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Information systems integration for better decision making in Tanzanian Higher Education Institutions

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ABSTRACT

Different Information Systems (ISs) have been implemented in many Tanzanian higher education institutions (HEIs) but most of them are not integrated with each other. This study aimed to discover whether these HEIs consider integrated ISs useful in performing different operations especially in decision making. A modified Technology Acceptance Model (TAM) was used for the study of one HEI in Tanzania along with a mixed methods approach. Data collection was achieved through unstructured interviews, observation and a questionnaire. The qualitative data were analysed thematically, and four themes were formed. Descriptive statistics were also computed for analysis of the quantitative data, followed by a regression analysis for hypotheses testing. The findings indicate that technology *($p < 0.030$)* influenced the perceived ease of use but not cost *($p < 0.412$)*. It was also found that performance has no influence on perceived usefulness *($p < 0.317$).* Both perceived usefulness *($\beta = 0.48, p < 0.026$)* and perceived ease of use *($p < 0.022$)* were found to influence behavioral intention on using integrated ISs. This study is potentially useful to the Tanzanian HEIs to improve their ISs to make them more useful in decision support.

Keywords: *Information Systems Integration; Higher Education; Decision Making; Tanzania.*

INTRODUCTION

Many Higher Education Institutions (HEIs) in Tanzania have adopted Information and Communication Technology (ICT) to support their daily activities (Mtebe and Raphael, 2018). Different Information Systems (ISs) have been implemented based on the management activities they were intended to support. In most of the HEIs the ISs include Student Management Information Systems, Human Resources Management Systems, Accounting Packages, E-Learning Systems, Library Management Systems, Payroll Systems and other systems for specific processes based on the HEI. It was noted that these ISs are always installed independently with no connection to each other. Each of the IS instances uses its own data and sometimes the same basic information required by one system is found in another system. The integration of these systems is necessary to avoid this kind of duplication of data and ensure an effective use of resources and improve business intelligence (Jiang et al., 2021; Zafary, 2020).

According to Kafel (2016) systems integration has many benefits for the organization such as increasing effectiveness and efficiency and hence customer satisfaction. The integration of the ISs used separately in the HEIs in Tanzania can improve operational performance (Kolasa, Papaj and Ziemba, 2020) and more data collection for processing and hence working efficiency improvement. According to a survey by Bakar (2003) and later by Kafel (2016) the following are some of the benefits of information systems integration:

i. Business processes steps are reduced.
ii. Processing time is reduced.
iii. Fewer customer complaints.
iv. More processes are completed at a time.
v. Cost reduction on data entry and correction.
vi. Eliminated errors on data entry and data duplication.

vii. Reduced administrative and service provision costs.

HEIs in Tanzania have not yet made integrating their information systems a priority despite all the benefits listed above. Based on the benefits, it was decided to research how users perceive the integration of their ISs used in their daily activities. The study used a modified Technology Acceptance Model (TAM) model to fulfill its main objective. The research will concentrate on answering the following questions:

1. How do you find it useful to integrate the available ISs in your HEI?
2. How do you think the integrated ISs are helpful in decision making in your HEI?

This study will help in raising awareness among the ICT departments in different HEIs in Tanzania to propose better solutions for implementing the ISs in a productive way, for supporting improved operational performance.

Information systems for decision support in Tanzanian HEIs

Although there have been challenges on the implementation of information systems in Tanzanian HEIs, they have been helpful in their different activities (Mtebe & Raphael, 2017; Muries & Masele, 2017; Kayanda, Busagala & Tedre, 2020). The use of information systems is very important for better and more informed decision making in an organization (Martins et al., 2019). Utomo et al. (2018) and Islam et al. (2019) noted that, with the use of ISs, more information is available for decision making and hence improved performance and therefore high customer satisfaction. These findings suggest that Tanzanian HEIs, like any other organization, need to make sure that they have better implemented ISs for more informed decision making to meet their development goal for sustainability and therefore systems integration is inevitable.

Systems Integration for better decision making in Tanzanian HEIs

According to Soliman and Noorliza (2020), ISs integration provides a platform that allows more data collection and information processing for easy generation of complex reports for better decision making. The use of well-integrated ISs ensures increased availability of data for processing to support fast decision making (Bamufleh et al., 2021). Systems integration is expected to facilitate an improved working performance (Ullah et al., 2018) which leads to an improved quality of services (Shou, Shan & Li, 2018). With better strategic planning, the Tanzanian HEIs are expected to better fulfill their goal (Al Dhaen, 2021) and hence their sustainability. The question arises as to how the ISs stakeholders from Tanzanian HEIs perceive the importance of systems integration for better decision making? This study is therefore important to fill the noted gap.

