FACTORS AFFECTING THE ADOPTION OF TECHNOLOGY IN PUBLIC UNIVERSITIES IN KENYA. A CASE OF PAPERLESS STUDENT DATA MANAGEMENT IN JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

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Abstract

The ICT concept has been generally embraced the world over; institutions of higher learning are by default mandated to being pace setters for technology adoption and use. The project research aimed at evaluating the reasons why despite data management being in existence for a long while, data was still being managed manually especially in institutions of higher learning. The general objective of the study was to determine the factors that affect the adoption of paperless student data management by public universities. Focus was on two specific objectives; to establish how cost affects adoption of paperless student data management and how personnel skills affects adoption of paperless student data management. Primary data was used and a descriptive research design was adopted taking a qualitative approach The research targeted public institutions with case study of Jomo Kenyatta university of Agriculture and Technology. The target population was non-teaching staff specifically those involved in data management. Data was analyzed with the aid of Statistical Packages for Social Sciences (SPSS). Questionnaires were mainly used to collect data which was analyzed using SPSS. Analysis of Variance, correlation analysis and multiple regression were used A multiple linear regression was applied to show how independent variables affected the dependent variable. The study found that the majority of the respondents agreed with the statements implying that the variables had a significant effect on the adoption of paperless technologies. The correlation analysis was used to assess the presence of multi co-linearity problem and it revealed that, the level of correlation between independent variables was low and the independent variable cost and personnel skills were key determinants of adoption of paperless data management technology in the university. The researcher concludes that cost and personnel skills play a key role in adoption of student data management. The researcher recommends further studies to be carried out to assess other variables that affect adoption of paperless data management technology in the universities and extend the study to the private universities in the Kenya. The correlation analysis revealed that, the level of correlation between independent variables was low. The study went ahead and used tolerance and variance inflated factor analysis to show the relevance of the results. The results showed that the model was well fit.

Keywords: *Cost, personnel skills and paperless data management*

1.1 INTRODUCTION

The ICT development are not of particular breakthrough technologies, but rather those of rapid and continuous improvement in price-performance of both computing and communications, the explosion of bandwidth capacity in fixed and mobile networks, and the emergence and development of the internet and internet-based applications (Michel and Betty, 2003). From a development perspective, ICTs are key instruments towards meeting the Millennium Development Goals (MDGs) related effective service delivery. In this respect, the increasing adoption of ICT in the service delivery industry of developing countries, by both public and private sectors, has been a welcome trend which everyone has to adopt so as to remain relevant in the dynamic business environment. All across the world, governments are pledging and pooling more and more of their resources towards developing ICT tools and systems with the ultimate aim of facilitating management, streamlining surveillance and improving better service delivery (Turban , 2004).

According to Tieke, (2005), ICT helps companies and other institutions increase productivity and create attractive products to be sold on the world market. It improves the quality and decreases lead-times and costs. ICT technology has also fuelled sustainable development by reducing the environmental impact of business activities. Firms that adopted ICT technologies several years ago, notably large firms, have already been able to make the technology work for them whereas more recent adopters are still adapting it in their organizational management.

The introduction of computers and the concept of information technology in organizations brought in the inevitable need for paperless data management. Generally persons who went through high school and tertiary education without the use of computers and IT in their day to day lives find it difficult and uncomfortable to read, understand and even process information on the computer (McCorry, 2009). For about a decade now, most organizations have heard that the paperless office is just around the corner but in the real sense, paper consumption has tripled in the last decade. Every year, the United States uses nearly 3.7 million tons of copy paper. The Information Age has not reduced our paper pile up; instead, we print data more quickly and easily. Most documents received via email are printed, creating a paper nightmare for the recipient. A Xerox survey showed that most U.S. office workers print more than 1,000 pages a month; the national annual average is 10,000-12,000 sheets per worker. For a company to have a paperless office is more complex than it seems. There are issues of technology, management change, how people process data, and work practices to consider. Along with reducing paper usage, companies must be clear that the value of becoming paperless will support business objectives, operations, and sustainability goals.

