The effect of information and communication technology on business performance

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Abstract: *Information and communication technology (ICT) utilization has proved to be influential in business performance among small and medium enterprises (SMEs). Many studies have analyzed the effect of ICT on business performance at a firm level. The current study, however, analyzes the effect of ICT utilization on business performance using national average data. The main objective of this study was to analyze the effect of ICTs utilization on business performance and how business performance as a latent variable can be measured by logistic performance indices. The study used structural equation modeling to analyze the influence of logistic performance indices on the business performance measurement model. All post-estimation tests show that the current study's model is the best fit. The results show that logistics performance indicators are good measurements of business performance. Nevertheless, the use of ICTs significantly improves business performance among countries. Policymakers should focus their attention in influencing the adoption of ICTs for sustainable competitiveness. Future studies, however, should concentrate on how best the ICT variables can be grouped to make a confirmatory factor analysis.*

Keywords: *International trade; business performance; information and communication technology*

JEL Classification: *P33; L21; D83*

This paper has five sections. Sections 1, 2, 3, 4 and 5 named as introduction, literature review, methodology, findings and discussions, and conclusion respectively.

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Introduction

The ninth goal of United Nations sustainable development goals is set to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. Over reliance of economic growth, social development and climate action on infrastructure, sustainable industrial development and technological progress, necessitates the investment. However, in many developing countries, basic infrastructures including information and communication technologies are said to remain scarce. In 2019, some 87 percent of people in developed countries used the Internet, compared with just 19 percent in the least developed countries. It is important that everyone cares for this goal because inclusive and sustainable industrialization, together with innovation and infrastructure, can unleash dynamic and competitive economic forces that generate employment and income. They play a key role in introducing and promoting new technologies, facilitating international trade and enabling efficient use of resources (World Bank, 2022).

As the importance of business competitiveness on sustainable business performance (Tan, Ochoa, Langston, & Shen, 2015) continues to grow, information and communication technology utilization becomes a thing not to do without (Arefin & TowfiqurRahman, 2020). Worldwide, economic development of a country is highly driven by competitiveness of enterprises in a particular country (Bajdor, Pawełoszek, & Fidlerova, 2021). The positive link between enterprise business performance improvement and economic development (Niebel, 2018; Koffi, Hongbo, & Zaineldeen, 2021) shows that countries with higher levels of living standards have higher levels of business competitiveness (Boikova, Zeverte-Rivza, Rivza, & Rivza, 2021). Improving business competitiveness through innovation has proved to sustainably expand business capital through increased profit. Business competitiveness is highly driven by ICT utilization.

ICT utilization is the main driver of business competitiveness among small and medium enterprises (Ongori & Migiro, 2010). In developing countries, the use of ICTs among small and medium enterprises is still low due to such barriers as high costs of hardware and software infrastructure, non-availability of support systems and lack of expertise (Asunka, 2016). Big companies invest heavily in ICT development with website and other internet based technologies to reach many customers within a short time and serve them efficiently. Countries like China (Zhu, Li, Yang, & Balezentis, 2021) and India (Erumban & Das, 2016) heavily and increasingly invest in ICT development in their businesses. ICT utilization has significantly reduced the distance barrier in business. Customers can easily locate companies and order products of their choice through the internet. Some have gone far to order food from restaurants through mobile phones given mailing addresses availability. As a result, due to ICT utilization, a company can be physically close to customers but be outperformed by far distance companies.

ICT utilization has proved to improve business performance from company to regional level (Vekic et al., 2020). The study intended to analyze the effect of ICT utilization on business performance using the country as a unit of analysis. Specifically, the study analyzed the interaction between ICT variables and their effect on business performance. Nevertheless, the structural equation modeling helped to show the importance of logistic indices in measuring business performance.

The rest of the study is organized as follows, section 2 reviews the literature, and section 3 discusses the study's methodology. The findings are discussed in section 4, and section 5 provides the conclusion and recommendations.

Literature Review

The importance of ICT on business competitiveness has attracted many development stakeholders both, policy makers, academicians and researchers, leading to a large volume of studies on the effect of ICT on business performance. Hector, Rudy, Hector, & Lidia, (2021) revealed a significant influence of ICTs adoption on marketing innovation. Their analysis uncovered a considerable impact of marketing innovation on business performance. These findings were similar to those of Héctor, Salvador, & Emigdio (2016) who used confirmatory factor analysis in structural modeling to reveal that, greater use of ICTs results in greater levels of innovation", "higher levels of innovation lead into greater performance", and greater use of ICTs leads into greater business performance.