Theoretical Research Framework and the Study Hypotheses

The technology acceptance model (TAM) has been used in different studies to seek users' views on their intention of adopting a new technology to use in their daily activities (Al-Emran, Mezhuyev and Kamaludin, 2018; Martín-García, Martínez-Abad & Reyes-González, 2019; Munabi, Aguti & Nabushawo, 2020; Mailizar, Almanthari & Maulina, 2021) . This theory suggests that perceived usefulness (U) together with perceived ease of use (E) are both affected by some external variables and thus U and E act as mediating variables to the external variables on the behavioral intention to use the intended technology and therefore the actual usage behavior (Davis and Venkatesh, 1996).

In this study the external variables are performance, cost and technology. These will be examined in relation to how the ISs stakeholders in Tanzanian HEIs perceived their effect on the integration of their ISs. This study describes perceived usefulness as the degree to which ISs stakeholders believe that the integration of their ISs will enhance their working efficiency through an increased performance, while the perceived ease of use describes the degree to which ISs stakeholders believe that the integration of their ISs will involve relatively less effort in the integration process

and in the use of the integrated ISs. Figure (1) represents the proposed research model for this study.

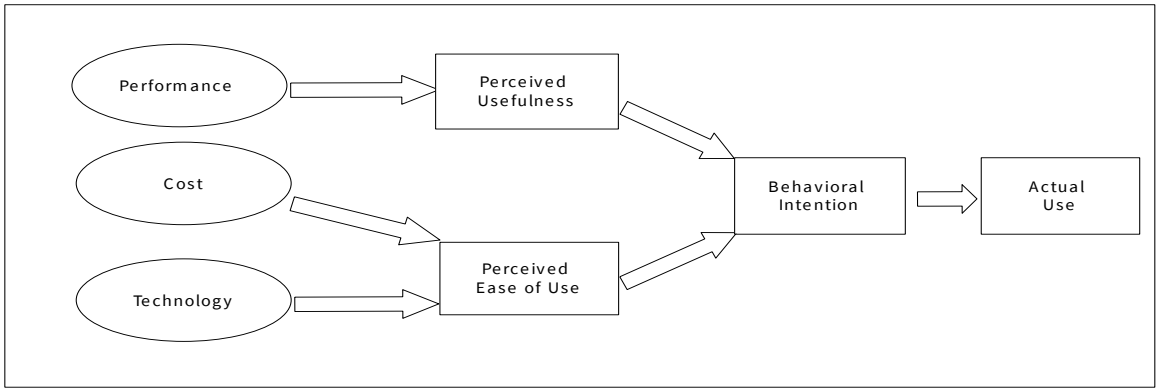

Figure 1: The research model

Performance

The proposed model considers performance expectancy as one of the factors which can influence the ISs stakeholders to consider it necessary to integrate the present ISs for more efficiency. According to Isaac et al. (2018), performance is an important construct in measuring ISs' success. It is therefore assumed that there is a positive relationship between the expected performance and the perceived usefulness of the integrated systems.

Hypothesis (H1): Performance has a positive effect on the perceived usefulness of the integrated ISs.

Cost

The perceived cost of integration in different dimensions has also been thought as having a positive effect on the perceived ease of use of the ISs' integration. A study by Sorce and Issa (2021) showed that adoption costs may affect acceptance of new technology. The costs may include the implementation cost, maintenance cost and all other costs associated with the integration of the ISs. For example, it may be thought that if one of the integrated systems is down after integration, then the whole system may be in trouble and hence time is wasted and some tasks may have to be carried out manually, leading to cost increases. This may decrease effort in integrating ISs.

Hypothesis (H2): Cost has a positive effect to the perceived ease of use of the integrated ISs

Technology

The existence of sufficient expertise in integration and information system management is also assumed to be among the factors which may influence the perceived ease of use of the integrated ISs. Due to the challenges of ICT expertise in developing countries like Tanzania (Matimbwa, H. and Masue, 2019; Warioba et al., 2021), lack of sufficient expertise in information systems may lead to stakeholders thinking that they may lack sufficient technology support for integration which may directly affect their motivation to integrate the ISs.