Paper is time consuming to manage in addition to the negative environmental impacts. Record keeping constitutes more than 90% of all office activity. Studies indicate that of all the paper filed, over 80% is never referenced again! One Xerox study showed that over 45% of the office paper that is discarded was thrown out on the day it was printed. A great deal of time is being wasted printing, sorting, purging, and filing paper. Then there is the cost aspect of paper. According to the Association for Information and Image Management, the lifecycle cost of a document is over $20, which includes the cost of paper, printing, mailing, distribution, and handling fees. Another study done by Coopers and Lybrand, (2000) estimated the cost of paper management to be about $50 per document. Essentially becoming a paperless office could reap the benefits of improved efficiency and effectiveness, reduce cost, and improve the brand and image of the company by becoming a better corporate environmental steward.

There are difficulties encountered by various organizations in becoming a paperless office. Employees who graduated from high school or college levels without the use of a computer grew up learning and processing information in paper format. It can be difficult and uncomfortable for these generations to process, read, comprehend, and absorb information on the computer. In their research for the book;- The Myth of the Paperless Office Sellen and Harper, (2002) discovered that these employees depend on paper to conduct their daily tasks, even though a digital version is available. For instance, when editing a document on screen, 89% of the time workers simultaneously use paper, spreading around their computers printouts of other supporting documents they are using.

Then there is the issue of data loss. Most employees don't understand Information Technology backup or disaster recovery processes. Citing past experiences with data loss, many employees continue to keep data in paper format for security and historical purposes. These concerns are not unfounded. According to RBS, Inc., 31% of PC users have lost all of their files due to events beyond their control. Gartner Research found that over 77% of organizations don't have disaster recovery or business continuity plans, and the ones that do are often outdated or never communicated to employees. In a different study it was found that 34% of companies fail to test their backups, and of those that do, 77% have found backup failures. Although there are other constraints and issues of becoming a paperless office, data protection and data process are key issues to address when becoming a paperless office.

For paperless transacting to be successful, the various entities must be capable of supporting electronic versions of the documents they use. The entities may have partial use of computers in their operations, but a fully integrated electronic system that connects users generally is imperative for paperless transacting to operate. There must be a system that connects parties internationally and domestically. For instance, internationally, there must be a system that directly or indirectly connects importers to exporters, banks, carriers and insurers. Domestically, there must be a system that connects importers and exporters to their banks, freight forwarders, brokers, and government agencies such as customs, revenue, health and quarantine authorities. The systems must support the exchange of structured electronic messages and must be secure and reliable. Electronic data interchange (EDI), defined broadly as the computer-to-computer communication of information in a specified format is essential.

1.2 Statement of the problem

The concept of ICT has been generally embraced the world over. Universities as institutions of higher learning have a mandate of setting pace for technology adoption and use. Most institutions of higher learning especially universities employ the use of ICT in various areas and aspects of organizing both student and staff data However, they press that even though this is the case their systems have not completely outfaced the use of physical paper (Gilani *et al*., 2009). Paperless data management is important for today's organizations as it ensures efficient and effective data handling. In 2010, 18 million tons of papers were consumed by both public and private sectors in the Middle East alone. The repercussions of extensive use of paper the researchers say brought in a decrease in both efficiency and productivity, pollution in terms of gas emissions into the atmosphere and the degrading of the environment. Saleh *et al.,* (2014). Management of paper is costly; included in estimates of paper management are cost of procurement of paper, cost of printing, distributing, mailing, filing, cost of storage space and time spent by staff in paper filing, handling and management. Depending on the different institutional/organizational, structures costs of paper management will also vary from one organization to another. On average the cost of labor to file each paper document, searching for each document that is misfiled and document recreation is approximately$340 (McCorry, 2009). In the early 1990s Deloitte

and Touché discovered that on average managers in the U.S. spent at least three hours weekly trying to trace paper that was lost, had been labeled inappropriately or filed incorrectly. When a high percentage of data is electronically created and generated a significant amount of time is still used inefficiently and also wasted in managing paper documentation. Document storage also results into high costs. Filing cabinets are expensive and as the no of cabinets grow it eventually translates to storage space which might also have to increase (McCorry, 2009). When looking at the factors that would affect the adoption of paperless student data management in public universities there is the realization that changing to a paperless system from a paper based system is still in progress for most developing countries . Gerald, (2011)