Héctor, Joao, & Neftalí (2022) analyzed the effect of ICTs adoption on absorptive capacity and open innovation for a greater business performance. They also determined the mediating role of absorptive capacity on the effect of ICT on open innovation. They revealed a significant impact of ICT on absorptive capacity and open innovation. Nevertheless, it was also established that absorptive capacity significantly influenced open innovation. Furthermore, absorptive capacity was revealed to play a significant partial mediating role in the relationship between ICT and open innovation indicating the ability of ICT adoption to strengthen open innovation through absorptive capacity.

Pathan, Jianqiu, Gilal, & Salam (2017) identified four hypotheses concerning the influence of ICTs on business performance. They verified a significant direct effect of ICT utilization on organizational performance among small and medium enterprises (SMEs). The second hypothesis stated that ICT utilization had a direct effect on the economic growth of SMEs. They also uncovered the ICT's direct effect on business expansion of SMEs, and a direct and significant effect of ICT utilization on technological development of SMEs. They contend that SMEs save time, improve business processes accuracy rate and reduce internal or external complexity by utilizing ICT. Furthermore, they observe that ICT enables companies to keep faster communication with their customers who in today's era are the real assets of

an organization. That firms which use business to business (b2b), and business to client (b2c) platforms usually enjoy more business benefits.

H1: ICT utilization affects business performance positively.

A company or country which is logistically competitive, in terms of time saving when serving customers, expands business by attracting more customers. Kerdpitak (2022) analyzed business performance of herbal community enterprise in Thailand using factors of marketing channel, competitive advantage, logistics integration and innovative management. In their findings, all the factors including logistic performance, affect business performance positively. Yingfei et al. (2022) found that firm performance and service quality have a strong mediating effect between green logistics performance, infrastructure, services, trade and environment.

Abushaikha, Salhieh, & Towers (2018) revealed the importance of warehouse operational and distributional performance in mediating the relationship between warehouse waste reduction level and business performance. They assert that improvement in distributional performance of warehouses is reflected in the logistics performance of downstream retailers. According to Agyabeng-Mensah et al. (2021), green logistics management practices are significant drivers of organizational performance. Their study explored the influence of green logistics management practices, logistics eco-centricity and supply chain traceability on sustainability performance. In their findings, green logistics management practices negatively influenced business performance. However, logistics eco-centricity and supply chain traceability augmented green logistics management practices to achieve significant improvements in both business performance and environmental sustainability through mediating effects approach.

Logistics is crucial in the development and competitiveness of a country due to its importance in national and international trade (Kabak, Önsel Ekici, & Ülengin, 2020). In their analysis, Kabak et al. (2020) investigated a two way interaction between the competitiveness and logistics performance of countries using a hybrid methodology. Initially, using a Bayesian Net, they established a causal relationship between countries' competitiveness and their logistics performance. The causal effect information gathered from the Bayesian Net was taken as input to the Partial Least Square model to highlight the pillars of competitiveness that are more critical in contributing to countries' logistics performance. They established a positive relationship between logistic performance index and market size of a country.

H2: Logistics performance indicators are good measurements of business performance.

Nearly all literature on ICT and business performance used firm level data. This study adds to the body of existing literature by using data at national level. In average values, categorical variables turn to be continuous in nature. The study innovatively applied logistic performance indicators in the measurement model.

Methodology

3.1. Variable Notation

The study applied a structural equation model due to the fact that business performance (BUSP) is not directly observed in the data set. This variable is considered a latent endogenous variable leading into a measurement model. Five variable types recognized by structural equation model (sem) commands are; observed endogenous variables (y), observed exogenous variables (x), latent endogenous variable (η), latent exogenous variables (ξ) and error variables. The error variables are divided into two groups, for observed endogenous $(e.y)$ and for latent endogenous $(e.\eta)$. In any given analysis, there are typically several variables of each type. However, in the current analysis, there is no latent exogenous variable. The vectors of the four main variable types are denoted as y, x η, and ξ.

The vector of all endogenous variables is given as $Y = \begin{pmatrix} y \\ \eta \end{pmatrix}$, the vector of all exogenous variables is given as $X = \begin{pmatrix} x \\ \xi \end{pmatrix}$, the vector of all error variables is given as $\zeta = \begin{pmatrix} e.y \\ e.\eta \end{pmatrix}$.

3.2. Model and Parameterization

The current study's model fitted by sem is of the form

$$Y = BY + \Gamma X + \alpha + \zeta$$

where $B = [\beta_{ij}]$ is the matrix of coefficients on endogenous variables predicting other endogenous variables, $\Gamma = [\gamma_{ij}]$ is the matrix of coefficients on exogenous variables, $\alpha = [\alpha_{ij}]$ is the vector of intercepts for the endogenous variables, and ζ is assumed to have mean 0 and $Cov(X, \zeta) = 0$.

