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An Empirical Assessment of the Success of Road Asset Management System in Tanzania and Its Economic Value in Managing and Planning for Roads Pavement

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Abstract

The deployment of Information Communication Technology in the Road sector has contributed positively towards achieving the national goal of ICT for infrastructure development. However, the deployment of ICT software for Road infrastructure in underdeveloped countries has been done with duplication of efforts contributing to software failure. This study aimed in evaluating the effectiveness and economic values of the Road Maintenance Management System in Tanzania. The study deployed System Usability Scale Framework in 26 regions of Tanzania, and Kruskal-Wallis test was used for significance testing. The result indicates positive response of adopting and scaling the R*oad Maintenance Management System* to all 26 regions in the country with R^2=0.863. The usability of the system remains steady for almost three years from 2017 to 2019. The economic value of system is found to be above average (61%), while the value for money is found to reach 76.5% of the expectation. It is therefore concluded that the use of ICT in planning for Roads Maintenance increases efficiency in delivery critical factors that facilitated decision making in road planning and also improves specific services delivery in government efficiency.

Keywords: Road Asset Management, Perceived Usability, Perceived Effectiveness, Perceived EASY Of USE, Software Failure.

1. INTRODUCTION

Globally, the use and application of ICT in the roads sector have contributed positively towards achieving the national goals of ICT for Infrastructure development. However, Tanzania among Africa countries has been far the least developed in the ICT sector and can least afford cost associated with duplication of efforts and the implementation of flawed ICT strategies[1].Moreover, in many instances there is little effective software under government ownership, many of them remain either donor-funded projects with premature testing or off shelf for business oriented with little essential functionalities for the organization [2]. These have leads the third world country to be testing laboratory for non-workable ICT solutions. In order to tackle these issues, it is suggested that, among others, prioritization of ICT as an industrial enabler solution should be a national agenda [3]. These problems have been attempted with Tanzania National Roads Agency (TANROADS) with much success in attaining ICT for Road infrastructure planning and maintenance. The main objective of establishing ICT on Road Maintenance Management System (RMMS) is to optimize the use of limited resources available for maintenance works. ICT escalate systematic approach of planning road maintenance works program and reduces the entire transport costs through proper and timely maintenance [4]. It is noted by [5] that most e-governments projects in developing countries failed. Many factors play roles in this disappointing record, including the application of inappropriate technologies, a field-level disconnection between project sponsors and government, as well as client imposing top-down approach methodology of system adoption. All these add considerably to the complexity of identifying workable ICT solution for government solution [6]. It is argued in [7] that while ICT tools improve specific services delivery and government efficiency, managing the human interactions in ICT environment requires ICT skill improvement within the organization. On the others hand ICT is the area which holds the most valuable returns to organization. Following the re-organization of the Tanzanian roads sector and the formation of TANROADS and the Road Funds Board in 2000 there has been a greater need for a road maintenance management system to cover the whole of the national trunk and regional roads network. The RMMS in TANROADS was initially supported with DFID where the inventory and condition information was developed. At this phase it was passive as top-down driven demand. The system interface was programmed but did not include analysis tools. At the beginning of 2005, TANROADS was supported by DANIDA under RSPS2 project, which perceived the need to expand the system to include other essential functional service of road maintenance and planning. From this time the need for RMMS was demand-driven. The system was developed for one year with good mixing of human resource ranging from local engineers, local programmers and international experts whereby the system reached full scale of use in regions. Since then the system was improved in multi-stages. In 2008 the system was rolled out to all regions with full support of top management and enforcement of human interaction to decision tool integrated in the system. In 2011, the government of Tanzania finances the improvement of RMMS to allow error corrections that were identified after first rollout. In 2013 the system was supported by millennium challenges account to include data integration and sharing between headquarter and regional offices. Furthermore, the system was enhanced to include contract monitoring for the development project, and in year 2015 the government of Tanzanian invested heavily into the system to integrate Falling Weight deflectometor (FWD) used to measure strength of pavement. Even though the RMMS was deployed and come to full operation in year 2008, no much attention was given in assessing its economic values and usefulness in terms of successes, shortcomings, and whether the system is meeting the objectives of the clients. This is considered as a problem which forms the basis of this study. Therefore this report is concerned with answering user's research question as follows***:*** *first, how usefulness is the Road Maintenance Management System to clients and second, what is the economic value of RMMS to clients and to the whole citizen?*

1.1. IMPACT OF ICT IN ROAD SECTORS

The impact of technology on our everyday life and economic interactions is undeniable. The ICT, in conjunction with megatrends such as globalization, climate change, and urbanization populations, is helping to transform our society and the economic structures which formed the basis of industries since the industrial revolution [8]. ICT plays both a fundamental and transformative role in the road sector. It is further claimed by[8] that the use of technology may be as effective as tripling the physical road capacity in some cities. ICT has a critical role to play in road's maintenance and planning. The use of ICT in roads sector my significantly not only reduce traffic congestion [9] but also save people living on the roads [10]. Well-established concepts such as Intelligent Transport Systems, HDM4, and RONET are only one part of the ICT integration in various parts of transport infrastructure analysis. It is claimed that the ICT systems lead to higher efficiency and effectiveness, which affect competitiveness in Transportation [11]. Likewise it is argued in [12] that key issue in using ICT tools is that no system or organizations that are static therefore continual effort are required to improve ICT tools at all the times. This requires a dedication from the agency and particularly from the individual staff involved. In addition, dynamic software packages are required to provide information on the current state of roads and forecast future conditions. ICT is also required to provide a sound basis for resource allocation and optimal use of funds as well as to increase the effectiveness of management and provide savings in expenditure.