Hypothesis (H3): Technology has a positive effect on the perceived ease of use of the integrated ISs.

Perceived usefulness

Perceived usefulness is considered as the degree to which the IS stakeholder believes that there will be a benefit from the ISs integration. According to Koul and Eydgahi (2018) and Mohd Amir et al., (2020) perceived usefulness has shown a significant relationship with attitudes towards using technology. In this study the test is whether perceived usefulness has a positive effect on the attitude towards using the ISs integration technology.

Hypothesis (H4): Perceived usefulness has a positive effect to the attitude towards using integrated ISs.

Perceived ease of use

It has been found that perceived ease of use affects intention to use a new technology (Koul & Eydgahi, 2018; Mohd Amir et al., 2020). In this study it is assumed that perceived ease of use is the extent to which the ISs stakeholders believe that using the integrated ISs is easier than using a single system with no integration. Therefore, it is considered that perceived ease of use has a positive effect on the attitude towards using the integrated ISs.

Hypothesis (H5): Perceived ease of use has a positive effect on the behavioral intention on using the integrated ISs.

METHODOLOGY

This study involved one Tanzanian HEI which was purposely selected based on the knowledge authors had on systems integration initiatives at this HEI (Descombe, 2010). This HEI is made up of four campuses located in different regions in Tanzania. These campuses have been using the same ISs and there have been initiatives on integrating the systems in all the campuses to improve its decision making process.

The mixed methods approach was involved in this study where different data collection techniques were used. The data collection process involved observation, unstructured interviews and a questionnaire.

The participants in this study involved different ISs stakeholders who have been using these systems in their daily student support activities and on production of different reports for decision support at this HEI. The participants included administrative staff like registration officers, academic officers, accounts officers and heads of department who are the main developers of decision support reports.

Observation of different activities conducted using available systems at this HEI was carried out for more than six months with 16 unstructured interviews conducted during the observation process, based on an observation guide. The interviews were 15 to 30 minutes in duration. Both English and Kiswahili were used during the interview. A total of 46 questionnaires were distributed to all campuses with 39 responses received.

The analysis of the observation and interview data used qualitative data analysis techniques. Firstly, the collected data were organized and then thoroughly read for familiarization with the data before the different codes were identified. Thereafter, the codes were grouped, and the different themes were formed as shown on Table 1. The quantitative data were analysed using SPSS statistical software whereby the descriptive statistics where calculated and regression analysis was done.

RESULTS

This study involved both qualitative and quantitative methods from which the results are hereby presented. From the quantitative data the descriptive statistics together with the results of the

hypotheses testing are presented, while from the qualitative data the themes together with some useful user statements will be used to support the findings from the analysis of the quantitative data.

Questionnaire reliability and validity

The validity and reliability of the questionnaire was tested by calculating factor loadings and the Cronbach's Alpha (α) coefficients. The items proved to be sufficiently valid as the values were above 0.5 as shown in Table 1 (Isaac et al., 2018; Kayanda et al., 2020). It was also found that the α coefficient of performance was below 0.7 and hence not reliable. However, all the other values were approximately 0.7 and above indicating reliability of the instrument (Isaac et al., 2018; Kayanda et al., 2020).

Table 1: *Validity and reliability analysis results*

SNo.	Construct	Item	Factor loadings	Cronbach's Alpha
1.	Performance	P1	0.63	0.53
		P2	0.72	
		P3	0.73	
2.	Cost	C1	0.79	0.66
		C2	0.81	
		C3	0.82	
3.	Technology	T1	0.87	0.79
		T2	0.88	
		T3	0.73	
4.	Perceived usefulness	PU1	0.65	0.69
		PU2	0.74	
		PU3	0.66	
5.	Perceived ease of use	PE1	0.56	0.71
		PE2	0.75	
		PE3	0.62	
6.	Behavioral intention	BI1	0.80	0.80
		BI2	0.65	
		BI3	0.51	

Descriptive statistics

Descriptive statistics (mean and standard deviation) were calculated to facilitate analysis of the responses based on each item as presented in Table 2.