Let $\kappa = [\kappa_j] = E(X)$

$$\Phi = [\phi_{ij}] = Var(X)$$

$$\Psi = [\psi_{ij}] = Var(\zeta)$$

Then the mean vector of the endogenous variables is $\mu_Y = E(Y) = (I - B)^{-1}(\Gamma\kappa + \alpha)$, the variance matrix of the endogenous variables is $\sum_{YY} = Var(Y) = (I - B)^{-1}(\Gamma\Phi\Gamma' + \Psi)\left\{(I - B)^{-1}\right\}'$, and the covariance matrix

between the endogenous variables and the exogenous variables is $\sum_{YX} = Cov(Y, X) = (I - B)^{-1}\Gamma\Phi$. Let Z be the vector of all variables: $Z = \begin{pmatrix} Y \\ X \end{pmatrix}$ then its mean vector is $\mu = E(Z) = \begin{pmatrix} \mu_Y \\ \kappa \end{pmatrix}$ and its variance matrix is $\sum = Var(Z) = \begin{pmatrix} \sum_{YY} & \sum_{YX} \\ \sum_{YX} & \Phi \end{pmatrix}$. Since structural equation modeling is using the maximum likelihood estimation approach, more definitions are needed to make the equations well elaborated. Let z_t be the vector of all observed variables for the t^{th} observation, $z_t = \begin{pmatrix} y_t \\ x_t \end{pmatrix}$ and let w_t be the corresponding weight value, where $t = 1,..., N$. If no weight is specified then we have $w_t = 1$. By letting w be the sum of the weights, the sample mean vector becomes $\bar{z} = \frac{1}{w}\sum_{t=1}^{N} w_t z_t$ and the sample variance matrix is $S = \frac{1}{w-1}\sum_{t=1}^{N} w_t (z_t - \bar{z})(z_t - \bar{z})'$.

Maximum Likelihood

Maximum likelihood is the method which the current study applied in estimating the structural equation model. Let θ be the vector of unique model parameters, such as

$$\theta = \begin{pmatrix} vec(B) \\ vec(\Gamma) \\ vech(\Psi) \\ vech(\Phi) \\ \alpha \\ \kappa \end{pmatrix}$$

Then under the assumption of the multivariate normal distribution, the overall log likelihood for θ is $\log L(\theta) = -\frac{w}{2}\left\{k\log(2\pi) + \log\left\{\det\left(\sum_O\right)\right\} + tr\left(D\sum_O^{-1}\right)\right\}$

Where, k is the number of observed variables, $\sum_O$ is the sub-matrix of $\sum$ corresponding to the observed variables, and $D = fS + (\bar{z} - \mu_O)(\bar{z} - \mu_O)'$

Where,

$$f = \begin{cases} 1 & \text{, if nm1 is specified} \\ \dfrac{w-1}{w} & \text{, otherwise} \end{cases}$$

and μ_O is the sub-vector of μ corresponding to the observed variables.

For the BHHH optimization technique, when computing observation-level scores, the log likelihood for θ is computed as

$$\log L(\theta) = -\sum_{t=1}^{N} \frac{w}{2}\left\{k\log(2\pi) + \log\left\{\det\left(\sum_O\right)\right\} + (z_t - \mu_O)'\sum_O^{-1}(z_t - \mu_O)\right\}$$

and the nm1 option is ignored.

3.3. Data and Data Source

The World Integrated Trade Solution (WITS) provided cross sectional data for 218 countries. However, only 79 countries remained for the analysis following data cleaning. Every country with a blank cell was excluded from the analysis. Some variables like mobile cellular monthly subscriptions and mobile accounts were excluded from the analysis due to missing data. These cross section data were obtained in different years. For instance, ICT infrastructure and services variables' availability range from 2014 fixed broadband internet tariff to 2015 internet users (per 100 people). Some variables' availability depend on the year the survey was conducted. For example, on trade logistics and trade facilitation, information on days to clear direct exports through customs varied from 2005 in Greece to 2014 in Afghanistan (WITS, 2022). Data availability varied from country to country and from variable to variable, but used as a cross section to establish the relationship between ICT and business performance.

3.4. Variables used in the Analysis

For effective visualization, variables have been abbreviated. Endogenous variables are in three groups namely observed, measurement, and latent, while no latent exogenous variable. Observed endogenous variables included; international shipment score (ishis), burden of customs procedure (bucp), used an account to make a transaction through a mobile phone (umobac), business to client internet use (b2c), and days to clear direct exports through customs (clex). The measurement to the latent variable included logistics

competence score (locs), tracing and tracking score (track), and timeliness score (tims). The business performance score (BUSP) is measured by a number of factors in which it perfectly stands as a latent variable. The list of observed exogenous variables include; business to business ICT use (b2b), debit card used in the past year in percentage of age 15+ (decup), and credit card used in the past year in percentage of age 15+ (crecup).

