012; Alnawaiseh, Al-Rawashdi, & Alnawaiseh, 2014; Bustinza, Bigdeli, Baines, & Elliot, 2015; Chumaidiyah, 2014; Ensign, 2001; Singh, 2012; Weng, Lin, & Chu, 2011).

Value chain describes the business activities that are required to bring a product or service from conception to final use including disposals (Kaplinsky & Morris, 2001; Porter, 1985). The value chain can be classified into product-related activities; market-related activities; and support activities (Porter, 1985). Product-related activities are those activities the organization performs to add value to the products and services itself and are classified as inbound logistics and operations (Acharyulu, Subbaiah & Rao, 2015; Porter, 1985; Saha, 2011).

It has been established that inbound logistic and operation activities are influential elements of the manufacturing value chain that affects competitive advantage (Bagshaw, 2014; Jie, Parton & Cox, 2013; McGuinness & Hutchinson, 2013; Naliaka & Namusonge, 2015; Netland & Aspelund, 2013; Thatte, Rao, & Ragu-Nathan, 2013). When manufacturers gain cost and differentiation advantage, they outperform their rivals (Sigala & Economou, 2013), and thus gain a competitive advantage.

Ironically, the competitive environment in Nigeria is not favorable to indigenous manufacturers (Lagos Chamber of Commerce and Industries, 2016; National Competitiveness Council of Nigeria, 2016). A testimony of this unsatisfactory situation is the preponderance of foreign products in the local market. The study area in Northern Nigeria still endures unique insurgency and insecurity, which has significantly impacted negatively on business activities (Achumba, Ighomereho, & Akpor-Robaro, 2013; Eme & Jide, 2012; Shehu, 2015). Scholars have adduced reasons that led to the situation (Obabori, 2016), but the solution probably lies with an overhaul of the production aspects of the value chain. Researchers have established that in the ideal situation, the management of these product-related activities would contribute to the attainment of competitive advantage (Jie et al., 2013; Mellat-Parast & Spillan, 2014; Naliaka & Namusonge, 2015; Nge, Rattanawiboonsom, Mahmood, & Rurkwararuk, 2016). Furthermore, despite all that is known about the contribution of the product-related activities of the value chain towards gaining competitive advantage, it has been argued that more need to be discovered (Watiri & Kihara, 2017) as the challenges of competitiveness still persists. The aim of the study, therefore, was to examine the effect of product-related activities on the competitive advantage of manufacturing companies. Specific objectives are:

- To evaluate the effect of inbound logistic activities on the competitive advantage of manufacturing companies.
- To examine the effect of operation activities on the competitive advantage of manufacturing companies.

## 2. Literature Review

### 2.1. Competitive Advantage

Competitive advantage is the ability of a company to, among other things relate to its competitors; satisfy customers and react to the competitive environment; provide value that motivate customers; and neutralize threats from rival firms (Alnawaiseh et al., 2014; Barney, 1991; Christensen, 2010; Ibidunni, 2011; Newbert, 2008; Porter, 1985). For a company to claim to have a competitive advantage, it not only have better performance than that of its competitors but also delivers genuine value to the customer, thus ensuring a dominant position in the market (Singh, 2012). The source of competitive advantage lies in the ability of an organization to differentiate its products or services either wholly or partly, via the skills of the employees, the capabilities of the processes and technologies, and the standard manufacturing procedures set by management (Antonioni, Levitt, & Schreihans, 2011; Porter, 1985, 1990). However, firms can only gain a competitive advantage by manipulating the various resources over which it has control (Singh, 2012).

### 2.2. Product-Related Activities

The value chain of a company describes the ordered sequence of different, horizontally linked activities, which are required to bring a product from conception all the way through the acquisition of basic raw materials, through the different phases of production, delivery to the final consumer, and disposal after use (Dekker, 2003; Kaplinsky & Morris, 2001; Porter, 1980; 1985). The primary activities of the value chain are those activities involved in the physical creation of the product and its sales, transfer to the buyer and after-sales services and these activities can be further divided into product-related activities and market-related activities (Porter, 1985). Product-related activities are the activities that the organization performs to add value to the products and services itself and are classified as inbound logistics and operations (Acharyulu et al., 2015; Porter, 1985; Saha, 2011).