Table 2: *Descriptive statistics*

Item	Mean	Standard Deviation (SD)
Using the integrated ISs would improve my work (P1)	3.81	0.94
Using integrated ISs would increase effectiveness of my work (P2)	4.14	0.96
Using integrated ISs will increase the quality of produced reports (P3)	3.68	0.91
Integrating ISs is costful (C1)	3.97	0.90
Using integrated ISs is costful (C2)	3.54	0.51
Maintaining integrated ISs is costful (C3)	4.08	0.68
Using integrated ISs needs ICT skills (T1)	2.43	1.09
Using integrated ISs needs intensive support (T2)	3.38	0.95
Using integrated ISs is difficult (T3)	2.70	0.91
I found integrated ISs useful in my work (PU1)	4.24	1.12
Using integrated ISs would improve my working efficiency (PU2)	4.24	0.86
Using integrated ISs would increase accuracy of my reports (PU3)	4.11	1.13
I would find integrated ISs easy to use (PE1)	3.65	0.92
Using integrated ISs would enable me to process my data more quickly (PE2)	3.68	0.85
Using integrated ISs would improve my production time (PE3)	4.16	0.90
I will recommend integrated ISs on my work place (BI1)	4.59	0.64
I think using integrated ISs is beneficial to our institution (BI2)	3.68	0.88
I think using integrated ISs is a good idea (BI3)	3.78	0.98

Most of the respondents agreed on the use of integrated ISs and recommended such use in their workplace (Mean: 4.59; SD: 0.64). The results also show that most of the respondents did not think that using integrated ISs is difficult (Mean: 2.70; SD: 0.91) and that ICT skills are not needed for use of the integrated ISs (Mean: 2.43; SD: 1.09). However, it is noted that a higher mean score was shown for whether intensive support is required for use of integrated ISs (Mean: 3.38; SD: 0.95). Generally, all other items show that the respondents agreed with the arguments (Mean approximately 4.00).

Hypotheses testing

This study used regression analysis to test the hypotheses. The results are presented in Table 3.

Table 3: *Regression analysis results*

Constructs	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	*Std. Error*	*Beta*		
Performance	0.22	0.22	0.17	1.01	0.317
Cost	0.22	0.26	0.14	0.83	0.412
Technology	0.30	0.11	0.29	1.82	0.030
Perceived usefulness	0.39	0.12	0.48	3.23	0.026
Perceived ease of use	0.23	0.17	0.20	2.91	0.022

The findings show that three of the five tested hypotheses - H3, H4 and H5 are supported. Further, only technology *(β = 0.29, p < 0.030)* has an influence on perceived ease of use. It is also shown that performance has no influence on perceived usefulness *(β = 0.17, p < 0.317).* Both perceived usefulness *(β = 0.48, p < 0.026)* and perceived ease of use *(β = 0.20, p < 0.022)* were found to have an influence on behavioral intention on using integrated ISs. A summary of the results of the hypotheses tests and the conclusion is shown in Table 4 below.

Table 4: *Summary of Hypotheses Testing*

Hypothesis	Results	Conclusion
Hypothesis 1: Performance has a positive effect on the perceived usefulness of the integrated ISs	Not Significant (β = 0.17, p < 0.317)	Not supported
Hypothesis 2: Cost has a positive effect to the perceived ease of use of the integrated ISs	Not significant (β = 0.14, p < 0.412)	Not supported
Hypothesis 3: Technology has a positive effect to the perceived ease of use of the integrated ISs	Significant (β = 0.29, p < 0.05)	Supported
Hypothesis 4: Perceived usefulness has a positive effect on the behavioral intention on using the integrated ISs.	Significant (β = 0.48, p < 0.05)	Supported
Hypothesis 5: Perceived ease of use has a positive effect on the behavioral intention on using the integrated ISs.	Significant (β = 0.20, p < 0.05)	Supported

Emergent themes

The findings from the observation and interview data are presented below. The data yielded four emergent themes, summarized in Table 5.

