Article

The suitability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model in open access adoption studies

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Abstract
Technology acceptance models or theories are commonly used in studies aiming at predicting and explaining the individual behaviours towards the acceptance and usage of new technologies. This paper reports part of the findings from a doctoral research project which focused at analysing the acceptance and usage of open access within public universities in Tanzania. The study was guided by the Unified Theory of Technology Acceptance and Usage (UTAUT) model). The survey questionnaire targeted 544 respondents selected through stratified random sampling from a population of 1088 university researchers at six public universities in Tanzania. A response rate of 73 percent was achieved and the binary logistic regression statistics of the Statistical Package for Social Sciences (SPSS) was used for data analysis. The study findings suggest support for the application of the UTAUT model in studying the adoption of open access in a research environment. Among the findings, attitude, awareness, effort expectancy and performance expectancy were established as the key determinants for the researchers' behavioural intentions of open access usage. Similarly, age, awareness, behavioural intention, facilitating conditions and social influence were found to significantly affect researchers' actual usage of open access. These factors should therefore be taken into account in the planning and implementation of open access projects. A further validation of the open access research model in similar research institutions in Tanzania and elsewhere is recommended.

Keywords
open access publishing, public universities, scholarly communication, technology acceptance models, Unified Theory of Technology Acceptance and Usage, UTAUT, Tanzania

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The UTAUT model has proved suitable in guiding an understanding of the factors that contribute to the acceptance and usage of open access by researchers in Tanzania.

Introduction

A theory emanates from a systematic and formalized expression of previous empirical generalizations and experimental testing. This is contrary to a model, which need not necessarily be derived from empirical generalizations and testing (Burch, 2003). According to Burch (2003:280), "some authors distinguish theories and models by assigning the latter a role as

[an] intermediary between theory and empirical data but such a difference is regarded not fundamental". Based on such observations, a theory can be

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considered to be emanating from a model that has undergone repeated tests and validation to support empirical generalizations. Nevertheless, the terms models and theories are in most cases used interchangeably as a result of being closely related. Theories or models are considered to play a critical role in the research process including planning, data collection and explanation of the emerging findings. Supporting this view, Neuman (2006:77) observes that "researchers who proceed without a theory or model, rarely conduct top-quality research and frequently find themselves in quandary" in reporting their research findings. It is thus not surprising that many scholars invest much of their time in developing and validating a variety of models and theories for application in different research environments. Technology acceptance and use models and theories are commonly used in many studies that investigate hindrances to the acceptance and usage of technologies for the purpose of promoting innovations adoption (Kripanont, 2007). According to Louho, Kallioja and Oittinen (2006: 15), "technology acceptance is about how people accept and adopt some technology to use".

A number of models/theories designed to facilitate the understanding of factors impacting the acceptance and use of technologies have been documented. Some of the well known technology acceptance models and theories include: Theory of Reasoned Action (TRA); Motivational Model (MM); Theory of Planned Behaviour (TPB); Decomposed Theory of Planned Behaviour (DTPB); Technology Acceptance Model (TAM); Technology Acceptance Model (TAM2); Combined TAM and TPB (C-TAM-TPB); Model of PC Utilization (MPCU); Social Cognitive Theory (SCT); Innovation Diffusion Theory (IDT) and; the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al, 2003; Kripanont, 2007; Wu, Tao and Yang, 2007; Ghobakhloo, Zulkifli and Aziz, 2010; Jayasingh and Eze, 2010). Due to the existence of several competing technology acceptance theories and models as noted above, researchers analyse and compare them in order to identify the most promising ones in respect of the ability to predict and explain individual behaviour towards the acceptance and usage of technology. Thus it has been acknowledged by various studies that the UTAUT model contributes to better understanding about the drivers of behaviour of acceptance and use of new technologies than other similar theories and models

(Venkatesh et al., 2003; Schaper and Pervan, 2007; Wu, Tao and Yang, 2007). As a result of its acceptability, the UTAUT model has been applied in several studies investigating the general acceptance and usage of information and communication technologies (ICTs) in different work environments (see for example, Anderson and Schwager, 2004; Louho, Kallioja and Oittinen, 2006; Kripanont, 2007; Schaper and Pervan, 2007; Al-Qeisi, 2009; Birth and Irvine, 2009; Tibenderana and Ogao, 2009; Suhendra, Hermana and Sugiharto, 2009; and Zhou, Lu, and Wang, 2010). It should however be noted that the UTAUT model has rarely been applied in open access (OA) related studies, especially in a developing country environment like Tanzania.

