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The Entrepreneurial Opportunity in Malawi's Digital Transformation: Modelling Public Information Management Systems for Development

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Abstract The digital transformation in developing countries offers significant entrepreneurial opportunities, especially in public information management systems for socio-economic development. This study explored the opportunities existing in IMS creation and adoption in Malawi. The study used the extended Technology, Organizational, Environmental, and Individual Conceptual Framework. The study design was cross-sectional and utilized quantitative methods to examine the factors that promote or hinder IMS development. Data was collected from 426 respondents in IMS organizations through two questionnaires, with 63 respondents focusing on IMS creation and 363 on IMS adoption. The predictors of the response variables creation and adoption of IMS were; perceived Benefits, Innovation, Cost, IT Ability, External Support, Firm Size, Competitor Pressure, Tech Readiness, IT Experience, and Customer Pressure. Only four variables were significant in predicting IMS creation, which are; Perceived benefits at all the levels (1 to 5), Innovation at levels 2, 3, 4 and 5, Cost at level 4 and Competitor pressure at level 5. A respondent at Innovation level 2 was more than one times (1.766) more likely to create IMS than the one without any innovation. At level 3, the respondent was 1.615 times more likely to create IMS than the respondent without innovation. The respondent at level 4 was 1.922 times more likely to create IMS than the one without any innovation. At level 5, the respondent was more than 2 times (2.001) likely to create IMF than the respondent without any innovation. At level 4, cost was 1.016 times less likely to create IMS than the one who did not want to incur any cost. A participant with a competitor pressure at level 5 was 1.442 times more likely to create an IMS compared to the one without any competitor pressure. However, only perceived benefits were a significant predictor ($P<0.01$) of IMS adoption. A respondent who perceives the benefits of IMS at level 5 was 1.286 more likely to adopt the IMS than one who has not perceptions of the benefits of IMS. These findings provide valuable insights for organizations wishing to implement IMS processes.

Keywords: *Technology; Digital Transformation; Digitalization; Digital Divide; Uptake; Creation, Malawi.*

Background

Digital transformation is a global agenda, despite the vast digital divide between the developed and the least and middle - income countries (LMICs). The LMICs are working very hard to reduce this digital divide and are at different levels of the digital transformation process. A digitally transformed nation, according to (Swift, 2020) is one that has IT firms that can adopt digital operating models and are able to integrate cross functional teams. Digitally transformed firms should be able to invest in big data governance so that they can be able to withstand competition. In addition, they have to be able to better use Artificial intelligence (AI) and machine learning to facilitate the expansion of public cloud adoption. Thus, digital transformation leads to success metrics as more attention is given to long-term value of digital initiatives.

In Malawi, the software development industry is relatively young because despite the industry being more than a decade old, it is only during the past 8-9 years that software development industry has substantially matured in Malawi (Hara, 2021). Local software developers have progressively become innovative in the space but the industry is still lagging behind. In the Digital Economic Strategy 2021-2026, Malawi aims at providing affordable internet by cutting out taxes including the 10% excise duty on purchasing data. The reduction will also be achieved by removing tariffs and the 3.5% revenue tax for telecom providers that was imposed by the Malawi Communications Regulatory Authority (MACRA) (National Planning Commission, 2021). Malawi can reduce the digital divide gap further by accelerating digital transformation process, which facilitates positive developments when migrating from analogue through digitization to digital transformation. For digital transformation to occur, there is a need for innovation development on the supply side and adoption on the demand side. However, there is scanty information in Malawi regarding digital transformation from both the supply and demand sides of IMS. Therefore, this study was conducted to investigate the determinants of IMS innovation development and adoption in Malawi.

Methodology

The study focused on the technological, organizational, environmental and individual (TOEI) factors framework (Zhu & Kraemer, 2005) which is an extension of the TOE (Tornatzky, Fleischer, and Chakrabarti, 1990) by including the individual factors. In this framework, the **environmental context:** market (demand) refers to opportunities for creation of information management systems (Zhu & Kraemer, 2005). The **organizational context** refers to the ICT technical expertise of firms, and the entrepreneurial (business development) capacity of firms. The **technological aspect** refers to access to resources (devices and the internet). Both ICT firms and individuals must create and adopt digital information management systems. Lastly, the **individual aspect** refers to the creator/user's time, and interest in creating/adopting information management systems. These factors were assessed under the Malawian context to understand how entrepreneurs can better leverage opportunities arising from Malawi's digital transformation, both from a demand and supply perspective.