Measurement model variables fall under trade logistics and trade facilitation. International shipment score (ishis) is the ease of arranging competitively priced shipments, rated from "very difficult" (1) to "very easy" (5). Burden of customs procedures score (bucp) asking how efficient are the customs procedures (related to the entry and exit of merchandise)? [1=not efficient at all; 7=extremely efficient]. Average time to clear direct exports through customs (clex) is the average number of days to clear direct exports through customs. Tracing and tracking score (track) is the ability to track and trace consignments, rated from "very low" (1) to "very high" (5). Logistics competence score (locs) is the competence and quality of logistics services, rated from "very low" (1) to "very high" (5). Timeliness score (tims) is the frequency with which shipments reach consignees within scheduled or expected delivery time rated from "hardly ever" (1) to "nearly always" (5).

Other variables used in the analysis fall under the payment solution category like the percentage of respondents who used an account to make transactions through mobile phones for the age of 15+ (umobac). It denotes the percentage of respondents who reported making a transaction with money from their account at a bank or another type of financial institution using a mobile phone in the past 12 months. This included using a mobile phone to make payments, to make purchases, or to send or receive money. Credit card used in the past year as percentage of age 15+ (crecup) denotes the percentage of respondents who reported to use their own credit card in the past 12 months. The debit card used in the past year as percentage of age 15+ (decup) denotes the percentage of respondents who reported using their own debit card directly to make a purchase in the past 12 months.

The e-commerce skills development category added two more variables in the analysis. The business to client internet use (b2c) variable which inquired information on the use of the internet to sell goods and services to customers. The extent businesses use the internet for selling their goods and services to customers. It was rated as 1 "not at all", to 7 "to a great extent". Business to business ICT use (b2b) uncovered the extent to which businesses use ICTs for transactions with other businesses. This was rated as 1 "not at all" to 7 "to a great extent".

Table 1. Variables Descriptive Statistics

Category	Variable	Mean	Min.	Max
Trade logistics and trade facilitation	ishis	2.891139	2	3.9
	locs	2.831646	1.9	4.3
	track	2.898734	1.9	4.3
	clex	7.867089	1.1	21.2
	tims	3.3	2.1	4.5
	bucp	3.901266	1.9	5.7
Payment solutions	decup	23.12025	0	88.8
	crecup	11.43671	0	75.1
	umobac	5.940506	0	32.9
E-commerce skills development	b2b	4.639241	2.9	6
	b2c	4.411392	2.6	5.9

Source: WITS (2022)

Descriptive statistics in Table 1 show the range for 79 countries included in the analysis. Starting from trade logistics and trade facilitation category, this does not have a significant gap between the lowest and highest level. On average, the ease of arranging competitively priced shipment ranged from difficult (2) to ease (3.9 which is close to 4). All countries strive to attain excellence.

The variation in time to clear exports through customs (clex) is huge. Some countries namely Albania, Croatia, Lithuania, Romania, and Slovak Republic have shown a high level of competence. It takes less than 2 days to clear exports in these countries. While others like Benin, Brazil, Burundi, Cameroon, Ecuador, Mali, Moldova, Peru, and Venezuela, RB, have shown low levels of competence. In these countries, it takes more than 15 days to clear export. However, for Burundi and Moldova the case is even worse, since it takes up to more than 20 days which is almost three weeks.

Another huge variation is noted in the payment solution category. The percentage of respondents who used an account to make transactions through mobile phone (umobac) varied significantly. The highest is 32.9 percent in Korea, Republic while the lowest is 0 percent in Moldova. The average is also very low compared to the highest value because many countries (65) had less than 10 percent out of which 47 countries had less than 5 percent. But still, 27 countries reported having less than 2 percent of respondents who used accounts to make transactions through mobile phones. In the sample, only 14 countries reported more than 10 percent of respondents using accounts to make transactions through mobile phones. Apart from Korea, Republic, only 2 countries (Ireland and Spain) reported having more than 20 percent of respondents using this channel to make transactions.

The same pattern is shown by crecup and decup where the variation is huge and the mean is closer to the minimum value than the maximum value. A close check on crecup shows 48 countries reporting less than 10 percent of respondents using credit cards in the past year. Only 13 countries had more than 20 percent of the respondents using credit cards to make

transactions. The highest value is reported in Israel followed by Korea, Republic with more than 50 percent of the respondents using credit cards to make transactions. However, the lowest value (0 percent) is reported in Bhutan, where no respondent had used a credit card to make a transaction. But, few users can make the ratio to total population of age 15+ technically not different from 0.