OA is scholarly communication achieved through open access refereed electronic journals (golden road) and self-archiving in open access repositories (green road) (Mann et al., 2008). The basic concept of OA is the online availability of scientific literature to readers at no charge and without any legal barrier (Chan and Costa, 2005; Bailey, 2006; Mann et al., 2008). This study used the UTAUT model in studying factors contributing to the acceptance and usage of open access. In this context, open access publication is regarded as a technology that provides scientists with a tool to reach their goals of distributing research results and documenting their copyrights as well as accessing scholarly content from other scholars (Mann et al., 2008). The findings reported in this article are part of the doctoral study titled 'An analysis of open access scholarly communication in Tanzanian public universities'. The objectives of the main study were to:

1. investigate the general awareness and open access usage
2. find out factors affecting adoption of open access
3. determine researchers' and policy makers' perceptions on open access
4. formulate and validate a research model of technology acceptance regarding the acceptance and usage of open access
5. suggest strategies to resolve the hindrances to open access adoption.

This article emanates from the findings for the fourth objective with respect to the formulation and validation a research model of acceptance and use of open access. This article attempts to exhibit the
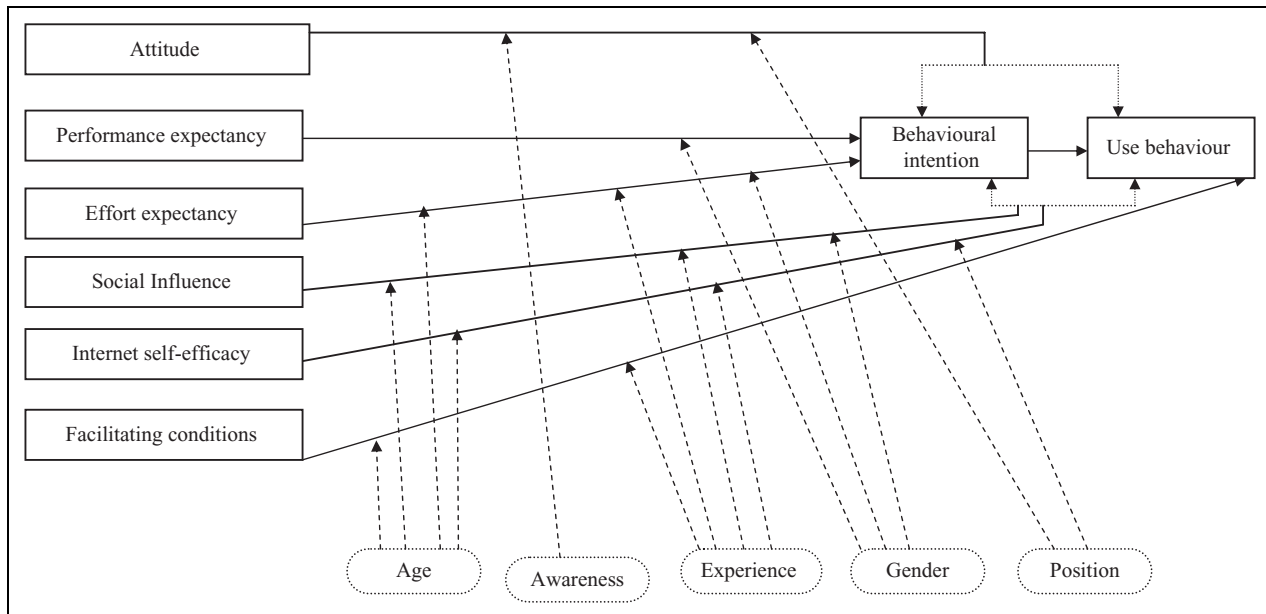
Figure 1. Open access research model based on UTAUT.

suitability of the UTAUT model in studying factors contributing to the acceptance and usage of open access.