The research adopted a cross-sectional design and utilized quantitative research method. This design guided the collection of data from many different individuals at a single point in time (Rindfleisch, Malter, Ganesan, & Moorman, 2008). The TOEI variables were observed without influencing them as the aim was to determine the cause and effect of digital transformation on both the demand and supply sides at the same time. Numerical data was collected and analyzed. This design led to the understanding of behavior context to better assess people's preferences in IMS Creation and Adoption. Hypotheses were tested, patterns identified, and predictions were made.

Study Population

The study was conducted in Malawi, specifically targeting people from all the 29 districts that were interested in creating and up-taking digital platforms. The study participants came from all backgrounds and were reached via social and web platforms, primary and secondary schools, and

technology hubs around Malawi. There were 461 respondents, which included creators and users of IMS from Secondary School to Postgraduate (out-of-school) level. Particularly, the survey targeted beneficiaries of the Digital Malawi project, being conducted by Ntha Foundation (Lilongwe & Mangochi), mHub (Lilongwe), Mzuzu Ehub (Mzuzu), Takenolab (Dzaleka), Growth Africa (Lilongwe) and Dzuka Hub (Blantyre) on behalf of the Malawi Government, with funding from the World Bank. These beneficiaries include users and potential ICT entrepreneurs around Malawi. The survey also targeted students from various universities and colleges around Malawi, which included, those from the University of Malawi (UNIMA), Malawi University of Business and Applied Sciences (MUBAS), Lilongwe University of Agricultural and Natural Resources (LUANAR), National College of Information Technology (NACIT), University of Livingstonia (UNILIA), Mzuzu University (MZUNI), and Malawi University of Science and Technology (MUST). These students were users or (potential) creators of IMS. The survey was split into 2 groups: CREATORS and USERS. Data were collected online through; (a link shared via social media), lecturers of ICT students in Malawi, and the Digital Malawi Innovation hubs around Malawi. The respondents were Malawians and foreigners living in Malawi and abroad.

This study used Slovin's formula to determine the sample size, which was calculated based on the estimated 19,800,000 population of Malawi in 2021(Worldometer, 2021). The calculation was based on the intention of having a sufficient sample size from which inferential statistics could be estimated with accuracy.

$$\text{Sample Size} = N / (1 + N*e^2) \quad \text{.....Equation 1}$$

Where**:**

N = population size

e = margin of error

Sample Size = 19,800,000 / {1 + 19,800,000 * 0.05^2}

Final sample size was 399.99, which was rounded off to 400. The target sample size was therefore 400 respondents, however, after disseminating the survey questionnaire via social and web platforms as well as technology hubs around Malawi, the final sample size was 426 respondents, which was distributed as 63 creators, 363 users of IMS.

The data collected were on the factors affecting both the creation and the use (adoption/uptake) of digital information management systems. A structured questionnaire was used to collect the data from research participants. The data collected, were ordinal using likert scales on the TOEI factors that affect both the creation and the use (adoption/uptake) of digital information management systems. The respondents rated using a likert scale of 1 to 5, how technological, organizational, environmental and individual factors was affecting the participant's creation or uptake of IMS. The figure 1 represented "not very" / "least likely", 3 being a median, and 5 being "very much" / "most likely." The 63 respondents who identified themselves as creators of IMS, were asked to rate the TOEI factors as they affect IMS creation as shown in Table 1.

TECHNOLOGICAL	**ORGANISATIONAL**	**ENVIRONMENTAL**	**INDIVIDUAL**
On a scale of 1 -5, how do **perceived benefits** influence your creation of IMS?	On a scale of 1 -5, how does **technology readiness** influence your creation of IMS?	On a scale of 1 -5, how does **consumer pressure** influence the creation of IMS?	On a scale of 1 -5, how does **innovativeness** influence your creation of IMS?
On a scale of 1 -5, how does **compatibility** influence your creation of IMS?	On a scale of 1 -5, how does a **firm size** influence your creation of IMS?	On a scale of 1 -5, how does **competitor pressure** influence the creation of IMS?	On a scale of 1 -5, how does **your IT ability** influence your creation of IMS?