Conversely, it is not practical to continue investing in the ICT tool without carrying out any review of the system on the bases of its economic justification, usefulness as well as its reliability to the user [13]. Contrary to the benefit of ICT in road sectors, adoption of ICT follows parted of system adoption theory. As cited by [11] the adoption rate of ICT depends upon the company size.

1.2. IMPACT OF ROADS ON TRANSPORTATION AND PUBLIC HEALTH

Road maintenance is not only crucial to the safety of a road network but to its profitability, people's health, and to the overall economy. Overused, poorly maintained, inadequately financed, and badly sign-posted roads are in the first place a safety hazard to road users. Many accidents could have been prevented if roads had been adequate for user demand. Poor maintenance of roads has both social and economic costs impact [14]. It is argued that Good roads save as health enabling factors by providing affordable access to health services and activities such as Medical care, food creation, school as well as employments [15]. On the other hand poor road creates health demand such as traffic accidents, air pollution emission exposure, noise pollution exposure, stress, and anxiety. Worse case is higher maintenance cost burden due to transport costs. It is argued in [15] that the effect of poor maintained roads spread to the effect of environment. The climate and bad structure may reduce productivity and reproductively of human kind directly or indirectly due to automobile emissions. Like any other piece of real estate, roads are asset, and it is the biggest asset owned by the government. Assets must be maintained to avoid greater costs to the economy brought about by the need for eventual reconstruction. Road maintenance is an essential part of any country's transport infrastructure program and vital to the economy. Poor road maintenance has a negative impact on the economy. It is narrated by [4] that the potential benefits of efficient road management systems are well known, but few systems appear to be sustainable within developing countries. Current difficulties on road Maintenance are partly a consequence of the substantial resources required to operate them effectively particularly the basic data collection itself and the development that are over-ambitious expectations of users.

1.3. INFORMATION SYSTEM EVALUATION

The measurement of Information Systems (IS) success or effectiveness on roads maintenance is critical to our understanding of the value and efficacy of investing in ICT decision support systems [16]. The success of IS is a complex process that embraces organization process, staff skill, and Technology [4, 17, 18]. However user satisfaction is considered one of the most important measures of information systems success [19]. The structure and dimension of the user satisfaction construct are important theoretical issues that have received considerable attention and are never fully resolved [20]. Most of literature focuses on explaining what user satisfaction is by identifying its components, but the discussion usually suggests that user satisfaction may be single construct. For a system to scale over, developers must plan to continually improve the user experience of services provided by the system. By tracking user satisfaction one can find out what users think about the service and which parts of the system that cause disappointing [21]. Likewise by exploring the economic value of the system to management becomes a better strategy to scale up the system. It is argued that many information systems are at higher risk if not providing feedback to stakeholders. However author can argue that there is no usability thermometer to tell you how usable your software or application is. The experience shows that many systems are normally discarded without the knowledge of the suppliers.

1.4. SOFTWARE FAILURE

According to many studies, the failure rate of software projects is between 50% to 80%. According to the study of projectsmart.co.uk as cited in [22], found that 61.5% of all projects in large companies are challenged, 29.5% fail while 9% do success. For Medium companies almost 46.7% of the project is challenged, 37.1% do fail while 16.2% succeed. Likewise in small company 50.4% of the project is challenged, 21.6% fails while 28 % succeed. Many literatures have quoted many overlapping factors that contribute to software failure. These include lack of customers or user involvements, unclear goals and unrealistic objectives, poor requirements specifications, lack of resources, failure to communicate, poor project planning and schedule, cost estimation, as well as poor testing and evaluation [22]. According to author experience poor testing account for major part of project failure. This is because while project managers are interested in delivery on time and maximization of the project profit the system test is considered double work hence time-consuming. Testing needs to be smart enough and be focused on achieving specifications and future project integration. Often lack of tester and their poor skill and knowledge will make project be unsuccessful [23]. According to study by [24] software failure is due to testing and evaluation. In the literature several theories have been proposed to explain the phenomenon for software project failure. These include self-justification theory, prospect theory, agency theory, and approach-avoidance theory [25]. The study by [26] avail that most of software failure is mainly due to inadequate requirements specification. However, it is well recognized that ICT facilitates the “integration of supply chain activities which enables the seamless globalization of services and can afford greater specialization for the service [16]. Indeed, the innovative use of ICT in the supply chain context can triple the profit of business organization [27].