### 2.3. Product-Related Activities and Competitive Advantage

Inbound logistic activities deals with arranging the inbound movement of materials, parts, and/or finished inventory from suppliers to manufacturing or assembly plants, warehouses, or retail stores (Porter, 1985), and affects firm's performance and competitive advantage in many ways (Mellat-Parast & Spillan, 2014; Obasan, Ogunkoya, & Hassan, 2016). Studies have shown that inbound logistics significantly affect competitive advantage (Jie et al., 2013; Naliaka & Namusonge, 2015; Thatte et al., 2013). Operations activities are concerned with managing the process that converts inputs, in the forms of raw materials, labor, and energy, into outputs, in the form of goods and/or services (Porter 1985). The operations systems adopted by a firm and the knowledge of product availability affects competitive advantage and performance (Bagshaw, 2014; McGuinness & Hutchinson, 2013; Netland & Aspelund, 2013).

This study was underpinned by the Stabell and Fjeldstad's (1998) value configuration theory, which explained and analyzed firm-level value creation logic across a broad range of industries and firms to the diagnosis of competitive advantage.

### 2.4. Theoretical Framework

The proposed model predicted that inbound logistic and operation activities both influences the ability of manufacturing companies to gain a competitive advantage as depicted in Figure 1.

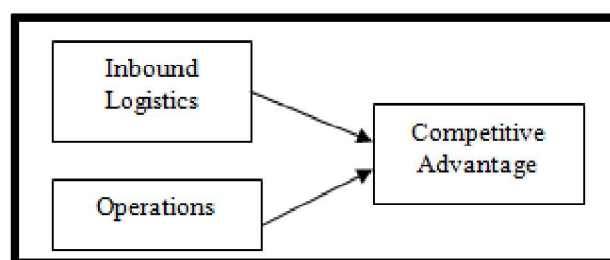


Figure 1: Theoretical Framework

#### 2.4.1. Inbound Logistic Activities and Competitive Advantage

Inbound logistics are the processes related to receiving materials from suppliers into the business, storing, material handling, inventory control, vehicle scheduling, returns to suppliers and distributing inputs internally (Porter, 1985; Sandhu, 2015). Inbound logistics affects firm's performance and competitive advantage in many ways (Mellat-Parast & Spillan, 2014; Obasan et al., 2016), and studies have shown that inbound logistics significantly affect competitive advantage (Jie et al., 2013; Naliaka & Namusonge, 2015; Thatte et al., 2013). Theoretically, if the components of inbound logistics are available and managed properly, they can lead to the attainment of competitive advantage. Therefore, it was hypothesized that:

- H1: Inbound logistic activities of the value chain significantly relate to competitive advantage.

#### 2.4.2. Operation Activities and Competitive Advantage

Operations is one of the major functions in an organization, along with marketing, finance, and human resources, and it requires the management of both the strategic and day-to-day production of goods and services (Chase, Jacobs, & Aquilano, 2007). Operations transform inputs into the final product that are sold to the customers and they include activities in machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations (Porter 1985; Sandhu, 2015). The operations systems adopted by a firm and the knowledge of product availability affects competitive advantage and performance (Bagshaw, 2014; McGuinness & Hutchinson, 2013; Netland & Aspelund, 2013). Thus, operation activities affect competitive advantage significantly, implying that the more enhanced the transformation process, the better the output and therefore the more the likelihood of gaining competitive advantage. For this reason, the following proposition was advanced:

- H2: Operation activities of the value chain significantly relate to competitive advantage.

### **3. Methodology**

#### *3.1. Design*

This study adopted the survey research design and it was a cross-sectional examination of members of the MAN. The primary data were obtained through the administration of the structured questionnaire, while the multiple regression analysis was conducted through the PLS-SEM using the Smartpls 3.0 software (Ringle, Wende, & Becker, 2015). The analytical procedure, for the stages of the PLS-SEM algorithm, was adopted from (Hair, Hult, Ringle, & Sarstedt, 2014; Henseler, Ringle, & Sarstedt, 2012).