On the E-commerce skills development category for both business to business ICT use (b2b) and business to client internet use score (b2c), the average score is slightly skewed to good performance exceeding the middle value of 4. Starting with b2b, we see that 19 countries had scored above 5 with Estonia scoring 6 much closer to the highest rate of 7. As such, Estonian business to business ICT use is close to a great extent. Other countries such as Germany, Israel, Lithuania, and Malaysia, with scores greater than 5.6, can be grouped together with Estonian and be considered as countries with high business to business ICT usage. The b2c like b2b, range from 1 "not at all" to 7 "to a greater extent. However, from Table 1, the disparity is very high ranging from 2.6 to 5.9 with average score of about 4.4. Burundi with less than 3 and other 18 countries ranging from 3 to 4, are considered to have lower extent of b2c internet usage.

Findings and Discussions

4.1. Post Estimation Tests

To assure robustness of the estimated model, the study performed post-estimation tests as shown in Table 2. Panel (a) of Table 2 shows equation level goodness of fit where only two equations umobac and clex have less than 50 percent of variations explained in the model. However, the overall R-square shows that our model is a good fit because more than 70 percent of the variation is explained in the model. The rest of equations have higher than 50 percent of their variations explained in the model. The residual statistics are all positive because the fitted variances are larger than predicted variances showing positive biasness.

Table 2. Test for equation-level goodness of fit

(a) Equation-level goodness of fit									
depvar		variance					(b) Wald test for equation		
observed	fitted	predicted	residual	R-Squared	mc	mc2	Chi 2	df	P-value
ishis	.206	.198	.021	.898	.948	.899	8.03	1	.0046
locs	.240	.223	.016	.933	.966	.933	279.40	1	.0000
track	.286	.271	.015	.947	.973	.947	300.30	1	.0000
tims	.240	.208	.033	.864	.930	.864	211.30	1	.0000
bucp	.505	.254	.251	.502	.709	.502	78.86	2	.0000
umobac	40.0	26.3	37.3	.067	.447	.200	42.13	4	.0000
b2c	.538	.415	.122	.773	.879	.773	268.27	2	.0000
clex	23.5	3.97	19.6	.169	.411	.169	16.09	1	.0000
latent									
BUSP	.234	.195	.108	.538	.751	.564	70.31	2	.0000
Overall				.732					

Source: WITS (2022)

In this study, a close analysis of the R-Squared and Bentler–Raykov squared multiple-correlation coefficient (mc2) reveals that we have both recursive and non-recursive structural equation models. According to Bentler & Raykov (2000) R-squared and mc2 are equivalent for recursive models, while for non-recursive models, the fits are distinct. As a result, ishis, umobac, and BUSP are non-recursive structural equation models while the rest of equations (locs, track, tims, bucp, b2c, and clex) are recursive models. It is recommended to use mc2 as a measure of explained variance for non-recursive systems that involve endogenous variables with reciprocal causations. The current study, however, did not involve such endogenous variables.

The Wald test also reveals that all equations involved in the structural equation model analysis are statistically significant. In this case we reject the null hypothesis which states that all coefficients are zero. The stability test provides a stability index of 0.774779. All the Eigenvalues lie inside the unit circle which implies that the estimated structural equation model satisfies the stability condition. The stability condition allows the study to analyze the indirect effects.

Table 3. Indirect and total effects

(a) Indirect effect					
Structural	**bucp**	**umobac**	**b2c**	**clex**	**BUSP**
ishis	-.317***(.051)	-.310(1.34)	-.342(cons)	-.299(cons)	-.105(.153)
umobac	.036***(.003)	.035(.073)	.039(cons)	.034(cons)	.012***(.004)
b2c	.156***(.015)	.153(.396)	.168(cons)	.147(cons)	.052**(.021)
BUSP	-.317 (cons)	-.310(cons)	-.342(cons)	-.299(cons)	-.105(cons)
b2b	.347***(.058)	.339(1.53)	.374(cons)	.327(.689)	.115*(.067)
decup	.004***(.001)	.003(.023)	.004(cons)	.0033(cons)	.001(.002)
crecup	.010***(.002)	.010(.035)	.011(cons)	.009(.0121	.003(.003)
Structural	ishis	Measurement	locs	track	tims
ishis	-.317**(.153)		2.78***(.149)		
umobac	-.017**(.008)		-.317***(.008)		
b2c	-.073(.045)		-1.37***(.044)		0 (no path)
BUSP	-.317 (cons)		-5.98(cons)		
b2b	.347***(.067)		-3.04***(.067)	0 (no path)	-2.63***(.066)
decup	.004**(.002)		-.030***(.002)		
crecup	.010***(.003)		-.042***(.003)	0 (no path)	-.023***(.003)
Structural	bucp	umobac	b2c	clex	BUSP
ishis	-.317***(.051)	-.310(2.88)	-.342(cons)	-.299(cons)	-.105(.153)
umobac	.036***(.003)	.035(.073)	.039(cons)	.034(cons)	.012(.008)
b2c	.156***(.015)	.153(.396)	.168(cons)	.147(.677)	.052(.045)
BUSP	.683***(.155)	.667(cons)	.735(cons)	.643(cons)	.226(cons)
b2b	.347***(.101)	.339(1.09)	.374***(.077)	.327(.689)	.756***(.067)
decup	.004***(.001)	.003(.032)	.004(cons)	.003(cons)	.001(.002)
crecup	.005***(.002)	.010(.047)	.011***(.003)	.009(.011)	.003(.003)
Structural	ishis	Measurement	locs	track	tims
ishis	-.3174**(.1526)		-5.981***(.1491)		