Table 5: *Summary of the emergent themes*

Theme	Aspect	Example Statement	Observation
Reports development	Reports generation process for different purposes with data in different independent ISs	*"We face a lot of difficulties on report generation. Students information are in different systems. You need to merge data from different systems so as to get a meaningful report."*	It was observed that sometimes on creating reports, the excel files from different systems are used. Manual copying and paste process is followed to make some of the reports which takes a lot of time unnecessarily.
	Reports generation process for different purposes with integrated ISs	*"I think my work will be very easy as I will just download the complete reports with less or no editing."*	
Time	Time used on different activities using different independent ISs	*"I use a lot of time to transfer data from student IS to the accounting package for reconciliation process."*	It was observed that the students data from the students IS has to manually be uploaded to other systems like accounting package for different purposes.
	Time used on different activities using integrated ISs	*"… things will be very fast if the systems are integrated."*	
Data accuracy	Correctness of data in using independent ISs	*"We have faced a lot of problems this time due to the wrong uploads of data from students IS to accounting package."*	It was observed that the process of data management is tiresome especially during data migration which led to a lot of unnecessary errors.
	Correctness of data in using integrated ISs	*"...I hope data error will be very much reduced a lot …"*	
Data access	Easy access of data on using different independent ISs	*"Sometimes you fail to make decision on students instantly as another information is in another system which someone else has to work on."*	It was observed that accessing students' information needs login to more than one system and therefore wastage of time unnecessarily.
	Easy access of data on using integrated ISs	*"I think things will easily be solved as data will be available easily… "*	

DISCUSSION

This study followed a mixed method approach whereby the identified themes supported with the quantitative findings have been used to answer the research questions on fulfilling the objectives of this study.

Usefulness of integrated ISs

In regard to the first research question, most of the respondents indicated that they find it helpful to have integrated ISs in their HEI. Some respondents said that if the systems are well integrated,

they will simplify their work on different aspects, not only on student management but also on staff management. The descriptive statistics also showed that most of the respondents agreed that the integrated ISs would be useful in their work and would increase the effectiveness and efficiency of their work (Mean > 4.00). The findings also indicate that perceived usefulness has a positive effect on the behavioral intention to use this technology, which concurs with the findings of other studies such as Munabi et al., (2020). Based on these findings it is noted that users wish to have all their ISs well integrated to improve their working environment.

Usefulness of integrated ISs on reports development

Reports generation is one of the main aspects of using ISs in organization. With the use of ISs, report generation is greatly simplified. Manual generation of reports is tedious and may lead to many errors which can be avoided using ISs. This study observed that generating reports using different separate ISs involves a lot of manual work which can be solved by integrating the ISs. According to respondents, if they will have everything in the main system, they generally use in their daily activities, the issue of reports generation will be simple, and the reports will be more accurate. One accountant noted:

> *"… for sure if this task of data transfer from students IS to this system will not be there, my work will be very simple. I will easily have all the reports ...".*

In addition, one head of department noted:

> *"... If I will get the timetable data in the system I will have my lecturer teaching report very easily ..."*.

These views lend support to the findings from the analysis of descriptive statistics which indicate that most of the respondents think that having integrated ISs will help them in developing more quality reports with high accuracy (Mean approximately 4.00). These findings show that users find it useful to integrate ISs to for a simplified reports development process and suggest that they will use the system if it is put in place.

Usefulness of integrated ISs on time management

The time used on accomplishing different tasks is also thought to decrease if the ISs are integrated. The respondents have indicated that they use a lot of time unnecessarily and if the ISs are integrated their work will be completed aster. One of the department heads noted:

> *"I think if the systems are well integrated we will have our students supported on time...."*.

The observations also showed that different activities are delayed due to having to await information from different people from different systems. For example, the student clearance issue may take a student several weeks looking for different officers for a clearance signature while if the systems were integrated, the students would be looking for one officer only. The findings from the descriptive statistics show that most of the respondents agreed that with the integrated ISs data processing is quick and production time is improved (Mean approximately 4.00). These findings indicate that users accept the integrated ISs as a useful tool for time management in their daily activities.

Usefulness of integrated ISs on data accuracy

Having ISs integrated decreases most of the unnecessary errors. Based on the descriptive statistics, most of the respondents agreed that the integration of the ISs will increase accuracy of their reports (Mean > 4.00). It was also observed that during the process of moving data from one system to another there is a high risk of uploading inaccurate data due to some human factors. This has resulted in most of respondents emphasizing the need for system integration to ensure data accuracy. For example, one of the respondents from the accounting department noted,

> "*… errors on our reports is a big problem … I really encourage systems integration…"*.

Usefulness of integrated ISs on data access

Having ISs integrated makes it easy to access other systems' data for different operations. The respondents explained how data can be easily used for different purposes in their daily activities if they will be accessible in the IS that they use daily. One of the accountants noted,

> *"… if the students names will directly be inserted into my accounting system when the student is registered would make my life easier".*

Integrated ISs for easy decision support

In regard to the second research question, the respondents noted that system integration will easily support decision making in different ways. For example, one head of department noted,

> *"… it would be easy having the class attendance system integrated to students management system for easy reports generation …"*.

