Exploratory and Confirmatory Factor Analysis of the Latent Determinants of E-government Adoption: An Evidence from Kenya's Public Sector

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Abstract: **Recently, e-government has attracted attention of many scholars. This has led to a growing scholarly literature on the importance and the factors that facilitate e-government implementation. However, despite the increased interest in e-government adoption, there is lack of information about the latent factors that affect e-government in the public sector. Most of the research has focused on observable determinants such as availability of resources, training and support. The latent determinants of e-government adoption therefore remain highly unknown in the existing literature. Due to this research gap, this study conducted an exploratory and confirmatory factor analysis with an aim of identifying the latent determinants of e-government adoption, with a reference to the Kenya's public sector. The findings indicated that perceived trust, compatibility, usefulness and satisfaction are the latent determinants that influence e-government adoption in the public sector.**

Keywords: **Exploratory, Confirmatory, Factor Analysis, Latent Determinants, E-government AdoptionOrganizational Performance**

I.INTRODUCTION

Many countries are faced with the problem of provision of public services in an efficient and effective way. A report by Organization for Economic Cooperation and Development (OECD, 2019) revealed that countries around the world are under pressure to improve public sector performance while at the same time containing the ballooning expenditure growth. In the last three decades, the topic of public sector transformation has been one of the central elements of new public management policies (Lubua, 2017).

The emergence of electronic government (e-government) is regarded as one of the modern ways to improve delivery of services in the public sector. The innovations that would have been regarded as science fiction a few years ago are now necessities in the public service, such as the internet, computers, smart phones, global information networks, virtual reality among other applications. According to Organisation of America States (2013), the growth in the adoption of e-government during the recent years has had a significant effect on different characteristics of society by making every day processes simpler and more effective.

Through e-government, government services are made available to citizens in a convenient, efficient, and transparent manner. In developed countries, e-government is important in providing communities with potential opportunities aimed at improving the quality of government services to citizens. E-government is facilitated by high internet access and computer literacy as well as effective political decision-making that promote coordination between government departments and citizens through standardized data and information sharing procedures.

According to the World Bank's Doing Business Report (2017), developing nations show improvement in many areas of government, but particularly across categories driven by the adoption of electronic platforms and other e-government initiatives. For example in Africa, a report by the Africa Open Data (2018), found that more people can access the internet which has made the continent to show visible progress in e-government. Furthermore, computer devices and data are becoming affordable, facilitating the expansion of electronic government technologies (Kaur & Singh, 2015).

In the Kenyan public sector, electronic government services were officially established in June, 2004 with the launch of the Electronic Government Strategy to enhance democracy, coherence and accountability within public administration. In 2006 the National ICT Blueprint was created to act as a guide the requirement for development of ICT infrastructure, development of human resource, participation of stakeholders and development of a regulatory framework to promote the use of new innovations for service delivery. Recent legislations and programs have led to several developments in electronic government and one-stop shops such as Open Data portal, myGov, Huduma Centre, e-Citizen Portal and various government websites used by citizens to access services.

II.STATEMENT OF THE PROBLEM

The study of e-government has attracted a lot of attention among researchers recently. However, most of the previous studies on E-government topics focus on its importance and the observable factors which influence its adoption. Observable factors such as e-government resources, management support and ICT infrastructure have been extensively studied and found to influence e-government.

However, the role of latent determinants of e-government adoption remains highly unknown among researchers. There is lack of data regarding the latent factors that affect e-government in the public sector. Due to this research gap, this study aims to conduct an exploratory and confirmatory factor analysis to identify the latent determinants of e-government adoption with a reference to the Kenya's public sector.

III. RESEARCH METHODOLOGY

A descriptive research design was utilized in the study. In the first step, Exploratory Factor Analysis (EFA) was utilized to identify the latent determinants of e-government adoption a using a sample of 120 respondents. In the second step, Confirmatory Factor Analysis (CFA) was used to verify the relationship between the observed variables and their underlying latent constructs as indicated by the EFA model using a separate sample of 108 respondents. The respondents consisted of active e-government users in Migori County (Kenya) who were selected through convenience sampling. Closed-ended questionnaires with 5-point Likert scales were used for data collection in both steps and each sample was analyzed independently.