1.5. NEED FOR EVALUATION OF ROAD ASSERT SYSTEM

It has been found that there are many tools across the world, but Road Management System has been apart because of lack of use of information to make sound decision "Many road management systems are not really helpful because they generate inappropriate outputs; this is mostly due to insufficient analysis of requirements and erratic reporting [28]. Due to many failures encountered by the system, top management in developing countries has realized that to achieve system success is a very complex task. To cover this gap it must be considered that after the system implementation phase the system must be assessed in terms of successfulness, its usability as well as efficiency. However, there are challenges in organization and industries on the deficiency of unified instruments to measure Information system success. When a foreigner donor evaluates system developed locally the report always shows poor evidence to justify investment in information system [19, 29]. Even so in the Information system context the system success must be evaluated by the valid model[30]

2. METHODOLOGY

2.1. STUDY AREA AND DESIGN

This study was carried out in Tanzania, where the participant was from 26 regions of mainland. The study was a cohort study of six years. To participate in RMMS evaluation the participant must have used RMMS at least for one month. The study used questionnaire for System Usability Scale extracted from usability website [31], and the questionnaire was modified and used to collect data in subsequent years. The questionnaire was developed using five-item scale expected to give a global view of subjective assessments of usability. The System Usability Scale-SUS questionnaire was in the form of Likert *scale*. Other more questionnaires were designed to cater to three dimension of information system acceptance model. The SUS was used to measure Perceived Usability-PE, and statistical test was done using Kruskal-Wallis equality test (One-Way ANOVA on ranks). This is a non-parametric method for testing whether samples originate from the same distribution. It is used for comparing two or more independent samples of equal or different sample sizes. On the other Perceived Effectiveness-PE was measured using four items as proposed by IS Success Model [19]. However some literature argues that SUS measurement should go hand-in-hand with economic value of the system. In this study three dimension of measuring economic value of RMMS was considered.

Furthermore, several studies [31, 32] insist that in order to measure system using SUS modal, data should be collected historically which was done in this study. The instrument should be able to explore studies and developed hypothesized measurement model via the analysis of imperial data from reference population. Also study should use confirmatory studies that test hypothesized measurement model against new data gathered from the same referred population [33].

2.2. Reliability measurement

Cronbach's alpha is a measure used to assess the reliability, or internal consistency, of a set of scale or test items [34, 35]. In other words, the reliability of any given measurement refers to the extent to which it is a consistent measure of a concept, and Cronbach's alpha is one way of measuring the strength of that consistency. The resulting α coefficient of reliability ranges from 0 to 1 in providing this overall assessment of a measure's reliability. It is observed that the $0.6227 <= \alpha <= 0.6762$ indicating a satisfactory measure of the concept.

Item	obs	sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
frequntlyuse	536	+	0.5520	0.4837	.1220592	0.6354
notcomplex	536	+	0.3185	0.1679	.1295516	0.6620
easytouse	536	+	0.1871	0.0397	.1383427	0.6762
needsuport	536	+	0.3988	0.2754	.1249231	0.6485
wellinterg~d	536	+	0.2142	0.0600	.1368734	0.6752
inconsiste~y	536	+	0.0994	-0.0629	.1454948	0.6914
otherdeptuse	535	+	0.4025	0.2868	.1252716	0.6476
ccombersum	536	+	0.3271	0.1891	.1290842	0.6585
confident	536	+	0.3294	0.1898	.1289063	0.6585
learnalot	536	+	0.3209	0.1461	.129566	0.6679
beffective~k	536	+	0.5782	0.4990	.1180879	0.6294
bproductive	536	+	0.6453	0.5762	.1151419	0.6227
bfindneeds	536	+	0.6031	0.5255	.1164757	0.6262
bcompletet~k	536	+	0.6359	0.5628	.1148805	0.6227
cpleasent	536	+	0.5349	0.4370	.1180103	0.6319
crecomend	536	+	0.4891	0.3729	.1191852	0.6371
erroranoying	536	-	0.2245	0.0694	.136164	0.6742
cumbersome	536	-	0.3131	0.1414	.1301457	0.6680
csatisfied	536	+	0.5322	0.4299	.117575	0.6318
Test scale					.1260915	0.6637

Table 1.1 Reliability tests of the Items

2.3. ANALYSIS

The study used an ordinal scale data. Therefore, the Mann-Whitney *U* test was used in the analysis to test whether the two sampled group means are equal instead of parametric tests that require interval data [36, 37].

2.4. FRAMEWORK for Measuring Economic value of RMMS

It is argued in[38] that in this arena of ICT organizations continue to increase spending on Information Technology (IT), and their budgets continue to rise, even in the face of potential economic downturns. The fear about condition and increasing completion create pressure to cut costs, which requires organization to measure and examiner the benefits and cost of technology. However the impacts of IT are often indirect and influenced by human, organizational, and environmental factors; therefore, measurement of information systems (IS) success is both complex and illusive. Conversely, to measure the success of these various IS, organizations are moving beyond traditional financial measures, such as return on investment. In order to measure economic value of the RMMS various framework was adopted including System Usability Scale (SUS), Technology Acceptance Model (TAM), and Information System Model (IS).