By your personal definition of the terms how does **cost** influence your creation of IMS?		On a scale of 1 -5, how does **external support** influence the creation of IMS?	On a scale of 1 -5, how does **your IT experience** influence your creation of IMS?

The 363 respondents who were identified as users of IMS were asked to respondents on how TOEI factors affect their adoption of IMS as shown in Table 2.

Table 1. The rating of TOEI factors as they affected IMS Adoption

TECHNOLOGICAL	ORGANISATIONAL	ENVIRONMENTAL	INDIVIDUAL
On a scale of 1 -5, how do **perceived benefits** influence your adoption of IMS?	On a scale of 1 -5, how does **technology readiness** influence your adoption of IMS?	On a scale of 1 -5, how does **consumer pressure** influence the adoption of IMS?	On a scale of 1 -5, how does **innovativeness** influence your adoption of IMS?
On a scale of 1 -5, how does **compatibility** influence your adoption of IMS?	On a scale of 1 -5, how does **firm size** influence your adoption of IMS?	On a scale of 1 -5, how does **competitor pressure** influence the adoption of IMS?	On a scale of 1 -5, how does **your IT ability** influence your adoption of IMS?
By your personal definition of the terms below, how does **cost** influence your adoption of IMS?		On a scale of 1 -5, how does **external support** influence the adoption of IMS?	On a scale of 1 -5, how does **your IT experience** influence your adoption of IMS?

Descriptive statistics in the form of means, frequencies and percentages were computed for the two datasets, the first for creators, then users. A correlation / association matrix was computed in STATA for each dataset and all the predictor variables (Xs) in each dataset that were significantly correlated / associated with the response variables (Ys) were selected to build a binary logistic regression equation. There were two binary logistic regression models. The first model (equation 2) had information management system **on creation** (*supply*) as the response variable. IMS creation was measured as a binary response variable with "yes" for creation and "no" for those that did not create. The second binary logistic regression model has IMS use, that is Adoption and use of information management systems (demand side) as a binary response variable. The information management system adoption is proxied by the scope of IMS use/utilization by the public. In this case, respondents were asked as to whether they used or did not use IMS technology. The scores were "yes" for IMS use and "no" for those that did not use IMS. There were eleven regressors / explanatory / independent (X) variables that were fitted to the two models, which were:

X_1 (Benefits) is an ordinal variable for perceived benefits.

X_2 (Compatibility) is an ordinal variable for perceived compatibility.

X_3 (Cost) is an ordinal variable for cost of IMS.

X_4 (TechReadiness) is an ordinal variable for technology readiness.

X_5 (FirmSize) is an ordinal variable for cost of firm size.

X_6 (CSPressure) is an ordinal variable for market pressure.

X_7 (CPressure) is an ordinal variable for competitor pressure.

X_8 (ExtSupport) is an ordinal variable for external support.

X_9 (Innovation) is an ordinal variable for innovation.

X_{10} (Ability) is an ordinal variable for ability to use technology.

X_{11} (Experience) is an ordinal variable for experience in technology.

The fitted binary logistic regression models were therefore of the form:

$$Logit\ (P) = \ln(p/1\text{-}p) = \beta_0 + \beta_1 Benefits_i + \beta_2 Compatibility_i + \beta_3 Cost_i + \beta_4 TechReadiness_i + \beta_5 FirmSize_i + \beta_6 CSPressure_i + \beta_7 CPressure_i + \beta_8 ExtSupport_i + \beta_9 Innovativation_i + \beta_{10} ability_i + \beta_{11} Experience_i + \varepsilon ijkl \ldots\ldots \text{Equations 2 and 3.}$$

Where:

Logit (P) is the binary response variable – Creation (Equation 1), Use (Equation 2) of IMS. P is the probability of one creating (equation 2) or using (equation 3) digital information management systems, and 1-p is the probability that one neither created, nor used digital information systems. β_0 is the constant/intercept; $\beta_{1\ \text{to}\ 11}$ are coefficients of the X variables 1 to 11, and ε_{ijkl} is the stochastic error term. The best subset of predictors (Xs) of the response variables (Ys) for each model were obtained from the STATA stepwise logistic regression analyses outputs.