#### *3.2. Population and Sample*

The population for the study is all manufacturing companies operating in Northern Nigeria (except for those in Abuja, due to the dearth of manufacturers located in the branch and the Adamawa/Borno/Yobe branches, due to insurgency and insecurity in the region), registered with MAN as at March 2017. MAN is structured into 11 sectors with five branches and has 225 members in the study area (MAN, 2017). Using Israel (1992) formula for determining sample size, a sample of 144 companies was obtained from the population, and the cluster sampling technique was used to draw samples from the population.

#### *3.3. Measurements and Instrumentations*

A 7-point Likert scale questionnaire coded: Strongly Disagree (1 point); Disagree (2 points); SomeWhat Disagree (3 points); Undecided (4 points); SomeWhat Agree (5 points); Agree (6 points), and Strongly Agree (7 points) was used to collect the data. The 4-item inbound logistics measure was adopted from Mahmood and Soon (1991), while the 5-item operation measure was adopted from Tallon, Kraemer, and Gurbaxani (2000). To measure competitive advantage, the 11-item Koufteros et al., (1997) instrumentation was adopted.

### **4. Analysis and Results**

Two primary software for analysis were used in the study, the IBM Statistical Packages for the Social Sciences (SPSS) version 21, and the PLS-SEM SmartPLS 3.0.

#### *4.1. Multicollinearity Diagnosis*

Multicollinearity is a problem associated with a correlation matrix when variables are highly correlated, i.e., 0.90 and above (Tabachnick & Fidell, 2007). As a rule of thumb, predictor variables can be correlated with each other as much as 0.8 before there was cause for concern about multicollinearity. The variance inflation factor (VIF), which measures collinearity, should be small. A VIF value of 5 and higher indicates a potential collinearity problem (Hair, Ringle & Sarstedt, 2011). The highest value obtained in the model was 4.132 (CA12), which shows that the collinearity was not an issue because the values are all less than 5.

#### *4.2. Research Model*

The measurement model displays the relationships between the constructs and the indicator variables, while the structural model displayed the relationships between the constructs. The inbound logistics consists of 4 items, while operations have 5 items. Competitive advantage consists of 14 items. However, as a consequence of factor analysis, the following items were removed: IL 3, IL4, OP1, OP2, OP3, CA1, CA3, CA4, CA5, CA6, CA7, and CA8.

#### *4.3. Measurement Model*

Product-related activities of the value chain and competitive advantage are modeled as reflective measures, based on (Chin 1998; Diamantopoulos & Winklhofer, 2001). An examination of the PLS-SEM estimates focuses on understanding how to assess the quality of the results through the evaluation of the reliability and validity of the construct measures. Composite reliability was used to evaluate internal consistency, while the average variance extracted (AVE) was used to evaluate convergent validity. The Fornell-Larcker criterion and cross-loadings were used to assess discriminant validity.

#### *4.4. Reliability*

The composite reliability served as the upper bound for the true reliability with the following values: CA (0.917), IL (0.870), and OP (0.801) as shown in Table 1. The results revealed that all the constructs have high levels of internal

consistency reliability above the threshold of 0.70 (Nunally & Bernstein, 1994) and therefore confirmed the reliability of the constructs.

Constructs	Composite Reliability	AVE
Competitive Advantage	0.917	0.615
Inbound Logistics	0.870	0.770
Operations	0.801	0.671

*Table 1: Measurement Model Evaluation  
Compiled by the Author*

#### 4.5. Content Validity

The factor loading was used to assess the content validity of the constructs in the study as suggested by (Chin, 1998; Hair, Black, Babin, & Anderson, 2010). As presented in Table 2, all items meant to measure a particular construct loaded highly on the construct they were designed to measure, thus confirming content validity.