2.4.1. System Usability Scale

In systems engineering, the system usability scale is a simple, ten-item attitude Likert scale giving a global view of subjective assessments of usability[31-33, 39-41]. The usability of a system, as defined by the ISO standard ISO 9241 Part 11, can be measured only by taking into account the context of the use of the system—i.e., who is using the system, what they are using it for, and the environment in which they are using it. Furthermore, measurements of usability have several different aspects, including effectiveness (can users successfully achieve their objectives) efficiency (how much effort and resource is expended in achieving those objectives) and Satisfaction (was the experience satisfactory). Nevertheless, SUS was improved to measure, which focus on measuring Perceived Usability (PU). The computation formula of SUS is, therefore, describes as follows.

$$Ri = \sum_{i=2,4,6..}^{10} 5 - Score + \sum_{i=1,3,5}^{9} Score - 1$$

The SUS value is an average of the total score of each respondent computed as follows

$$SUS = \frac{\sum_{i=1}^{N} 2.5 \times Ri}{N} \quad N = 59$$

Where:

SUS= SUS Value

Score=Rating value

N = Total number of respondents

R_i= Rating score for the individual person

2.4.2. Technology acceptance model

The technology acceptance model (TAM) is an information systems theory that models how users come to accept and use technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably **Perceived usefulness that** is a degree to which a person believes that using a particular system would enhance his or her job performance". In this study it is argued that in order to be accepted, a system needs to have economic value to the user[42]. Usefulness refers, among other things, to whether users believe that a developed application fulfills specific needs or whether it helps them to be more effective and productive hence increases their economic value. The next level user needs to think of easiness that is how system is friendly to them. User-friendliness (ease of use) refers, among other things, to whether users believe that using an application will be easy and simple to use[43].

Perceived ease-of-use (PEOU) – that is, the degree to which a person believes that using a particular system would be free from effort"[44]. Likewise, the ISO 9241-11 suggests that measures of usability should cover three things [45, 46]. First is effectiveness, that is the ability of user to complete tasks using the system and the quality of the output of those tasks. Second is the efficiency that is the level of resource consumed in performing a task. And lastly is user satisfaction that is users' subjective reactions to using the system. However, the precise measures to be used within each of these classes of metric can vary widely [47-49].

All in all, the measuring IS value is of great importance for organization to cut off the cost [49]. It is argued by [49]that if one thinks of an IT system as a combination of hardware and software, then the value of the system is the sum of the individual values of the equipment and software as independent products. On the other hand, if one thinks of an IT system as a service, the value of the system is more than the sum of the values of its components. The difference comes from the value of the service. Either way the service value occurs from using the system and increases over time [50]. To conclude on the economic value of RMMS the above three-dimension should be above satisfactory level.

2.4.3. Information System Success Modal

The information systems success model (IS) is an information systems theory which seeks to provide a comprehensive understanding of IS success by identifying, describing, and explaining the relationships among six of the most critical dimensions of success along which information systems are commonly evaluated[18, 51]. The details of the IS Success Model is presented in Figure 2.2.1