Results

Demographic Characteristics of Participants

IMS Creation

The age of the respondents ranged from under 15 to over 40, a total of 13 were in between 20 and 24, while 24 were in between 25 and 29. A total number of 11 were in between 30 and 34, while 8 were in between 35 and 39, and 5 were over 40 years old. The highest numbers by specific age were those aged 28 years (6 respondents) and those aged 29 years (6 respondents). Of the respondents, 48 were male, and 15 were female. The respondents included students in secondary school, undergraduate, postgraduate, and graduates at universities. The highest number of respondents were undergraduate students (or graduated) with a total number of 40 respondents.

IMS Adoption

The IMS Adoption survey had a total of 363 respondents and 359 of whom were Malawian, some based in Malawi and others in the diaspora. There were 2 non-Malawians living in Malawi, and 2 non-Malawians not living in Malawi. The respondents were both male and female of various age groups, with different levels of academic experience. The age of the respondents ranged from under 15 to over 40 years. One was under 15 years of age. A total of 190 were in between 15 and 19 years and 66 were in between 20 and 24. There were 50 participants that were in between 25 and 29 years, a total of 26 in between 30 and 34 years, while 17 were in between 35 and 39 years, and 13 were over 40 years old. The highest number by specific age was 18 years for 54 respondents. A total of 175 of the respondents were male, while 187 were female. The respondents included students in secondary school, undergraduate, postgraduate, and graduates in the universities. The highest number of respondents were secondary school students, with a total number of 225.

Factors that determine creation and uptake of information management systems in Malawi

All variables were significantly associated with IMS creation ($P<0.0$) except, compatibility and technology readiness ($P>0.05$). Only one variable, external support was significantly associated with IMS adoption ($P<0.0$) Table 3. This might have been caused by multicollinearity among the predictors.

Table 2. Results of correlation / association matrix for IMS creation, Adoption and both creation and adoption

Regressor variable	**Response Variable**	**Association (χ^2)**	**P-Value**
Perceived Benefits	Creation of IMS	1.961	0.003
IT Ability	Creation of IMS	13.777	0.008
IT Experience	Creation of IMS	16.173	0.003
Perceived Compatibility	Creation of IMS	2.211	0.697
Cost	Creation of IMS	19.237	0.001
Tech Readiness	Creation of IMS	5.807	0.214
Firm Size	Creation of IMS	23.141	0.000
Customer Pressure	Creation of IMS	27.171	0.000
Competitor Pressure	Creation of IMS	26.594	0.000
External Support	Creation of IMS	25.876	0.000
Innovation	Creation of IMS	16.935	0.002
Regressor variable	Response variable IMS Adoption	Association (χ^2)	P-Value
Perceived Benefits	IMS Adoption	8.670	0.070
IT Ability	IMS Adoption	5.492	0.240
IT Experience	IMS Adoption	8.255	0.083
Perceived Compatibility	IMS Adoption	2.502	0.644
Cost	IMS Adoption	7.320	0.120
Tech Readiness	IMS Adoption	5.806	0.214
Firm Size	IMS Adoption	5.835	0.212
Customer Pressure	IMS Adoption	7.789	0.100
Competitor Pressure	IMS Adoption	5.789	0.215
External Support	IMS Adoption	13.570	0.009
Innovation	IMS Adoption	7.400	0.116

The results of the reduced model that was fitted to predict creation of IMS in Malawi are presented in Table 4. For all the variables, the stated levels are compared to a reference level 1 which is "least likely to create" and 5 "most likely to create". A total of seven (Benefits, costs, firm size, competitor, external support, innovation and IT ability) of the eleven predictors in this study were significant ($P<0.05$) to predict IMS creation in Malawi (Table 4). The predictor "Benefits" was

important to predict IMS creation at all the levels (3 and 5) (P<0.05), meaning that as perceived benefits increase from level 1 to level 5, the odds of IMS creation also increased with levels 3 and 5 being the most important in IMS creation.