#### 4.6. Convergent Validity

Convergent validity was confirmed by examining the composite reliability and the AVE as shown in Table 1. The composite reliability measures are all above the threshold of 0.70 for construct reliability as recommended by Hair et al., (2010). A satisfactory level of convergent validity was also maintained since the AVE values [CA(0.615), IL (0.770), and OP (0.671)] are all above the recommended threshold of 0.50 (Wong, 2013). Based on the assessments of the composite reliability as well as AVE values, the measures of the constructs have high levels of convergent validity.

Items	Competitive Advantage	Inbound Logistics	Operations
CA10	0.806	0.355	0.254
CA11	0.697	0.151	0.328
CA12	0.886	0.444	0.124
CA13	0.884	0.520	0.327
CA14	0.792	0.294	0.224
CA2	0.630	0.322	0.341
CA9	0.760	0.376	0.212
IL1	0.294	0.813	0.053
IL2	0.495	0.938	0.000
OP4	0.189	-0.132	0.710
OP5	0.330	0.106	0.915

*Table 2: Cross-Loading of Items  
Compiled by the Author*

#### 4.7. Discriminant Validity

Discriminant validity was examined by following the Fornell-Larcker criterion, which compares the square root of the AVE values with the latent variable correlations, where the square root of each construct's AVE should be greater than its highest correlation with any other construct (Fornell & Larcker, 1981). The discriminant validity is assumed if the diagonal elements are higher than other off-diagonal elements in their rows and columns. As presented in Table 3, the Fornell-Larcker criterion provides evidence for discriminant validity. Alternatively, an assessment of the cross-loadings (Table 2) shows that an indicator's loading on a construct was higher than all of its cross-loadings with other constructs, thus further confirming discriminant validity.

Constructs	CA	IL	OP	AVE
CA	0.784			0.615
IL	0.471	0.878		0.770
OP	0.332	0.023	0.819	0.671

*Table 3: Discriminant Validity  
Compiled by the Author*

#### 4.8. Structural Model and Hypotheses Testing

Once reliability and validity were confirmed, the constructs are therefore suitable for inclusion in the path model. Thus, the next step involves examining the relationships between the constructs and the model's predictive capabilities.

#### 4.8.1. Path Coefficients

The path coefficient represents the hypothesized relationships linking the constructs, and the values are standardized on a range from  $-1$  to  $+1$ , with coefficients closer to  $+1$  representing strong positive relationships and coefficients closer to  $-1$  indicating strong negative relationships (Hair et al., 2014).

#### 4.8.2. The Coefficient of Determination (R2)

The coefficient of determination (R2) is a measure of the model's predictive accuracy and represents the exogenous variable's combined effect on the endogenous variables. This effect ranges from 0 to 1, with 1 representing complete predictive accuracy, while values of 0.75, 0.50, and 0.25 represent substantial, moderate and weak effects respectively (Hair et al., 2011; Henseler, Ringle, & Sinkovics, 2009). As shown in Figure 2, the R2 values obtained for competitive advantage (0.325) indicated a moderate effect. That is, 32.5% of the variance in competitive advantage is explained by the product-related activities of the value chain. As shown by the results, the exogenous latent variables have different effects on the endogenous constructs. With the path coefficient value of 0.464, inbound logistic has the largest effect on competitive advantage, compared with operation (0.321).