IV. FINDINGS

4.1 Exploratory Factor Analysis (EFA)

4.1.1Respondents' Characteristics

The respondents' characteristics consisted of gender, age, education level, job position and experience. The results were presented in Table 1 below.

Table 1: Respondents' Gender

Category	Frequency	Percent
Gender		
Male	62	51.7
Female	58	48.3
Age		
Below 30	24	20.0
30-34	23	19.2
35-44	18	15.0
45-49	31	25.8
50 and above	24	20.0
Education Level		
Certificate	3	19.2
Diploma	40	16.7
Bachelors Degree	63	19.2
Masters	12	26.7
Doctoral	2	18.3
Job Position		
Junior level	33	22.5
Intermediay level	58	23.3
First level management	12	15.0
Senior level management	10	25.8
Top level management	6	13.3
Experience		
Below 1 year	16	13.3
1-3 years	27	25.8
3-5 years	25	23.3
5-10 years	24	19.2
10 and above	28	18.3

4.1.2 Descriptive Analysis of the Measurement Items

All the 25 items had Means between 3.41 and 4.19; and Standard Deviations between 0.932 and 1.109

Table 2: Item Descriptive Statistics

Item	Statement	M	SD	N
Item1	I find e-government easy to use	3.78	1.170	120
Item2	Learning how to use e-government is easy for me	3.76	1.021	120
Item3	Using e-government can improve access to services	3.93	1.101	120
Item4	I am very contented with e-government	3.87	1.084	120
Item5	I find the process of using e-government pleasant	3.83	1.042	120
Item6	I feel that using e-government does not put my privacy at risk	3.83	0.964	120
Item7	E-government is flexible to use	3.73	0.932	120
Item8	I would use e-government if I had access to it	3.78	1.049	120
Item9	I intend to continue using the available e-government in future	3.78	1.022	120
Item10	E-government has the capacity to address my needs	3.78	1.096	120
Item11	I can use e-government without assistance from someone	3.75	1.063	120
Item12	I believe that e-government is trustworthy	3.90	1.056	120
Item13	I believe that e-government can enhance service delivery	3.75	0.964	120
Item14	I do not doubt the honesty of e-government	3.93	1.098	120
Item15	I can use e-government without reference manuals	3.78	1.109	120
Item16	I plan to use e-government for the next 5 years	3.68	1.053	120
Item17	I would find using e-government useful in my job	3.78	1.030	120
Item18	Using e-government can increase my productivity	3.81	1.056	120
Item19	I feel that e-government is compatible with other electronic applications	3.69	0.977	120
Item20	I believe that people support the idea of using e-government	3.82	1.004	120
Item21	My colleagues encourage me to use e-government	3.73	1.083	120
Item22	E-government is compatible with my lifestyle	3.81	0.955	120
Item23	I am content with e-government	3.87	1.061	120
Item24	I feel that e-government is cheaper and saves time	3.94	1.031	120
Item25	E-government fits well with my self-image	3.88	1.097	120

4.1.3 Diagnostics tests for assumptions of EFA

Sampling Adequacy was tested using the Kaiser-Meyer-Olkin (KMO) measure while Bartlett's Test of Sphericity was used to check redundancy between the items to be summarized into factors. The results of KMO measure indicated sampling adequacy, since KMO = 0.712 was above the recommended threshold of 0.6 for factor analysis. The Bartlett's test of sphericity rejected the null hypothesis that correlation matrix was identical, indicating that the chosen items were adequately correlated for factor analysis χ^2 (36) = 97.239, P<0.001

Table 3:EFA Diagnostic Tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.712
Bartlett's Test of Sphericity	Approx. Chi-Square	97.239
	Df	36
	Sig.	.000

4.1.4 Factor Extraction

The EFA was done using Principal Component factor extraction method with Promax Rotation and Kaiser Normalization. The items with factor loading more than 0.4 were considered for further analysis. The Items with factor loading less than 0.4 were dropped. The results indicated that out of the 25 items, 9 items loaded with a factor greater than 0.4. In Factor 1, Item6 loaded with 0.799, Item14 loaded with 0.752 and Item5 loaded with 0.550. In Factor 2, item7 loaded with 0.758 while Item19 with 0.673. In Factor 3, Item3 loaded with 0.839 and Item24 loaded with 0.688. In the Factor 4, Item23 loaded with 0.762 while Item2 loaded with 0.636. Factor 1 consisted of "Trust factors", Factor 2 consisted of "Compatibility factors", Factor 3 had "Usefulness factors" and Factor 4 consisted of "Satisfaction factors". All the communalities were above 0.4, indicating that the extracted components represented the variables well.