Costs of IMS creation was significant (P<0.05) at levels 3, 4 and 5, meaning higher levels of cost (levels 3 through 5) are associated with significantly increased odds of IMS creation. Firm size was only significant at level 5 (P>0.01), showing that Firms with the large sizes (level 5) had significantly increased odds of IMS creation compared to small firms. Competitor pressure was significant only at level 5 (P<0.01) and external support was also significant at level 2 (P<0.01) showing that firms with external support (level 2) had significantly increased odds of IMS creation. The predictor variable "innovation" was significant (P<0.01) at level 5 suggesting that firms with the highest level of innovation have increased odds of IMS creation compared to less innovative firms. IT ability was significant at level 3 (P<0.05) suggesting that firms with higher IT ability (level 3) had increased odds of IMS creation compared to those with lower IT ability. The rest of the variables in the model and their associated levels were not significant in predicting IMS creation in Malawi (P>0.05) (Table 4).

Table 3. Reduced Logistic Regression Model for predicting Creation of IMS in Malawi

IMS_Creator	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Perceived Benefits2	.307	.206	-1.76	.079	.082	1.145	
Perceived Benefits3	.278	.175	-2.04	.042	.081	.954	**
Perceived Benefits4	.3	.192	-1.88	.06	.085	1.053	
Perceived Benefits5	.172	.111	-2.72	.006	.048	.611	***
Cost3	2.313	.829	2.34	.019	1.145	4.67	**
Cost4	3.714	1.425	3.42	.001	1.751	7.878	***
Cost5	3.337	1.297	3.10	.002	1.558	7.148	***
Tech Readiness2	1.558	.582	1.19	.235	.749	3.239	
Firm Size5	2.321	.66	2.96	.003	1.329	4.052	***
Competitor Pressure3	1.377	.384	1.15	.252	.797	2.378	
Competitor Pressure5	2.759	.803	3.49	0	1.559	4.88	***
External Support2	2.517	.82	2.83	.005	1.329	4.767	***
Innovation2	1.526	.628	1.03	.304	.682	3.418	
Innovation3	1.229	.392	0.65	.518	.658	2.296	
Innovation5	1.777	.52	1.97	.049	1.002	3.152	**
IT Ability3	1.826	.531	2.07	.039	1.032	3.229	**
Constant	.186	.111	-2.81	.005	.058	.601	***
Mean dependent var	0.268	SD dependent var	0.443				

Pseudo r-squared	0.117	Number of observations	496
Chi-square	67.572	Prob > chi2	0.000
Akaike crit. (AIC)	543.182	Bayesian crit. (BIC)	614.694
*** p<0.01, ** p<0.05			

Factors that determine Adoption of IMS in Malawi

The reduced binary logistic regression had 5 of the 11 regressor variables that were significant in predicting IMS adoption in Malawi. The five variables were; perceived benefits, cost, consumer pressure, external support and innovation (P<0.05). The rest of the 6 variables in the full model were not significant in predicting IMS adoption (P>0.05) (Table 5).

Table 5. Reduced Logistic regression for the Adoption of IMS in Malawi.

IMS Adoption	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Perceived Benefits4	2.565	.969	2.49	.013	1.223	5.378	**
Perceived Benefits5	3.297	1.309	3.01	.003	1.514	7.177	***
Cost3	.344	.152	-2.41	.016	.144	.818	**
Cost4	.286	.14	-2.57	.01	.11	.744	**
Cost5	.356	.181	-2.03	.042	.131	.965	**
Customer Pressure4	2.465	1.022	2.18	.03	1.094	5.557	**
External Support2	.375	.14	-2.62	.009	.18	.781	***
Innovation3	.113	.119	-2.07	.038	.014	.89	**
Innovation4	.077	.082	-2.42	.016	.01	.616	**
Innovation5	.102	.109	-2.14	.033	.013	.828	**
Constant	82.544	87.223	4.18	0	10.405	654.84	***