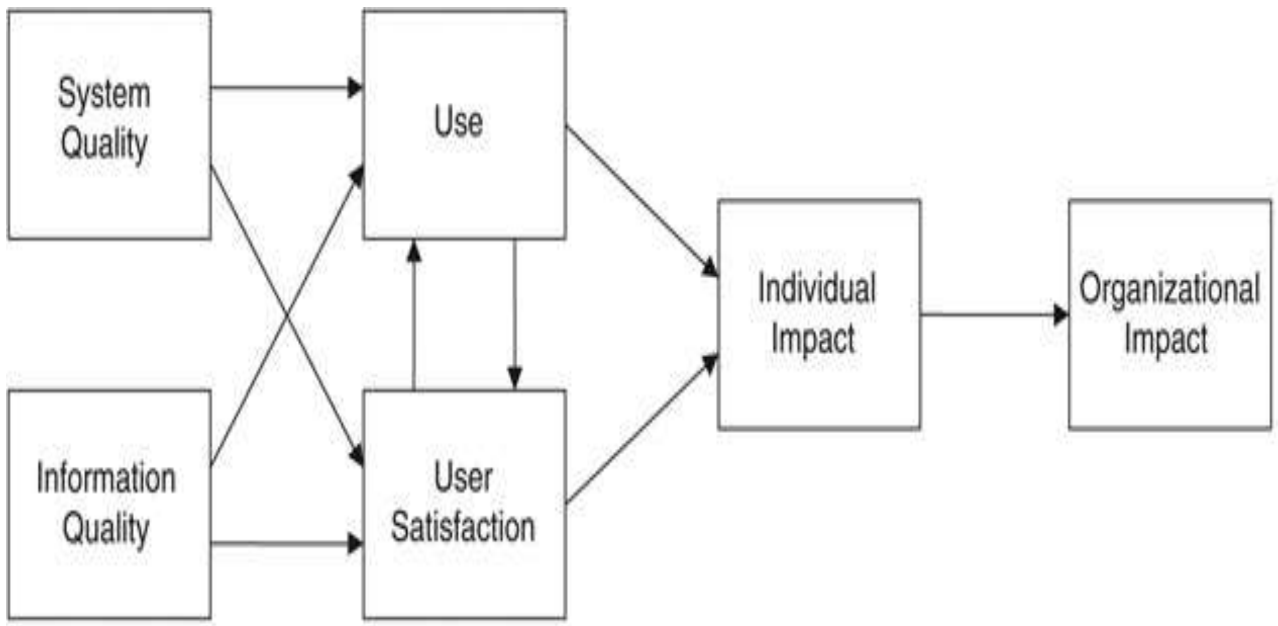

Figure 2.1 DeLone and McLean IS success model

The three models were combined with having a multiple frameworks to measure the economic value of RMMS. To measure perceived usability, 10 items of SUS Model were used. The technology acceptance model was used to measure effectiveness of the system while DeLone and McLean are success model was used to measure perceived Ease of Use. The integration of three models is shown in Figure 2.2

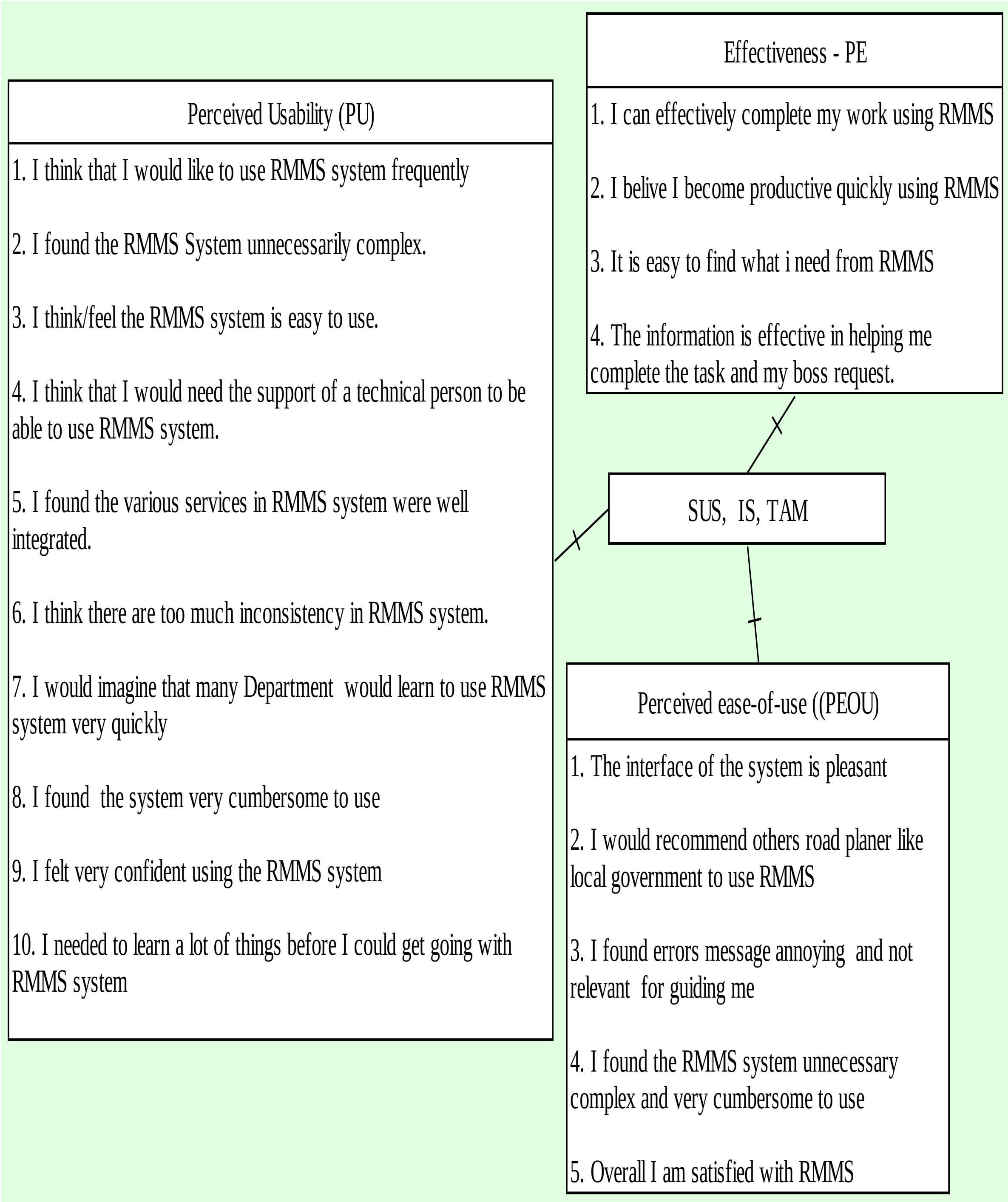

Figure 2.2: A mixed Framework evaluation

Results and Discussion

Table 3.1 Present the characteristics of respondents for six years. The results indicate that 4.85% of respondents had more than five years of the experience while 6.54% had less than one years of working experience for using RMMS.