The research model

The Unified Theory of Technology Acceptance and Use (UTAUT) model was adopted in the process of formulating the research framework for this study. This model was developed by Venkatesh and his team based upon the conceptual and empirical similarities among eight competing technology acceptance models (Venkatesh et al., 2003; Kripanont, 2007). The eight technology acceptance and usage models that were used in formulating the UTAUT model include: TR, TAM, MM, TPB, C-TAM-TPB, MPCU, IDT, and SCT (Venkatesh et al., 2003; Kripanont, 2007; Schaper and Pervan, 2007).

The choice of the UTAUT model for the current study was motivated by its comprehensiveness and high explanatory power as compared to other technology acceptance and use theories (Venkatesh et al., 2003; Kripanont, 2007; Hess et al., 2007; Schaper and Pervan, 2007; Tibenderana and Ogao, 2009). The UTAUT model is comprised of two direct determinants of usage behaviour (intention and facilitating conditions) and three indirect determinants of technology usage (effort expectancy, performance expectancy, and social influence) (Venkatesh et al., 2003). In addition to the core constructs, the UTAUT model developers also identified four moderators (age,

gender, voluntariness and experience) as having specific moderating roles to indirectly and directly determine technology usage behaviour. According to Serenko, Turel and Yol (2006), moderators are variables that affect the strength or direction of relationships between independent and dependent variables. The theoretical basis for the UTAUT model constructs and moderators is well documented by several studies (Venkatesh et al., 2003; Kripanont, 2007; Schaper and Pervan, 2007).

The researchers formulated an open access research model comprised of six constructs and five moderators, as illustrated in Figure 1, for guidance of this study. The original UTAUT model was modified by adding two constructs (attitude and Internet self-efficacy) and two moderators (awareness and position). The effects of these additional constructs on the adoption of new technology including open access have been established by other studies, as reported by Kripanont (2007), Mann et al. (2008) and Tibenderana and Ogao (2009). Thus for this study, the key determinants of the researchers' behavioural intention and usage of open access in Tanzanian public universities were conceptualized as attitude, effort expectancy, Internet self-efficacy, performance expectancy, social influence, and facilitating conditions. Furthermore, age, awareness, gender, experience and position were conceived to have various moderating effects on main constructs towards the acceptance and usage of open access. Voluntariness

was dropped as a moderator in this respect because it is only relevant when technology usage is mandatory (Venkatesh et al., 2003; Tibenderana and Ogao, 2009), which is not the case in the current study.

Attitude is an individual's overall affective reaction to using a system (Venkatesh et al., 2003). In this study, the attitude of researchers towards open access was conceptualized to affect both their intention and usage behaviour of open access with its effect being moderated by awareness.

Performance expectancy relates to how individuals believe new technology will help them perform their job better, and most of the previous technology acceptance studies have acknowledged the strength of this factor in predicting behavioural intention (Venkatesh et al., 2003; Louho, Kallioja and Oittinen, 2006). With respect to the current study, performance expectancy, moderated by gender, was assessed to determine its effect on researchers' adoption of open access.

Effort expectancy is the degree of ease or difficulty associated with the use of the system and is said to significantly affect technology adoption during early stages but becomes non-significant over periods of extended and sustained usage (Venkatesh et al., 2003). Age, experience and gender were conceptualized to moderate effort expectancy significance on researchers' behavioural use intention of open access. Such moderators increase the effect of effort expectancy towards researchers' future usage of open access. In other words, the impact of effort expectancy in shaping researchers' usage of open access in future is reduced in the absence of those moderators.

Social influence relates to how an individual is affected by his/her peers or other leading researchers and/or his/her organization in deciding on open access usage. This factor has been established to significantly affect the adoption of technology in both voluntary and involuntary contexts (Venkatesh et al., 2003; Schaper and Pervan, 2004 and 2007). This study considered social influence moderated by age, experience and gender to affect researchers' behavioural intention and usage of open access in scholarly communication.