(a) Indirect effect					
Structural	**bucp**	**umobac**	**b2c**	**clex**	**BUSP**
umobac	.036***(.008)		-.317***(.008)		
b2c	.156***(.045)		-1.37***(.044)		-2.72***(.043)
BUSP	-.317(cons)		-5.98***(.058)		
b2b	.347***(.067)		2.36***(.067)	.970***(.074)	-2.63***(.066)
decup	.004**(.002)		.065***(.002)		
crecup	.010***(.003)		.150***(.003)	.009***(.003)	-.023***(.003)

Note: ***, **, and * imply significant at 1, 5, and 10 percent respectively. Standard errors and in parentheses and constr. = constrained

Source: WITS (2022)

The direct effects are normally ignored in the sem system because they are found on the path diagram. The total effects are the direct plus the indirect effect. The indirect effects are also referred to as mediating effects.

4.2. Estimation Results

4.1.1. Indirect Effect

Structural model indicates only three equations, bucp, BUSP and ishis, with significant variables. An improvement in international shipment score (ishis) reduces efficiency in customs procedure (bucp). The business performance latent variable is constrained in all equations. The use of account to make transactions through mobile phone (umobac), business to client internet use (b2c), business to business ICT use (b2b), the use of debit card (decup), and use of credit card (crecup), each improves efficiency in customs procedure. Their individual effects on customs procedure are statistically significant at all levels of significance. B2b, decup, and crecup have a positive and significant influence on international shipment score (ishis). However, ishis has a negative feedback on itself and b2c also negatively influences ishis. Business performance (BUSP) is positively and significantly influenced by umobac and b2c. The influence of b2b on ishis is significant at 10 percent, but when the confidence interval is used, the effect becomes insignificant because the interval crosses zero.

In the measurement model, logistics competence (locs), and timeliness (tims) scores are significantly influenced by the variables. There is no path for the track equation in the indirect portion of Table 3. Locs is positively influenced by ishis in the measurement model. Logistics competence improves with improvement in the international shipment score. However, umobac, b2c, b2b, decup and crecup negatively affect locs. The effect of independent variables changed direction differently from what was portrayed in bucp variable for structural model.

4.1.2. Total effects

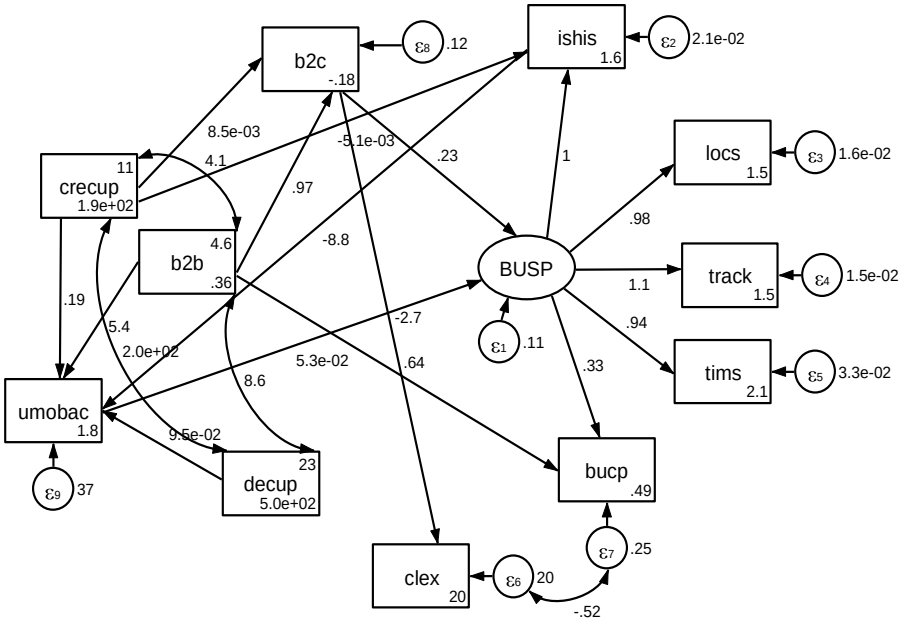
In the total effect, bucp is negatively influenced by ishis, but positively influenced by umobac, b2c, BUSP, b2b, decup and crecup. The business to business ICT uses (b2b) and credit card usage (crecup) influences business to client internet use (b2c) positively. But business performance (BUSP) is only influenced by business to business ICT uses (b2b). The use of ICT among businesses improves their business performance. Again, international shipment score (ishis) has a negative feedback on its own, while use of an account to make transactions through mobile phone (umobac) has changed the effect from negative indirect effect to positive total effect. There is an improvement on how business to client internet use (b2c) influences international shipment score (ishis). The effect changed from negative indirect effect to positive total effect. Business to business ICT uses (b2b), debit card usage (decup) and credit card usage (crecup) have retained the magnitude and direction of their effect on international shipment score (ishis).