Table 3.1 Characteristics of respondent per year

Experience of using RMMS	**2013**		**2015**		**2016**		**2017**		**2018**		**2019**		**Total**	
	Fre	**%**	**Fre**	**%**	**Fre**	**%**	**Fre**	**%**	**Fre**	**%**	**Fre**	**%**	**Fre**	**%**
Less than 1 year	2	3.85	2	2	18	9.68	9	8.18	2	4.44	2	4.76	35	6.54
1 to3 year	14	26.92	26	26	29	15.59	26	23.64	6	13.34	9	21.43	110	20.56
3- 5 year	13	25	30	30	43	23.12	22	20	15	33.33	11	26.19	134	25.05
Above 5 Year	23	44.23	42	42	96	51.61	48	48.18	22	48.89	20	47.62	256	47.85
Total	52	100	100	100	186	100	105	100	45	100	42	100	535	100

Table 3.22 present the frequently use of RMMS. The results show that 71.46 % of respondents are frequently using RMMS, while 28.54% are not much using the system. There are several reasons for not using RMMS. These include the fact that RMMS is a standalone while some users would prefers web-based applications and also there is a lack of some module such as bridges system, environmental, etc.

Table 3.2. Frequency use of RMMS

Do you Frequently use RMMS	**Fre**	**Percent**
No	153	28.54
Yes	383	71.46
Total	536	100

2.5. PERCEIVED USABILITY-PU

Based on the computation method of SUS in the following formula.

$$Ri = \sum_{i=2,4,6..}^{10} 5 - Score + \sum_{i=1,3,5}^{9} Score - 1$$

The SUS value is an average of the total score of each respondent computed as follows

$$SUS = \frac{\sum_{N=1}^{N} 2.5 \times Ri}{N} \qquad N = 59$$

The efficiency and usability of RMMS were measured at different points of a year while keeping the same questions. The results for six-year show that there is positive response of the usability of RMMS. The model shows a coefficient of 5.363and the coefficient of determination$R^2 = 0.863$. For the case of introducing in house development software the result is not surprising. This is because the development curve is varying yearly. Every time new specification is provided and may take some time before being rolled out. From the

SUS Measurement, there is a drop in usability between 2015 and 2016. This can be explained that it was the time system was subjected to major development changes on how to handle VAT in the system. Nevertheless, the usability growth in year 2017 to early 2019 can be explained that it was the time the system was improved to work in modular fashion.

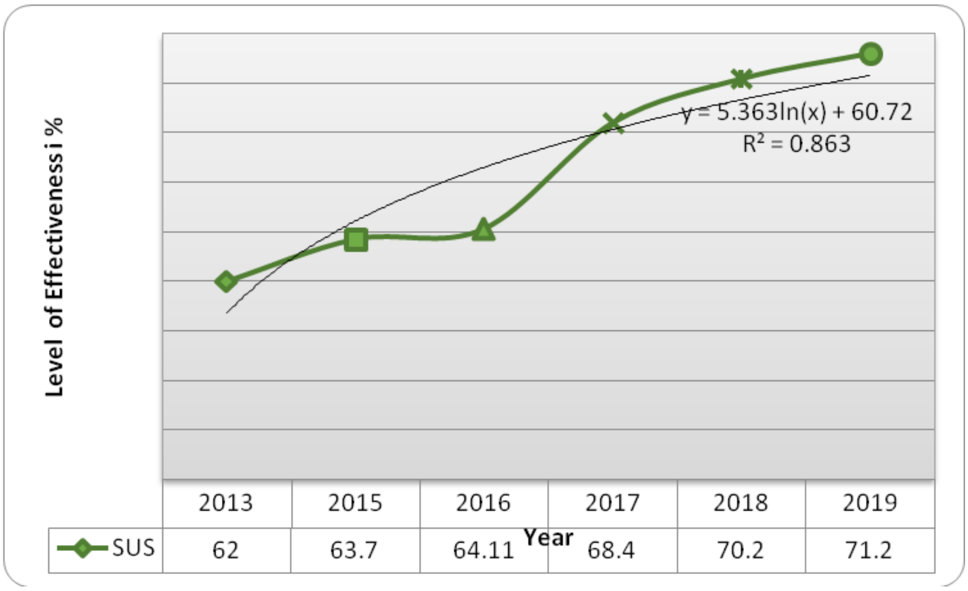

Figure 3.3 RMMs Usability using SUS

Figure 3.3 presents the summary of the usability in each year. The mean of the usability was high in 2013 and 2016 while low in 2019. Despite of SUS score, different of usability between 6year of implementation of the system was tested. The kuskal –wallis test by rank /One way –Anova was conducted. Table 3.1 present the usability by years. The results indicate that the comparison of usability between years was statistically significant with chi-Squit of 26.919 with 5 d.f having a probability of 0.0001 (< 0.005). This implies that the usability between years was significantly different.