Mean dependent var	0.873	SD dependent var	0.333
Pseudo r-squared	0.106	Number of obs	496
Chi-square	40.159	Prob > chi2	0.000
Akaike crit. (AIC)	361.471	Bayesian crit. (BIC)	411.950
*** p<0.01, ** p<0.05			

All variables, in the IMS adoption model, their stated levels are compared to a reference level 1 meaning the "least likely to adopt", with 5 being "most likely to adopt". For Perceived Benefits, levels 4 and 5 are significant in predicting IMS adoption (P<0.05), showing that higher levels of perceived benefits are associated with significantly

increased odds of IMS adoption (Table 5). For Cost, levels 3 through 5 were significant (P<0.01) in predicting IMS adoption, meaning that higher levels of costs of creation were associated with increased odds of IMS adoption (Table 5). This is due to high quality of expensive IMS compared to cheap ones. Similarly, higher levels of customer pressure were significantly associated with increased odds of IMS adoption (P<0.05). External Support at level 2 was significant (P<0.01) in predicting IMS adoption, suggesting that firms with external support at level 2 had increased odds of IMS adoption (Table 5). Regarding the variable innovation, levels 2 through 5 were significant (P<0.05) in predicting adoption of IMS, suggesting that higher levels of innovation were associated with increased odds of IMS adoption than the lower levels (below 2) (Table 5).

Results of the stepwise regression analysis of the reduced model with the Odds ratios for each predictor variable are presented in Table 6.

Table 6. Results of Stepwise Logistic Regression analysis for IMS creation and Adoption for the significant predictors

	(1)	(2)
Variable	IMS Creation	IMS Adoption
Perceived Benefits2	-1.812**	
	(0.786)	
Perceived Benefits3	-1.877**	
	(0.745)	
Perceived Benefits4	-1.683**	0.930**
	(0.753)	(0.382)
Perceived Benefits5	-2.271***	1.286***
	(0.759)	(0.407)
Competitor Pressure4	0.741	
	(0.408)	
Firm Size5	0.859***	
	(0.289)	
Innovation4	1.922***	-2.374**
	(0.727)	(1.067)
Customer Pressure4	-0.958***	0.845**
	(0.311)	(0.416)
Innovation3	1.615**	-2.133**
	(0.721)	(1.056)
Cost3	0.703*	-1.083**
	(0.372)	(0.446)

Cost4	1.016**	-1.172**
	(0.400)	(0.494)
Cost5	0.986**	-0.915
	(0.402)	(0.518)
Tech Readiness2	0.807**	
	(0.407)	
IT Ability3	0.705**	
	(0.304)	
External Support2	0.970***	-1.039***
	(0.342)	(0.382)
Competitor Pressure5	1.442***	
	(0.431)	
Innovation2	1.766**	-2.039
	(0.756)	(1.104)
Innovation5	2.001***	-1.829
	(0.724)	(1.089)
Competitor Pressure3	0.789**	
	(0.399)	
IT Experience5		-0.868**
		(0.371)
Constant	-2.782***	4.430***
	(0.809)	(1.058)
N	496	496
Aic	527.6	357.9
chi2	89.12***	45.68***

Standard errors in parentheses; ** $p < 0.05$, *** $p < 0.01$

This logistic regression analysis had two different response variables: Creation of IMS and Adoption of IMS. Each response variable represents a different aspect of the Information Management System (IMS) process: creation and adoption.

Creation of IMS

In the full model, Perceived Benefits, Innovation, Cost, IT Ability, External Support, Firm Size, Competitor Pressure, Tech Readiness, IT Experience, and Customer Pressure were significant predictors of Creation of IMS. However, in the reduced model, only four variables were important in predicting IMS creation, which are; Perceived benefits at all the levels (1 to 5), Innovation at levels 2, 3, 4 and 5, Cost at level 4 and Competitor pressure at level 5 (Table 6). High levels of perceived benefits, reduced IMS creation. A respondent at Innovation level 2 was more than one times (1.766) more likely to create IMS than the one without any innovation. At level 3, the respondent was 1.615 times more likely to create IMS than the respondent without innovation. The