In the measurement model, logistics competence score (locs) is negatively influenced by international shipment score (ishis), use of account to make transactions through mobile phone (umobac), business to client internet use (b2c), and business performance (BUSP), while positively influenced by business to business ICT uses (b2b), debit card usage (decup), and credit card usage (crecup). In the indirect effect panel, track had no path, but in the total effect, it is positively influenced by business to business ICT uses (b2b) and credit card usage (crecup). There was no path between tims and business to client internet use (b2c) in the indirect effect panel. However, in the total effect panel, tims is now negatively influenced by b2c, b2b, and crecup.

4.1.3. The Path Diagram

The path diagram shows the relationship between observed endogenous and exogenous variables, and the latent variable (business performance). From the path diagram, we have endogenous observed variables which are the variables in the squared boxes with error term attached. The endogenous observed variables are divided into two groups. As it can be seen in the diagram, those which determine other variables like b2c, ishis and umobac, and those which do not determine other variables clex, bucp, locs, track and tims. However, clex and bucp are connected in terms of correlation or covariance denoted by the double headed arrow. Nevertheless, locs, track and tims are measurement variables with only arrows from latent variables pointing to them. Exogenous observed variables are b2b, crecup, and decup with arrows only pointing to other variables.

Figure 1. Path Diagram for Structural Equation Model



Source: WITS (2022)

The direct effect of a variable to another variable is denoted by a coefficient on the arrow which shows the effect of a variable the arrow is pointing from on the variable the arrow is pointing to. The indirect effects are the influence of a variable on another variable with which there is no direct connection in terms of path coefficient. The indirect effect cannot be observed directly from the diagram but rather through post estimation tests. From the diagram, we can only see the magnitude and direction of the effect coefficients on the arrows, error terms pointing to respective endogenous variables, and intercept coefficients at the bottom right of the squared boxes. The top right coefficients in the squared boxes of the observed exogenous variables denote the approximate mean value. Nevertheless, the variance coefficients can be seen besides the error term and the covariance coefficient along the covariance arrow. However, it is not possible to tell from the diagram whether or not a variable is statistically significant. The diagram is not exhaustive in terms of statistical inference. Table 4 is used to make statistical inferences on the relationship between the variables used to fit the structural equation model.

From Table 4, we have three types of parameters, structural, measurement, variance and covariance in panels (a), (b), (c) and (d) respectively, all of which are statistically significant. From the maximum likelihood method, -1199.9539 an estimate for log likelihood is reached

after 124 to 125 iterations. The structural equation model estimated in the current study is robust since the null hypothesis that the model is saturated, cannot be rejected. The LR test of model versus saturated provided a chi2 (35) statistic of 17.46 with probability value of 0.9942 which is far larger than 0.05, the estimated model is the best fit.

Table 4. Structural Equation Model Estimates

(a) Structural	**ishis**	**bucp**	**umobac**	**b2c**
BUSP	1(constrained)	.331**(.155)		
ishis			-8.76**(4.21)	
b2b		.641***(.125)	5.40***(2.08)	.970***(.077)
decup			.095**(.048)	
crecup	-.005***(.002)		.192***(.071)	.009**(.003)
umobac				
b2c				
cons.	1.62***(.261)	.491(.481)	1.817(8.225)	-.1836(.3406)
	clex	BUSP		
umobac		.053***(.012)		
b2c	-2.72***(.677)	.229***(.066)		
cons.	19.9***(3.03)			
(b) Measurement	**locs**	**track**	**tims**	
BUSP	.977***(.058)	1.08***(.062)	.941***(.065)	
cons	1.54***(.262)	1.47***(.288)	2.05***(.257)	
(d) Covariance	**e.bucp**	**decup**	**b2b**	**crecup**
e.clex	-.524**(.257)			
decup		503		199***(16.5)
b2b		8.55***(.746)	.355(.424)	
crecup			4.14***(.589)	186