Table 3.1 Comparison of Usability of software by year

Year	Observation	Rank Sum	Ch-square	P-value
2013	52	15638.0		
2015	100	22594.0	26.919	<0.001
2016	184	55573.0		
2017	111	29732.0		
2018	45	10469.0		
2019	42	8839.0		

2.6. PERCEIVED EFFECTIVENESS -PE

Effectiveness is about extent to which a system may be expected to achieve its objectives within its specified environment. System effectiveness is there for a function of system availability, capability, and dependability. Effectiveness of the system my influences its acceptance. There are many factors that affect system effectiveness. These include accuracy, range, invulnerability to countermeasures, operational simplicity space and weight requirements, input power requirements, input information requirements, and requirements for environments. The effectiveness of RMMS was measured using 5 related questions that probe to give responses that related on how fast the system is assisting in completing a task. The probing questions feature in the following concept. How the system effectively assists in completing the task, how staff becomes productive when using system, how system assist in answering ad-hock query, how effective is the system in searching related information needed by user. Table 3.2 presents the summary of effectiveness by year. The result shows that the effectiveness means was high in 2016 (2.92) and low in 2018 (2.73).

Table 3.2 Summary of effectiveness by year

Year	observation	Mean	std.Dev	Min	Max
2013	52	2.84	0.459	1	3
2015	100	2.86	0.402	1	3
2016	184	2.92	0.302	1	3
2017	111	2.81	0.47	1	3
2018	45	2.73	0.539	1	3
2019	42	2.83	0.489	1	3

The average of each items in relation to effectiveness is shown in Table 3.3. The mean value of each item related to effectiveness was higher above-average range from 4.20 to 4.30.

Table 3.3 summary of items related to effectiveness

Variable	observation	Mean	std.Dev	Min	Max
Effectiveness	536	4.226	0.898	1	5
Productive	536	4.309	0.885	1	5
Find needs	536	4.256	0.915	1	5
Completed	536	4.209	0.916	1	5

Table 3.4 present the Kruskal-Wallis equality test of effectiveness across the six years. The result show that the mean of effectiveness in each year was not significantly different (Chi-square=3.270, df=5; P-value=0.6584).

Table 3.4 Comparison of Effectiveness of software by year

Year	Observation	Rank Sum	P-value
2013	52	13921.0	
2015	100	26707.0	0.6584
2016	184	52421.0	
2017	111	28891.0	
2018	45	10784.0	
2019	42	11192.0	

Note: P-value is calculated based on chi-square.

2.7. PERCEIVED EASE OF USE-PEOU

The concept of usability is about how easy the system can be used with minimum support. Easy of use is all about the learnability of human-made tool. In software engineering is a degree to which software can be used by specific consumers to achieve quantified objectives with effectiveness, efficiency, and satisfaction in quantified context of use. Usability considers user satisfaction and utility as quality components and aims to improve user experience through iterative design[52]. The main concern in this section is System Ease of use"; Any application should solve a problem, fill a need or offer something people find useful. In fact, people are willing to put up with poor usability if an application delivers something of great perceived value. To measure easy of use we adopted five questions customized from Lud on measuring EASY of USE (Lund,2015).These questions dweals on measuring how pleasant is the designed interface of the system, find how user recommend the system to other stakholder, determine how system handle error in case of fault. Other includes how is cumbersome is the system and finally look for the overall satisfaction of the user. The literature shows that among of the annoying factors that demoralize ease of use of many systems are errors. A system that shutdown when error occur during processing is very irritating. Error is spontaneous and must be controlled whenever it occurs.Table 3.5 summarize the items which measure the easy to use of the software. The results show that on average more participants were more satisfied with the software. Cumbersome and error anoying are items with low mean which indicates that majority of participants have opinion that the software is not cumbersome and anoying.

Table 3.5 Summary of items related to the Easy use.

Variable	observation	Mean	std.Dev	Min	Max
Pleasant	536	3.987	1.031	1	5
Recommend	536	4.164	1.148	1	5
Error annoying	536	2.660	1.299	1	5
Cumbersome	536	2.565	1.471	1	5
Satisfied	536	4.198	1.070		

The results in Table 3.6 present the summary of ease to use software by year. The results indicated that the mean of ease to use the software was almost the same across all years but slightly high in 2016 and 2017.

Table 3.6 Summary of Ease of use by the year

Year	Observation	Mean	Std.Dev	Min	Max
2013	52	2.4	0.65	1	3
2015	100	2.44	0.55	1	3
2016	184	2.52	0.54	1	3
2017	111	2.52	0.58	1	3
2018	45	2.42	0.65	1	3
2019	42	2.42	0.59	1	3

Despite of the mean score remaining almost the same across years, different of ease to use between 6 years of implementation of the system was tested. Table 3.7 presents the kuskal –wallis test by rank, and the result indicates that there were no statistically significant differences across the years (Chi-square=2.587; df=5; P-value=0.7633).