respondent at level 4 was 1.922 times more likely to create IMS than the one without any innovation. At level 5, the respondent was more than 2 times (2.001) likely to create IMS than the respondent without any innovation. Cost was also very important in predicting IMS creation as a respondent at level 4 of cost was 1.016 times less likely to create IMS than the one who did not want to incur any cost. A participant with a competitor pressure at level 5 was 1.442 times more likely to create an IMS compared to the one without any competitor pressure. The model has a chi-square value of 89.12 ($P<0.05$) indicating that it is statistically significant.

When levels are considered for each significant predictor, increasing levels of perceived benefits from "Slightly much" to "Very much" are associated with decreased odds of being an IMS creator. The odds ratios indicate that higher levels of perceived benefits are associated with lower odds of being an IMS creator. On the other hand, as the cost increases from "Moderately much" to "Very much", the odds of being an IMS creator also increases. Higher levels of cost are associated with higher odds of being an IMS creator. Having a slightly much level of tech readiness increases the odds of being an IMS creator. Having a firm size categorized as "Very much" increases the odds of being an IMS creator. Only "Very much" competitor pressure significantly increases the odds of being an IMS creator. Having slightly much external support increases the odds of being an IMS creator, while having moderately much external support decreases the odds. For the "Moderately much" and "Very much" categories, higher levels of innovation decreased the odds of being an IMS creator. Having "Moderately much" IT ability increases the odds of being an IMS creator. Lastly, "Considerably much" customer pressure significantly increases the odds of being an IMS creator.

Adoption of IMS

Perceived Benefits, Innovation, Cost, IT Ability, External Support, Competitor Pressure, Firm Size, IT Experience, and Customer Pressure significantly predict adoption of IMS in the full model. On the other hand, as the cost increases from "Moderately much" to "Very much", the odds of being an IMS adopter decreased. Higher levels of cost are associated with lower odds of being an IMS adopter. Having a slightly much level of tech readiness increases the odds of being an IMS adopter. Having a firm size categorized as "Very much" increases the odds of being an IMS adopter. Only "Very much" competitor pressure significantly increases the odds of being an IMS adopter. Having slightly much external support increases the odds of being an IMS adopter, while having moderately much external support decreases the odds. For the "Moderately much" and "Very much" categories, higher levels of innovation decrease the odds of being an IMS adopter. Having "Moderately much" IT ability increases the odds of being an IMS adopter. Lastly, "Considerably much" customer pressure significantly increases the odds of being an IMS adopter.

In the reduced model, only perceived benefits was a significant predictor ($P<0.01$) of IMS adoption. A respondent who perceives the benefits of IMS at level 5 was 1.286 more likely to adopt the IMS than one who has not perceptions of the benefits of IMS. Increasing levels of perceived benefits from "Slightly much" to "Very much" are associated with decreased odds of being an IMS adopter. The odds ratios indicate that higher levels of perceived benefits are associated with lower odds of being an IMS adopter. The model has a chi-square value of 45.68, indicating it is statistically significant. These findings provide valuable insights for organizations wishing to implement IMS processes.

Discussions

The study demonstrated a positive correlation between the (TOEI) framework and the uptake of Information Management Systems (IMS) in Malawi. In the entrepreneurial landscape of Malawi's digital transformation emerges as a pivotal force reshaping traditional business paradigms and unlocking unprecedented opportunities for innovation and growth (National Planning Commission, 2021). In this study, factors such as innovativeness, cost, and competitor pressure, were significant in predicting IMS creation. Results show that firms that are innovative were more likely to create IMS, because creation of IMS is directly related to innovation. These results are supported by the findings reported by (Chuang & Lin, 2015) who also reported the