While looking at barriers to adoption of Electronic Health Records by physicians (Simaand, 2013), discovered that to ensure that methods of information sharing and communication within the physicians fraternity was effective, reduced medical errors, and that patient medical records were better managed, IT aspects need to be embraced. For these very reasons then adoption of paperless data management would therefore be inevitable. On the other hand, Owusu and Romeo, (2012), speak of the desirability of adoption of paperless office and at the same time points out that it has been a difficult objective to achieve. Universities, being institutions of higher learning have all the manpower and knowledge of the advantages that come with paperless data management. But to the contrary, most of them do not embrace paperless student data management. The establishment therefore that there is a need to adopt a paperless student data management system despite it being an uphill task provides grounds for research to find out the factors that hinder its adoption. (Gerald, 2011)

1.3. General Objective

The general objective of the study was to establish the factors affecting the adoption of technology in public universities in Kenya. A case of paperless student data management in JKUAT

1.3.1Specific Objectives

1. To establish how cost affects the adoption of paperless student data management in JKUAT

2. To establish how personnel skills affects the adoption of paperless student data management in JKUAT

1.4 Research Questions

1. How cost affects adoption of paperless student data management in JKUAT?

2. How personnel skill affects the adoption paperless student data management in JKUAT**?**

1.5 Scope of the study

This study sought to determine the factors affecting the adoption of technology in public universities in Kenya. Case of paperless student data management in JKUAT. The study involved all non-teaching staff members consisting of only administrative and management personnel in JKUAT.

2.0 LITERATURE REVIEW

2.1Theoretical Framework

The study was based on the following theories

2.1.1 Diffusion of Innovations Theory

Diffusion is defined as a special type of communication concerned with the spread of messages that are perceived as new ideas. Innovation on the other hand is an idea that is perceived as new by an individual/s. Under this theory, Rogers, (2003) enumerates that there are four main elements that would facilitate the adoption of a new idea or a new way of doing things. They include; Individual (leader) characteristics, internal characteristics of organizational structure and External characteristics of the organization.

This is a theory that shows how, why and at what rate new ideas and technology spread through cultures, operating at the individual and firm level. The study will look at the firm level under which institutions and organizations fall. According to (Rogers, 1995), innovativeness is dependent on independent variables such as characteristics of the individual(leader), the internal characteristics of the organizational structure and external characteristics of the organizational structure. Rogers, (1995) developed an adoption model that could be used to identify the factors that affect adoption of paperless data management. Paperless data management is a type of innovation developed from the aspect of ICT use and just like ICT use that is still being adopted. The researcher found the model useful when seeking to understand and relate the dynamics on the variables that would influence adoption.

2.2.2 The Technology Acceptance Model

This is one of the earlier and most used models to measure behavioral intention towards the adoption and use of technology. This Model, (TAM) developed by Davis, (1989) is built on the Theory of Reasoned Action (TRA) Ajzen and Fishbein, (1980) the specific focus being on the understanding of the reasons that might influence individuals either to accept or to reject the use of information systems. TRA was a generalized theory that provided a theoretical framework that attempted to provide links between two beliefs of perceived usefulness and perceived ease of use and their influence on individual attitudes towards adoption of technology.