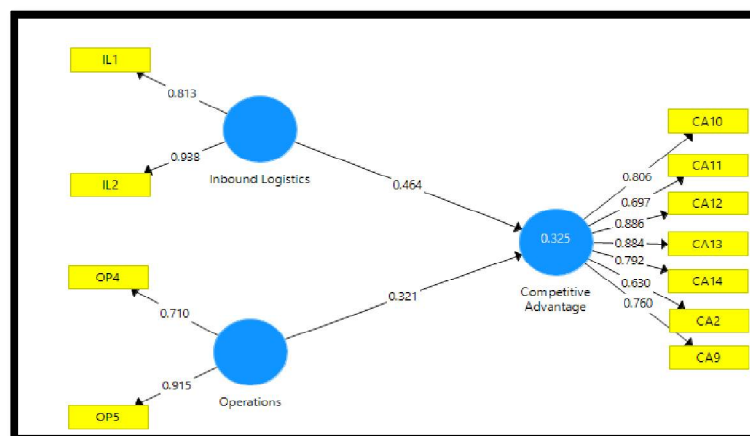


Figure 2: Path Coefficient

#### 4.8.3. Critical Values

The bootstrapping procedure was used to assess the path coefficients' significance at 5000 minimum bootstraps, and the critical t-values for a two-tailed test was 1.96 at 5% significance level. Thus, when the empirical t-value is larger than the critical value, the coefficient is significant at the stated significant level. As shown in Figure 3, the paths IL  $\rightarrow$  CA (8.171) and OP  $\rightarrow$  CA (4.921) have a coefficient value larger than the critical value.

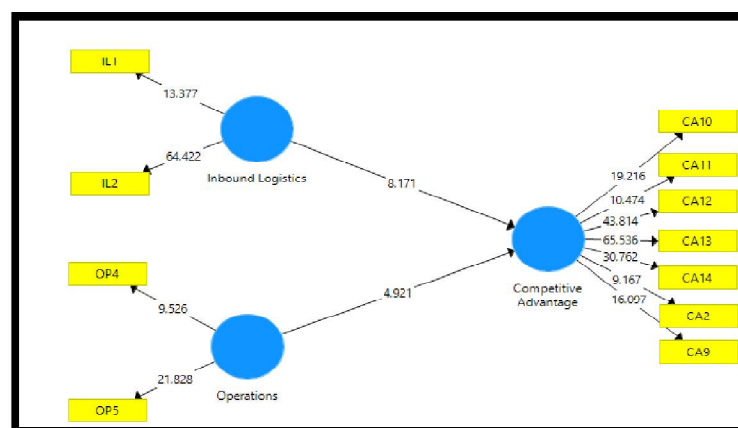


Figure 3: Path Coefficient T-Values

#### 4.8.4. Predictive Relevance of The Model (Q2)

To assess the predictive power of the model, the cross-validated redundancy was utilized. The value of the cross-validated redundancy was obtained by running the blindfold procedure to generate the communality and redundancy at 300 maximum iterations, a stop criterion of  $1 \cdot 10^{-5}$  and an omission distance of 7. The predictive power of the model was based on Cohen's (1988) guidelines 0.26: substantial; 0.13: moderate; 0.02: weak. A model is considered to have predictive quality if the cross-validated redundancy values were found to be more than zero, otherwise, the predictive relevance of the model cannot be confirmed (Fornell & Cha, 1994). The cross-validated redundancy of the endogenous variable was found to be 0.175, which is greater than zero. Therefore, the hypothesized model indicated good overall predictive power, since the Q2 value of 0.175 was positive, in line with (Hair et al., 2014; Henseler et al., 2009).

#### 4.8.5. Effect Sizes ( $f^2$ ) and ( $q^2$ )

The effect size  $f^2$ , is computed by noting the change in  $R^2$  when a specific construct is eliminated from the model. To calculate the  $f^2$ , two PLS path models are estimated. The first path model is the full model as specified by the hypotheses, yielding the  $R^2$  of the full model ( $R^2_{included}$ ). The second model is identical except that a selected exogenous construct is eliminated from the model, yielding the  $R^2$  of the reduced model ( $R^2_{excluded}$ ). Based on the  $f^2$  value, the effect size of the omitted construct for a particular endogenous construct can be determined, such that 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively (Cohen, 1988). The effect size of inbound logistic activities (0.29) was large, while that of operation activities (0.14) was medium. Similar to the procedure for obtaining  $f^2$ , the effect size ( $q^2$ ) is computed by noting the change in  $Q^2$  when a specific construct is eliminated from the model. To calculate the  $q^2$ , two PLS path models must be estimated. The first path model is the full model as specified by the hypotheses, yielding the  $Q^2$  of the full model ( $Q^2_{included}$ ). The second model is identical except that a selected exogenous construct is eliminated from the model, yielding the  $Q^2$  of the reduced model ( $Q^2_{excluded}$ ). Based on the  $q^2$  value, the effect size of the omitted construct for a particular endogenous construct can be determined, such that 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively (Cohen, 1988). The effect size of inbound logistic activities was (0.14) medium; while that of operation activities was (0.06) small.