positive correlation / relationship between innovation and IMS creation. Additionally, digital technologies enable entrepreneurs to overcome traditional barriers such as limited access to capital and infrastructure, fostering a more inclusive entrepreneurial ecosystem (Al-Tabbaa, O'Brien, & Kitching, 2020). The results showing that cost was a significant predictor of IMS creation imply that high costs may adversely affect IMS creation because of the limited financial resources for individuals and firms in the form of capital. This is shown by the results in this study that external support increased the odds of IMS creation. These results align with the study by (Zheng & Dai, 2018) who emphasized that the availability of capital is a major determinant in IMS creation. Results that competitor pressure was significantly associated with IMS creation imply that firms and individuals operating in competitive environments are more likely to innovate and adopt IMS. Similar conclusions were reached by (Porter, 1995), who argued that competition drives innovation. In Malawi, 88% of Malawians now have access to either 3G or 4G internet connectivity (World Bank, 2021), which underscores the importance of prioritizing digital transformation and advancing public information management systems. Such efforts are essential for driving inclusive growth, promoting good governance, and improving the well-being of citizens. The proliferation of digital tools offers entrepreneurs unprecedented opportunities to innovate, access global markets, and streamline operations, thereby catalyzing economic growth and job creation (Lupton, 2018).

IMS Adoption

For IMS adoption, perceived benefits were the most important predictor at the high levels of 3, 4, and 5. These results underscore the fact that the higher the perceived benefits, the greater the likelihood of IMS adoption. People will adopt a technology that they perceive will benefit them. These results are supported by (Lai, 2016) who reported that the rate at which new technologies such as e-payment systems, develop, largely depends on a struggle between rapid technological change and natural barriers to new product acceptance. Several theories have been used to explain consumers' adoption of new technologies and their intention to use the technologies. Such theories include; the theory of diffusion of innovation (DIT) (Rogers, 1995), the theory of task technology fit (TTF) (Goodhue & Thompson, 1995), the theory of planned behavior (TPB) (Ajzen I. , 1991) and the Theory of Reasonable Action (TRA) (Davis, 1986) among others. The results in this study that perceived benefit was a significant predictor of IMS adoption are supported by all these theories. The results that customer pressure at level 4 was also a significant predictor, are supported by the findings of (Goodhue & Thompson, 1995), who emphasized that a high quality new technology can make an impact to an individual because of improved efficiency and effectiveness. These attributes attract consumers that in turn exerts pressure on the new technology. Competitor pressure at level 3 was also significant, indicating that external pressures from rival firms or individuals promotes technology adoption. Competitors influences adoption decisions because of subjective norms. Fishbein & Ajzen (1975) reported that subjective norms of the community of adopters' attitude towards a new technology, can positively and significantly influence technology adoption. For example, the belief among the participants that IMS was better than other forms of technologies on the market. Innovativeness at levels 2, 3, and 4 negatively impacted adoption, suggesting that while innovativeness drives creation, it may pose challenges for adoption without sufficient readiness and support.

Conclusions

The TOEI factors have contributed to IMS creation and adoption in Malawi. The technological factors of perceived benefits and cost are very important for IMS creation. Additionally, external support presents a chance for entrepreneurs to offer consultancy services or collaborate with stakeholders to facilitate IMS implementation. For IMS adoption, perceived benefits and cost are very important factors, hence entrepreneurial ventures can develop and market IMS solutions that highlight their value and affordability. Environmental factors, such as customer pressure, also present opportunities for businesses to cater to market demands driven by customer expectations. Innovation is another key individual factor influencing IMS adoption, allowing entrepreneurs

to differentiate themselves by offering cutting-edge solutions that meet evolving market needs.

recommendations are provided. These include enhancing digital infrastructure, fostering digital literacy, and creating a conducive regulatory environment. Policymakers should prioritize investments in technology-related initiatives and provide incentives for private sector involvement. Practical implications for businesses involve integrating IMS into their operations, improving customer engagement, and adopting a strategic approach to digital transformation.

Author Contributions

Nthanda is an M.Sc student in innovation who designed the study, collected data analyzed it and drafted the manuscripts. Alfred Maluwa and Atikonda Nkochi supervised Nthanda during her study, edited and proofread the manuscript. All authors agreed to have the manuscript published.

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To promote effective IMS implementation and digital entrepreneurship in Malawi, several policy

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Declaration of Conflicts of Interest

None of the authors has any conflict of interest on this manuscript to be published in the ASA journal.

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