When studying acceptance and use of technology in offices, Burton-Jones and Hubona, (2003)., realized that; It is also very important to note the external factors that would influence the adoption of a new technology. From the model the five antecedent variables that influence the intention and actual use of technology are external factors, perceived usefulness, perceived ease of use, attitude towards use, and intention to use. The model sought to link these variables to the actual use of technology, and to explain and forecast user acceptance of information system from observations measured after a short period of user interaction with the system. Davis (1989), Bagozzi, Davis and Warshaw (1992).
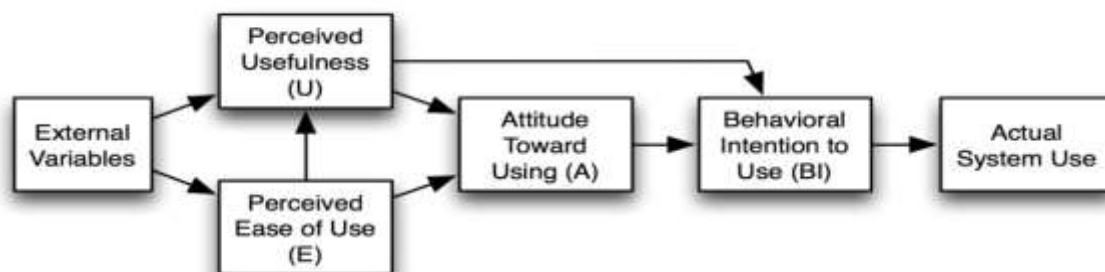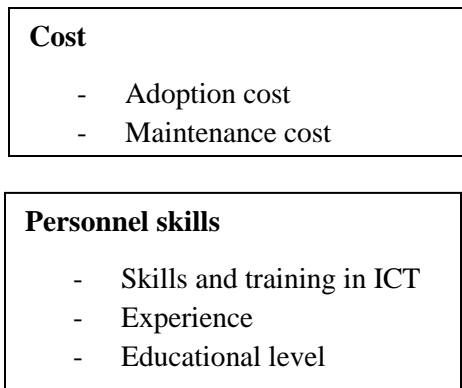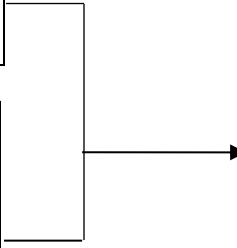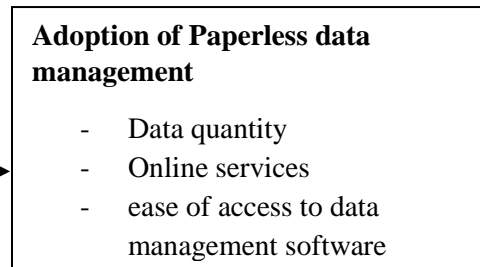

Fig: 2.1 *Technology acceptance model*
Source*: Davis. (1989)*

2.3 Conceptual framework

Independent variables   **Dependent variable**

Cost
-   Adoption cost
-   Maintenance cost

Personnel skills
-   Skills and training in ICT
-   Experience
-   Educational level

Adoption of Paperless data management
-   Data quantity
-   Online services
-   ease of access to data management software

3.0 RESEARCH METHODOLOGY

A descriptive research design was adopted taking a qualitative approach to describe the relationship between dependent and independent variables. The target population was employees in JKUAT which comprised 1433 non-teaching staff members consisting of only administrative and management personnel constructed with the assistance of human resource personnel.

The sample size consisted of non-teaching staff that are in administration. These would include personnel such as secretaries, clerks and administrators. A sample was obtained using Yamane's, (1973) formula as used by Fei and Isa (2010):

$$n = \frac{N}{1+N(e)^2}$$

Therefore:

Administration

n = 1329   .

      [1 + 1329 (0.07^2)]

=177

Management

n = 104   .

      [1 + 104 (0.07^2)]

=69

The study used a sample of 246 respondents. The study used simple random and stratified sampling techniques. Stratified sampling was used to group the employees into two groups consisting of administrative staff and managerial staff. Simple random sampling was adopted because the population constituted of two homogeneous groups of non-teaching staff (Kothari, 2004). Primary data was used thus the technique that was

used to collect data was questionnaires which were distributed among all of the top management and some of the administrative staff. The questionnaire was administered to respondents by the researcher. Each respondent required only one questionnaire which was used for obtaining qualitative data; it comprised of both structured and unstructured questions, Kothari, (2004).The data was analyzed using qualitative statistics. Qualitative method of data analysis is in form of words rather than numbers. This was because the data so collected was more qualitative than quantitative and the measurables were also qualitative. Content analysis was also used in analysis of the data to interpret the data so collected. Other inferential statistics such as, Analysis of Variance, correlation analysis and multiple regression were used to elaborate the study further. The Multiple Regression Model below was used to analyze the data

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Where:

Y = adoption of paperless data management

β_0 = Intercept term

β_i = Are the various coefficients of the independent variables

X_1 = cost

X_2 = personnel skills

ε = error term

4.0 RESULTS AND DISCUSSION

4.1 Response Rate

Table 4.1: Response rate

	Number	Percentage
Responded	170	69.10
Did Not Respond	46	30.90
Total	246	100

Table 4.1 indicates that out of the 246 questionnaires administered, only 170 were returned. The overall response rate was thus found to be 69.10 % which was very high. The 30.90 % of the respondents did not respond. The interpretation was that the high response rate was essential to obtain sufficient observations for further analysis.