Internet self-efficacy refers to what individuals believe they can do with technology skills they have already acquired (Venkatesh et al., 2003). Several studies have demonstrated that technology self-efficacy plays a key role in the acceptance and usage of technology (Hsu, Chiu and Ju, 2004; Ifinedo,

2006). The current study also conceptualized Internet self-efficacy to affect individuals' decisions towards behavioural intention and usage of open access by researchers.

Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of a system (Venkatesh et al., 2003). Age and experience were considered to play moderating roles on facilitating conditions towards usage of open access. Facilitating conditions have been established to impact actual usage of technology rather than behavioural intention (Schaper and Pervan, 2004; Garfield, 2006). In addition to facilitating conditions and Internet self-efficacy, the current study also conceptualized behavioural intention to have a significant positive influence on usage of open access scholarly communication.

Data collection and analysis procedures

The study adopted the survey as the main method for data gathering. Data was collected at six of the eight public universities in Tanzania, namely: Ardhi University (ARU); Muhimbili University of Health and Allied Sciences (MUHAS); Mzumbe University (MU); Open University of Tanzania (OUT); Sokoine University of Agriculture (SUA); and the University of Dar es Salaam (UDSM). The other two public universities did not meet the selection criteria. The criteria for selecting such universities were their existence as higher learning institutions for at least 10 years as well as evidence of postgraduate programmes. The above criteria ensured that the selected institutions had a comparatively well established research infrastructure, generated more research output and hence were more likely to benefit from open access initiatives. The study targeted public universities on the understanding that being publicly funded, they are obliged by social mandate to make their research findings available widely (e.g. through open access) to the user community (Comba and Vignocchi, 2005).

A self-administered questionnaire was distributed to 544 respondents selected through stratified random sampling from a population of 1088 university researchers. The sample included researchers within the ranks of lecturers, senior lecturers, associate professors and full professors from the main campuses of the six public universities in Tanzania. Through the stratified random sampling the desired representation

from the various subgroups on the basis of gender, rank and research discipline of the respondents was ensured. The questionnaire used a five-point Likert scale where the score 1 represented 'strongly agree' while the score 5 represented 'don't know/no opinion.' Among the distributed copies of the questionnaire, 405 were returned, of which 398 were found usable for analysis. The overall response rate obtained was thus 73 percent, which is considered adequate for this kind of study. The standard and acceptable response rate for most surveys is 60 percent (Malaney, 2002; Evans, Peterson and Demark-Wahnefried, 2004).

The descriptive and binary logistic regression statistics of SPSS (version 15) were used for data analysis. The software in question has also been widely applied by many scholars specifically in technology acceptance and user studies (Al-Zahrani, 2006; Ifinedo, 2006; Louho, Kallioja and Oittinen, 2006). The descriptive statistics were used in order to describe the characteristics of the sample, as well as in determining the awareness and usage of open access by the respondents. Binary regression was chosen for multivariate analysis. This kind of analysis is acknowledged to give more accurate predictions of probabilities when one dependent outcome is binary or dichotomous (1, 0) in nature as compared to the other multivariate techniques such as structural equation modelling, ordinary least squares and discriminant analysis (Hernandez and Mazzon, 2007). In this study, while one of the dependent variables was determined using a continuous dependent variable (behavioural intention), the other dependent variable (usage) was binary in nature, hence making the binary logistic regression most appropriate.

Reliability analysis and construct validity tests were done prior to running a binary logistic regression. Reliability tests attempt to indicate the extent to which the research tool is without bias and hence offers consistent measurement across time and across the various items in the instrument (Kripanont, 2007; Varma, 2008). On the other hand, construct validity refers to the degree to which the obtained results from the use of the measure fit the theories around which the test was designed for the obtained results (Kripanont, 2007; Trochim, 2006). The construct validity is normally broken into convergent validity and discriminant validity. Reliability analysis was conducted using SPSS for all the six constructs (attitude, effort expectancy, facilitating conditions, Internet self-efficacy, performance expectancy, and social influence) that were used in this study to predict

behavioural intention and usage of open access by researchers as illustrated in Figure 1. The results of reliability analysis revealed Cronbach's alpha values ranging from 0.713 to 0.917, implying that all constructs were either acceptable or good, and therefore eligible for retention during construct validity tests (Anez, Reis and Petroski, 2008).