It was also noted from the descriptive statistics that most of the respondents were of the view that using integrated ISs will help them process their data more quickly and produce quality reports (Mean approx. 4.00). It was observed that the executives cannot easily get their reports directly from different available systems in this HEI and hence they mostly rely on manually delivered reports. Based on these findings, ISs integration is important to simplifying the decision making process using data from all the available ISs in HEIs. Integrating ISs is very necessary to ensure a better informed decision making process.

The results of this study showed that perceived ease of use has a positive effect on the behavioral intention on using the integrated ISs and perceived ease of use is directly influenced by how the technology involved is perceived by the users. It is therefore very important to consider integrating the ISs in a manner that is as easy to use as possible to avoid a need for intensive support from the systems experts. A study by Mailizar et al., (2021) found that perceived ease of use does not have an influence on behavioral intention to use a new technology but making the integrated ISs easy to use will ensure that the decision makers find it more useful, as they will not depend on others especially for technical support.

Reports development with integrated ISs on decision support

Reports development is a crucial activity in the decision making process. Sufficient data are needed to develop meaningful reports for better decision making. Having integrated ISs helps in more data generation for decision support. The respondents noted that sometimes the reports they use in different meetings miss important information due to missing connections between data from different systems. They also insisted that the integration is important as if more data are available and are brought together, they can be more meaningful. One of the executives noted,

> *"... I think it would be easy if I could download the reports from the system alone … with quick information on hand decision making is faster ..."*.

Time management with integrated ISs on decision support

Timely decision making is important for institutional development. Customer satisfaction is based on timely responses to the customers' issues, and failure to do so places the HEI at developmental risk. Integrating ISs helps in timely decision making as reports are produced in time for decision support. The respondents have confirmed that integrating ISs is very helpful for providing better decisions on time, especially on the issues related to student support and reducing delays. One member of the registration office noted,

> *"... I think our students will be supported on time and with proper decision on their matters...."*.

Data accuracy with integrated ISs on decision support

Making correct decisions relies on the accuracy of the data used in reports preparation. The respondents have explained clearly that wrong data may cause very big problems to students and to the institution. One head of department noted,

> *"… if by mistake I allow a student who has no completed payments to attend examinations, it is a big problem ..."*.

Data access with integrated ISs in decision support

Having ISs integrated, allows accessing data from other systems for reports generation to be easy and quick and therefore easy report generation. The responses have also shown that if the systems are integrated it will be easy to make decisions as fast as possible as the information will be available on time. One respondent from the registration office noted,

> "*… it will be very easy to handle graduates' issues if I will get the clearance information in my login account ..."*.

PRACTICAL IMPLICATIONS AND LIMITATIONS

This study highlights the importance of information systems integration for better decision support in HEIs. The study is potentially useful to Tanzanian HEIs on their process of improving their information systems to make them more useful in decision support. The study findings suggest that the management team of Tanzanian HEIs should put more emphasis on better implementation of ISs for decision support.

Apart from the benefits of integrated ISs that have been noted, HEIs should consider an implementation with very high abstraction so as to make users work as if they are working with a single system. The implementation should also consider the security threats associated with systems integration and manage them as early as possible.

Some limitations are associated with this study and therefore more studies are invited. The research was conducted on only one Tanzanian HEI and focused on finding how useful this HEI viewed integration of the available ISs used in their daily activities, and also how helpful it would be in decision support. The findings of this study need further research to be generalizable to other HEIs.

CONCLUSION AND FUTURE RESEARCH

According to the benefits of systems integration mentioned by Kafel (2016) and in keeping with the results obtained in this study, it is evident that systems integration is critical to the operations of the different HEIs in Tanzania. To make better decisions, management needs sufficient data . It is therefore recommended that Tanzanian HEIs should place more emphasis on integrating their information systems to enjoy the benefits which have been highlighted for better decision making. Management should also consider increasing their budget for systems integration issues to ensure a quality integration process.

This study has focused on highlighting the usefulness of systems integration in HEIs in Tanzania especially on decision making. It is therefore important to conduct more research on the wider systems integration issues in HEIs in Tanzania to improve the management processes for better learning environments.

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