4.2 Descriptive statistics of constructs

4.2.1 Cost

Table 4.2 cost

Opinion statement	Mean	Std. Deviation
The cost of hiring system upgrade companies is low	1.59	.657
The computers used in our college and school are of low quality	1.62	.671

The software used in our computers are cheap	1.72	.754
The computers maintenance cost is low	1.55	.822
The expense of customizing computer rooms is low	1.59	.666

The study sought to examine the respondent's level of agreement or disagreement on the various measures of cost. Table 4.2, presents the relevant results which show that on a scale of 1 to 5 (where 1= strongly disagree and strongly agree=5) this meant; that the cost of hiring system upgrade companies was low at 1.59, the computers used in the college and school were of low quality at 1.62, the software used with the computers were cheap at 1.72, the computers maintenance cost were low at 1.55 and the expense of customizing computer rooms were low at 1.59. The interpretation was that majority of the respondents felt that the cost was a key hindrance to the adoption of paperless data management system.

4.2.2 Personnel skills

Table 4.3 Personnel skills

Statement opinion	Mean	Std. Deviation
The staff have regular training in computers	4.38	1.171
I have access to a working computer at my desk	4.51	1.178
Lack of skilled personnel has delayed implementation of paperless services	4.54	1.121
Employees are encouraged to upgrade their technology skills	4.60	1.112
Majority of my colleagues have competence in electronic data management techniques	4.52	1.112

The study sought to examine the respondent's level of agreement or disagreement on the various measures of personnel skills. Table 4.3, presents the relevant results which show that on a scale of 1 to 5 (where 1= strongly disagree and strongly agree=5) this meant that; the state of data management in the institution was of high quality at 4.38, student data was properly managed in the department at 4.51, student data was always available whenever needed at 4.54 and the staff was regularly trained in the new techniques in data management at 4.60. The interpretation was that majority of the respondents felt that the personnel skills was a challenge on the adoption of paperless data management system.

4.3 Correlation analysis

Table 4.4 Correlation matrix

		Paperless Adoption	Personnel skills	Cost
Paperless Adoption	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	170		
Personnel skills	Pearson Correlation	0.802**	1	
	Sig. (2-tailed)	.000		
	N	170	170	

	Sig. (2-tailed)	.000	.000	
	N	170	170	
Cost	Pearson Correlation	-0.838[**]	-0.160[**]	1
	Sig. (2-tailed)	.000	.000	
	N	170	170	170

From table 4.4 it was observed that the correlation between the independent variables and the dependent variable was high and positive at 0.802 and -0.838 for personnel skills and cost respectively. According to Brook, (2002) multicollinearity is the problem that occurs when the explanatory variables are very highly correlated with each other. Burns and Burns, (2008) asserted that multi-collinearity is the presence of very high correlations between the independent variables and should be avoided. The level of multicollinearity of the two variables; personnel skills and cost was weak and negative, thus the effect of independent variable could be easily isolated from the model.

4.4 Regression Results

Table 4.5: Regression coefficients

	Coefficients	Std. Error	t-statistic	p-value	Collinearity Statistics Tolerance	VIF
(Constant)	0.240	0.028	8.571	0.000		
Personnel skills	0.253	0.039	6.487	0.000	0.485	2.063
Cost	-0.319	0.047	-6.803	0.000	0.420	2.380

The fitted regression model is

$$Y = 0.240 + 0.253 X_1 + -0.319 X_4 + \varepsilon$$

Standard Error 0.028   0.039   0.047

t-Statistics   8.571   6.487   -6.803

p-value   0.000   0.000   0.000

Where; Y = Paperless Adoption, X1 = Personnel skills, X2 = cost, ε = Error Term,

4.4.1 Personnel skills

From table 4.5 the regression coefficient of Personnel skills was found to be 0.253. This value showed that holding other variables in the model constant, an increase in Personnel skills by one unit caused the Adoption of Paperless data management to increase by 0.253 units. The value of the coefficient was also positive. The positive effect showed that there was a positive relationship between personnel skills and adoption of paperless data management.