(c) Variance			
e.ishis	.0211***(.0044)	e.umobac	37.29***(12.84)
e.locs	.0161***(.0037)	e.b2c	.1223***(.0195)
e.track	.0152***(.0039)	e.clex	19.55***(3.112)
e.tims	.0325***(.0060)	e.BUSP	.1082***(.0272)
e.bucp	.2515***(.0401)		

Log likelihood = -1199.9539 LR test of model vs. saturated: chi2(35) = 17.46, Prob. > chi2 = 0.9942
*Note: *** and ** denote significance at 1 and 5 percent levels of significance. Standard errors are in parentheses.*

Source: WITS (2022)

The burden of customs procedures (bucp), which indicate how efficient customs procedures are in relation to entry and exit of merchandise, is influenced by business performance (BUSP) and business to business ICT use (b2b). Both business performance and business to business ICT use positively influence efficiency in customs procedure. As business performance improves, customs procedures become more efficient and as businesses

increase their ICT usage in communicating with other businesses, custom procedures become more efficient.

The use of an account to make transactions through mobile phone (umobac) like crecup in the payment solution category, is negatively affected by international shipment score (ishis). Referring to Table 1, a large number of countries show a lower percentage of people using accounts to make transactions through mobile phones. But improvement in the business to business ICT usage positively influences the use of accounts to make transactions through mobile phones. The same effect is shown by debit card as well as credit card usage.

Business to client internet use (b2c) is also positively affected by business to business ICT usage (b2b) and credit card usage. When businesses strengthen their ICT with other businesses, communication with clients becomes easy. Credit card usage also influences business to client internet use as clients can easily use their credit card to make transactions online. Therefore, credit card use acts like a catalyst in influencing business to client internet usage.

Days to clear direct exports through customs (clex) is determined by business to client internet use (b2c). The effect of b2c on clex is negative and statistically significant at all levels of significance. The average increase in business to client internet usage reduces the average number of days to clear direct exports through customs. Countries with higher scores in business to client internet use take a few days to clear direct exports through customs. For instance, Lithuania and the Slovak Republic, which takes less than 2 days to clear direct export through customs, are found in the list of countries with the highest b2c score. This is an indication that b2c increases efficiency in terms of direct export clearance time reduction.

Two observed variables, umobac and b2c have been used to determine business performance (BUSP) which is measured by logistics competence score (locs), tracing and tracking score (track), and timeliness score (tims). The use of an account to make transactions through mobile phone (umobac), positively and significantly influences business performance. The use of mobile phones to make transactions saves time and increases safety among businesses and clients. There is no need to worry about paper money since every transaction goes to the bank account. In connection to mobile phone usage, business to client internet use (b2c) also increases business performance as it saves time and other resources.

The measurement model shows that all variables, logistics competence score (locs), tracing and tracking score (track), and timeliness score (tims), are all measurements of business performance, but with error. The error coefficients pointing to each measurement variable is an indication that the latent variable, in our case, business performance is measured by each variable with error. The variance of error parameters point to endogenous variables

based on the assumption made in structural equation modeling that all endogenous variables are measured with error.

There are four covariance coefficients as in the diagram with four double headed arrows. The covariance or correlation coefficient between clex and bucp is negative and statistically significant at 5 percent levels of significance. We expect direct export clearance days reduction with more efficient custom procedures. The remaining covariance coefficients which show the correlation between exogenous variables are all positive and statistically significant. Business to business ICT use is positively correlated with use of credit card and debit card. Nevertheless, credit card usage is also positively correlated with debit card usage.

Conclusion

The study aimed to analyze the effect of ICT on business performance. Business performance as an unobserved dependent variable was measured using four logistics performance indices, namely international shipment score (ishis), logistics competence score (locs), tracing and tracking score (track), and timeliness score (tims). The measurement variables were found to be good measurements of the latent business performance variable. While other information and communication technology indicators namely business to client internet use (b2c) and usage of an account to make transactions through mobile phone (umobac) were used to directly determine business performance. However, they are also determined by other exogenous and endogenous variables, namely Business to business ICT use (b2b), business to client internet use (b2c), usage of account to make transaction through mobile phone (umobac), debit card usage (decup), and credit card usage (crecup). The findings revealed that ICT utilization influences business performance. Nevertheless, logistics performance indicators proved to be good measures of business performance. Policy makers should put efforts to increase ICT utilization in order to realize higher business performance.

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