Table 3.7 Comparison of Ease to use of the software by year

Year	Observation	Rank Sum	P-value
2013	52	13191.0	
2015	100	25693.5	0.7633
2016	184	51483.0	
2017	111	31088.5	
2018	45	11697.0	
2019	42	10763.0	

Note: P-value calculated based on chi-square.

The failure of the deployment of software may arise from internal. It is argued by [10] that internal political constrain may prevent the firm from fully utilizing its investment. This was not observed in the implementation of RMMS as almost every year, the top management plan for financing the development of the system. The commitment of the specialized users count as the critical success of the system to the region hence minimizes the implementation failure. The specialized group do organized test occasionally. Doing so reduces the number of error in the system.

THE ECONOMIC VALUE OF RMMS

Measuring the benefit derived from Software deployment or its values as a realization by user is one of the primary challenges in IT organizations. This applies whether an organization purchased a product or use in-house developed software. To realize the economic values the software should be efficient. That is client should install and use it to maximize business agility.

It is noted that many systems in government fails within one year of their installation. It is common to find a system installed in the agency but never being used. Installing and not using the software system is not an efficient use of funds, but also not possible to demonstrate the value for money of the software system. The client realize economic value of software in threefold, to

i. Save money on existing, projected, and future requirements. We argue that the uses of databases system are to assist in storing and retrieving data on required time. The response of one of the despondence is quoted as follows:-

   "Producing an evaluation sheet for several contracts was not easier before using RMMS. It could take us 3 to 4 days, but now once you have all data into the system you just click and get the evaluation sheet with a certificate. Things are even getting better because we can retrieve back both a certificate and its associated evaluation sheet at any time. Moreover CMM has been simplified for producing reports. We can select a financial year and produce all reports for R1, R2, R4, and others more"

ii. Delivering productivity, gaining from ongoing activities by reducing expenses, and increasing staffs productivities. It is noted that the use of RMMs has reduce biasness in Road asset prioritization for maintenance. The quotation of resonances is concerning prioritization of maintenance is summarized as follows:

   "RMMS have reduced biasness in budget allocation at the regional level. This is very significant for equal development of roads in the region. We need each region to feels that it has equal representation in national budget in road maintenance.

iii. Delivering IT Innovation to client line of business to enable client gain and maintain competitiveness advantage. The quotation of the despondence concerning the economic values of RMMS is summarized as follows.

"RMMS have been of very values to us, before deployment of RMMs we used to do planning from December to February at all this period it was a headache to human resource. Many staff was involved, including drivers, but now once data are collected and entered into the system, it is a matter of clicking to have a presentable report. We have reduced much on human resource and even cost of fuels. Likewise, we have reduced tension of staff in the directorate of planning"

Table 3.8 summaries the economic value of RMMS. The results on the economic value of RMMS indicates that s 61.0% of the respondents perceived the system as of very economical, 25.2 % found somehow economic while 13.8% found less economical.

Table 3.8 Economic value of RMMS

Economic value of RMMS	Number	Percentage
Is of very economic	327	61.0
It is economic	135	25.2
Not of much economic	74	13.8
Total	536	100

Table 3.9 presents the responsive of the RMMS systems and value for money. The results indicate that 51.68%respondents found the system of very responsive to their query, while 16.6 % found it less responsive. Nevertheless, 41.8% of the respondents found the system to be of very valuable, while 23.5% perceived it has less value.

Table 3.9 Responsive of the RMMS system and value for money

Item	**Number**	**Percentage**
Responsive does the RMMS system been to concern		
Neither	89	16.6
Very responsive	277	51.7
Responsive	170	31.7
Total	**536**	**100**
How would you rate the value for money		
Less valuable	126	23.5
Is of very valuable	224	41.8
Somehow valuable	186	34.7
Total	**536**	**100**

3. Conclusion and Recommendation

From the results, it can be concluded that there are a higher adoption and acceptance of RMMS as ICT decision suport tool in planning and improving the equality nation road network. The key benefits that are realised in RMMS can be summarised as folows, efficiency, that is greater effciency in delivery critical reports to facilitaed decision and enhance Road network planning as well as improving intra-organization service.

Cost effectives: that is reducing time of productions, increasing the productivity, and releasing staffs tension on had hock queries. Accountability that is increasing greater transparency in budget allocation, fund distribution among implementing units. Responsivesnes. The system increase responsiveness of planners department in meeting the political demand by providing realistic and wel formed conclusions of Road network planning strategies. The following are some recommendations put forward in improving RMMS for the benefits of goverments.The implementation of IT infrastructure tools is a continuous process that continues demand for further improvement is recommended. More efforts should be put in building robust system to enable the planning department to continue benefiting the IT decision support tool. More analysitcal and mathematical models need to be developed and intergrated into RMMS. Likewise, more services suchas online report generation, enabling online access, as well as mobile access of the system, needs to be considered in RMMS.

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