The coefficient was statistically significant with a t-statistic value of 6.487. The p-value was found to be 0.000 which showed the probability of getting a greater t-statistic than the one already achieved in the model. The variable was also found to be a less influential variable to cost on the adoption of paperless data management.

The tolerance and variance inflated factor were found to be 0.485 and 2.063 respectively. The interpretation was that given that the tolerance value was below 0.5 and the variance inflated factor below 5 it thus showed that there was no collinearity problem.

4.4.2 Cost

From table 4.5 the regression coefficient of Cost was found to be -0.319. This value showed that holding other variables in the model constant, an decrease in Cost by one unit caused the Adoption of Paperless data management to increase by -0.319 units. The value of the coefficient was also negative. The negative effect showed that there was a negative relationship between Cost and adoption of paperless data management.

The coefficient was statistically significant with a t-statistic value of - 6.803. The p-value was found to be 0.000 which showed the probability of getting a greater t-statistic than the one already achieved in the model. The variable was also found to be the most influential variable on the adoption of paperless data management. The tolerance and variance inflated factor were found to be 0.420 and 2.380 respectively. The interpretation was that given that the tolerance value was below 0.5 and the variance inflated factor below 5 it showed that there was no collinearity problem.

4.5 Model summary

Table 4.6: Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.942[a]	0.888	0.884	0.29698349

From table 4.6 the values of the adjusted R square were 0.884. This value showed that there was a strong relationship between Personnel skills, cost and Paperless Adoption. This indicated that the factors considered caused a variation of 0.884 on adoption of paperless data management. The conclusion is that the two variables that were used only explained 88.4 % of the variation on the dependent variable.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of findings

The purpose of the study was to study the factors affecting the adoption of technology in public universities in Kenya. A case of paperless student data management at Jomo Kenyatta University of Agriculture and Technology. The study was guided by two research objectives; to establish how cost affects the adoption of paperless student data management in JKUAT and to establish how personnel skills affects the adoption of paperless student data management in JKUAT. Descriptive statistics were used and the responses were presented using tables. The mean and standard deviation statistics were the key statistics of interest in the preliminary analysis. The study found that the majority of the respondents agreed with the statements implying that the variables had effect on the adoption of paperless technologies.

The correlation analysis was used to assess the presence of multicolinearity problem before regression analysis. The correlation analysis revealed that, the level of correlation between independent variables was low. The study went ahead and used tolerance and variance inflated factor analysis to show the relevance of the results. The results showed that the model fitted well.

5.2 Conclusion

The study showed that personnel skills had significant effect on the adoption of paperless student data management system; specifically, state of data management in the institution was of high quality ,student data was properly managed in the department, student data was always available whenever needed and the staff was regularly trained in the new techniques in data management which were the key factors that showed that personnel skills was a key determinant of adoption of paperless data management technology in the university.

The study also showed that cost had significant effect on the adoption of paperless student data management system; specifically, the cost of hiring system upgrade companies was low, the computers used in the college and school were of low quality, the software used with the computers were cheap, the computers maintenance cost was low and the expense of customizing computer rooms was low. These were the key factors that showed that personnel skills was a key determinant of adoption of paperless data management technology in the public universities.

5.3 Recommendations

Based on the study findings, the researcher recommends the following:

There should be an establishment of good technology adoption strategies that ensure that the public universities are able to migrate from the manual system to paperless technology. Secondly the universities should ensure that the cost of computer hardware and software is taken into account to ensure that it is affordable. The cost of various components was found to have a negative effect on the adoption of paperless technology in the data management systems.

Thirdly since the Adoption of Paperless data management is significantly affected by the personnel skills the management of the university should ensure that employee skills are enhanced. This can be achieved by making sure that individuals are trained on the basic computer skills. Finally the study also noted that the Top management should have the capability to motivate and mobilize the resources for the purchase of the right software and hardware in order to encourage the efficient adoption of the technology in data management.

5.4 Area for further research

Future research should be directed towards identifying more variables that affect adoption of paperless data management technology in the public universities in Kenya. The study should also be extended to the private universities in the country. From the regression model it was noted that the variables included were only able to explain 88.4 % of the variation in adoption of paperless technology. This study therefore recommends the improvement of this model by including more variables that are relevant in explaining the adoption of paperless technology in data management. In particular some of the variables are organizational conservative culture and structural challenges.

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