#### 4.8.6. Hypotheses Testing

Based on the results of the study achieved through PLS-SEM statistical procedure as shown in Table 4, the following discoveries were made:

- Hypothesis 1, which predicted a significant relationship between inbound logistic activities and competitive advantage of manufacturing companies has this result:  $\beta = 0.464$ ,  $t = 8.171$ ,  $p = 0.001$  and therefore was supported. The alternate hypothesis was accepted.
- Hypothesis 2, which predicted a significant relationship between operation activities and competitive advantage of manufacturing companies has this result:  $\beta = 0.321$ ,  $t = 4.921$ ,  $p = 0.001$  and therefore was supported. Thus, the alternate hypothesis was accepted.

	Relationships	Beta	t-value	p-values	Decision
H <sub>1</sub>	IL→CA	0.464	8.171	0.000	Supported
H <sub>2</sub>	OP→CA	0.321	4.921	0.000	Supported

Table 4: Hypotheses Testing  
Compiled by the Author

#### 4.9. Findings

The following are the findings of the study:

- Inbound logistic activities have significant effects on the competitive advantage of manufacturing companies in Northern Nigeria.
- Operation activities have significant effects on the competitive advantage of manufacturing companies in Northern Nigeria

### 5. Discussion

The broad objective of the study was to assess the effect of product-related activities of manufacturing companies on competitive advantage and the results of the study underscored the importance of the relationships and the implications therein.

#### 5.1. Inbound Logistic Activities and Competitive Advantage

It was postulated that there will be a significant relationship between inbound logistic activities and competitive advantage of manufacturing companies. The relationship ( $\beta = 0.464$ ,  $t = 8.171$ ,  $p = 0.001$ ) was found to be significant. This means that for every unit increase in inbound logistic activities, there was a 46.4% increase in a firm's competitive advantage. The consequences of this finding were that activities associated with receiving, storing, and disseminating inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling, and returns to suppliers, are significant in gaining competitive advantage for manufacturers. This finding agreed with most established results (Jie et al., 2013; Mellat-Parast & Spillan, 2014; Naliaka & Namusonge, 2015; Obasan et al., 2016; Thatte et al., 2013) and supported the hypothesis.

#### 5.2. Operations Activities and Competitive Advantage

It was proposed that there will be a significant relationship between operation activities and competitive advantage of manufacturing companies, and the relationship ( $\beta = 0.321$ ,  $t = 4.921$ ,  $p = 0.001$ ) was found to be significant. This means that for every unit increase in operation activities, there was a 32.1% increase in a firm's competitive advantage. Thus, it implied that the activities associated with transforming inputs into the final product form, such as machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations are vital in gaining competitive advantage for manufacturers. The findings support the hypothesis and in agreement with the outcomes of other studies (Bagshaw, 2014; McGuinness & Hutchinson, 2013; Netland & Aspelund, 2013).

## 6. Conclusion and Recommendations

Results obtained indicated that the two product-related activities of manufacturers in the model have a significant relationship with a competitive advantage. Based on the findings, it was recommended that managers of manufacturing companies should deploy more resources at both activities and take advantage of the significant relationship between them and competitive advantage.

## 7. Implications, Limitations and Future Research

Managers can count on their inbound logistic as well as operation activities along their value chain to contribute to gaining competitive advantage. The first notable limitation of the study was the typical limitations of the cross-sectional design, such as finding and recruiting participants from the target population, representativeness of the sample, lower validity and reliability scores. The second limitation was the PLS bias, which relates to the assessment of model fit and consistency of the parameter estimates. Future studies should consider a longitudinal design to determine the relationships over time and should use covariance-based SEM (CB-SEM) to avoid the PLS bias.

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