Table 4: Factor Extraction

Items and Factors		Component				Communalities
		1	2	3	4	
Trust Factors						
Item6	I feel that using e-government does not put my privacy at risk	.799				.665
Item14	I do not doubt the honesty of e-government	.752				.621
Item5	I find the process of using e-government pleasant	.550				.429
Compatibility Factors						
Item7	E-government is flexible to use		.758			.635
Item19	I feel that e-government is compatible with other electronic applications		.673			.574
Usefulness Factors						
Item3	Using e-government can improve access to services			.839		.771
Item24	I feel that e-government is cheaper and saves time			.688		.677
Satisfaction Factors						
Item23	I am content with e-government				.762	.729
Item2	Learning how to use e-government is easy for me				.636	.503

4.1.5 Eigen Values and Variance Explained

Analysis of the Eigenvalues and variance indicated that "Trust factors" had an eigenvalue of 1.994 and a variance of 22.154. "Compatibility factors" had an eigenvalue of 1.385 with a variance value of 15. 385. "Usefulness factors" had an eigenvalue of 1.182 and a variance of 13.134. The "Satisfaction factors" had an eigenvalue of 1.042 and a variance of 11.579. The four factors accounted for 62.252% of the total variance which was more than the 50% threshold.

Table 5: Eigenvalues and Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.994	22.154	22.154	1.660	18.445	18.445
2	1.385	15.385	37.539	1.358	15.088	33.533
3	1.182	13.134	50.673	1.324	14.712	48.245
4	1.042	11.579	62.252	1.261	14.007	62.252

4.1.6 Cronbach's Reliability

The internal consistency was analysed using the Cronbach's alpha coefficients. For each of the 4 factors, the Cronbach's alpha test produced values which were higher than 0.70, indicating adequate reliability.

Table 6: Rliability Test

Factors	Cronbach's Alpha
Trust Factor	.859
Compatibility Factor	.732
Usefulness Factor	.823
Satisfaction Factor	.729

4.1.7 Convergent and Discriminant Validity

The convergent validity was demonstrated by the factors as their loadings were above the recommended threshold of 0.4, indicating that the items within a single factor were highly correlated for factor analysis (refer to Table 5). The Factor correlation matrix showed no correlation above 0.70, demonstrating that each factor assessed a unique variable, and further showing that there was sufficient discriminant validity.

Table 7: Validity Test

Component	1	2	3	4
1	1.000	.056	.208	.096
2	.056	1.000	-.038	.047
3	.208	-.038	1.000	.152
4	.096	.047	.152	1.000

4.2 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was used to verify the exploratory model using a separate sample of participants.

4.2.1 Respondents' Characteristics

The respondents' characteristics consisted of gender, age, education level, job position and experience as shown below

Table 8: Respondents' Gender

Category	Frequency	Percent
Gender		
Male	62	51.7
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4.2.2 Descriptive Analysis of the Measurement Items

All the 25 items had Means between 3.41 and 4.19; and Standard Deviations between 0.932 and 1.109 as indicated in Table 9

Table 9: Item Descriptive Statistics

Item	Statement	M	SD	N
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Item23	I am content with e-government	3.87	1.061	120
Item24	I feel that e-government is cheaper and saves time	3.94	1.031	120

4.2.3 Reliability Test

Both the composite and convergent reliability were tested for EFA. The composite reliability for each factor was found to be greater than 0.7. On the other hand, the convergent reliability was met since all the values of composite reliability were greater than their corresponding values of Average Variance Expected, (CR>AVE, AVE>0.5).

Table 10: Reliability Test

Factors	CR	AVE
Trust Factor		.859
Compatibility Factor		.732
Usefulness Factor		.823
Satisfaction Factor		.729

4.2.4 Convergent and Discriminant Validity

All the factors achieved convergent validity as indicated by the AVE values which were greater than the recommended minimum value of 0.50, indicated in the table above. Discriminant validity was achieved by comparing the square roots of AVE on the diagonal in the matrix below to inter-factor correlations. The square roots of the AVE values were greater than the correlations, indicating that the factors achieved adequate discriminant validity.

Table 11: Validity Test

Factor	Satisfaction	Usefulness	Compatibility	Trust
Satisfaction	1.000			
Usefulness	.327	1.000		
Compatibility	.632	-.060	1.000	
Trust	.506	.284	.262	1.000

4.2.5 Model Fit Evaluation

Through CFA, the goodness-of-fit between the hypothesized model and the sample data was determined. Eleven model fit indices and their criteria were used to examine the goodness-of-fit of the model with the given dataset: goodness-of-fit

index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), Tucker-Lewis Index (TLI), comparative fit index (CFI), root mean square error of approximation (RMSEA), minimum discrepancy per degree of freedom (CMIN/DF), incremental fit index (IFI), p-value (PCLOSE), root mean square residual (RMR) and Standardized Root Mean Square Residual (SRMR) .

Table 12: Model Fit Evaluation

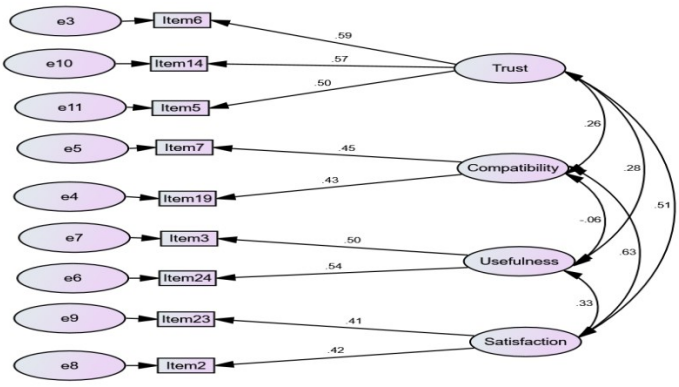
Metric	Observed Value	Recommended value
cmin/df	1.553	between 1 and 3
CFI	.901	>0.950
GFI	.938	>0.90
AGFI	.988	>0.90
RMSEA	.068	<0.060
TLI	.691	>0.90
IFI	.817	>0.90
NFI	.614	>0.90
PCLOSE	1.000	>0.050
RMR	.080	<0.050
SRMR	0.0389	<0.090

The findings of the indices illustrated a good model-data-fit.

4.2.3 The CFA Model

The CFA model was used to test, confirm and show the acceptability of the EFA model. is used to test how well the measured variables represent the number of constructs. is used to test how well the measured variables represent the number of constructs. Confirmatory factor analysis (CFA) is a statistical technique used to verify the factor structure of a set of observed variables. CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists. Dimensionality of the workplace innovation constructs.

Fig. 1.CFA Model



The CFA model supported the four-factor structure provided by EFA. The empirical support for the multidimensional model is indicated by the factor loadings which were above the recommended minimum value of 0.4. Moreover, all the inter-factor correlations were less than 0.7. This confirms that the latent factors of e-government adoption in the public sector are “trust factors”, “compatibility factors”, “usefulness factors” and “satisfaction factors”.

IV. CONCLUSIONS

The study concluded that there exist latent factors which affect adoption of e-government in the public sector. Specifically, the study concluded that the four factors: trust, compatibility, usefulness and satisfaction have an impact on implementation of e-government in the public sector.

V. RECOMMENDATIONS

The study analyzed only 25 items for EFA and 9 items for CFA. Future researchers need to use a larger number of items for EFA to generate more items for CFA. However, researchers can generally include more appropriate items for the latent factors and proceed with CFA and compare the results with the current study. For practical purposes, the model of this study gives an insight into the “hidden factors” which affect success of e-government strategies and programs. Therefore, policy makers need to ensure that other than provision of ICT infrastructure and training, perceptions and level of satisfaction of the users with the programs need to be evaluated since they directly affect adoption of e-government. Policy makers need to ask themselves the following questions: 1. Do the citizens trust e-government platforms? 2. Are e-government platforms compatible with other applications? 3. Does e-government offer the usefulness it is meant for to the citizens? and 4. Are citizens satisfied with e-government applications?

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