Construct validity was assessed through exploratory factor analysis using principle component analysis of SPSS by examining the convergent and discriminant validities. The convergent validity is the actual general agreement among ratings, gathered independent of one another, while the discriminant validity refers to the degree to which measures of different constructs are distinct or lack relationship (Cheong and Park, 2005; Trochim, 2006). Before proceeding with factor analysis, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test were conducted to determine whether it was appropriate to conduct factor analysis. For factor analysis to work properly, KMO values should be greater than 0.5 and Bartlett's test should be significant with a value less than 0.05 (Field, 2006a). An eigenvalue of more than 1 was adopted as a determinant criterion for each factor in the factor analysis. The varimax rotation was used to obtain factor loading values and cumulative proportions of variance. Exploratory factor analysis yielded six constructs with a total of 30 items as designed in the survey questionnaire. As evidenced in Appendix 1, the factor loadings of the individual items ranged from 0.5 to 0.9, meeting the threshold significant level of the acceptable convergent validity. For an item to be retained in a particular construct, its loading should not be less than 0.5 (Field, 2006b; Marshall and Marshall, 2007; Horne, 2008). The findings, which corroborate Al-Zahrani (2006) and Garfield (2006), also revealed the acceptable discriminant validity as a result of items belonging to the same construct loading highly in their construct when compared to their loadings in different constructs.

Results and discussion

This section presents and discusses the emerging research results. To begin with, the descriptive statistics are provided to highlight the profile of the respondents and their awareness and usage of open access. The remaining sections report and discuss the findings emanating from the inferential statistics in order to isolate factors affecting the adoption of open access.

Profile of respondents

Gender representation among the 398 respondents-was 77.9 percent (310) male and 22.1 percent (88) female researchers. Categorized by their positions/ranks, it was revealed that a majority (46.2 percent) of the respondents were lecturers, followed by professors (28.9 percent) and senior lecturers (24.9 percent). In terms of the highest academic qualifications attained by the respondents, 299 (75.1 percent) were holders of PhD degrees while the remaining 99 (24.9 percent) held Masters Degrees. With respect to age, 157 (39.4 percent) were aged between 41-50 years; 145 (36.4 percent) between 51-60 years; 78 (19.6 percent) were aged between 31-40 years; and 18 (4.5 percent) were above 60 years. As far as Internet usage experience is concerned, a majority (53.5 percent) of the respondents had experience of 6-10 years; followed by 34.9 percent who had more than 10 years of experience and lastly; 11.6 percent who had 1-5 years experience. The profiles of the respondents, including age, gender, experience in terms of Internet usage, and rank/position were the five attributes that were used as moderators of the main constructs in shaping open access usage by researchers as illustrated in Figure 1. Based on the above data, academic qualifications and seniority reflect the fact that there are highly qualified and experienced researchers who are potential, if not actual, scholarly communicators and most of whom are also potential beneficiaries of OA opportunities due their Internet usage experience.

Determination of factors affecting adoption of open access

Prior to determining the factors affecting the usage of open access, it was deemed necessary to find out the level of awareness and usage of open access. The findings revealed that the majority (72.1 percent) of the researchers were aware of the open access concept before this survey. Despite this high awareness level, less than 20 percent of the respondents published in open access outlets, as compared to 62 percent who accessed free scholarly content from the Internet. These findings confirmed observations from previous studies done elsewhere that indicated high involvement of scholars in merely accessing rather than disseminating scholarly content through open access media (Gadd, Oppenheim and Probet, 2003; Deoghuria and Roy, 2007; Mann et al., 2008).

The remaining task was to identify important factors for the adoption of open access by researchers. The essence of formulating the research model and the adoption of binary logistic regression analysis was to isolate important factors determining the adoption of open access scholarly communication in Tanzanian public universities. The predictive power and fitness of the model with respect to behavioural intention and open access usage by researchers were determined prior to examining the causal relationships among various factors. This was an important step to ensure the appropriateness of the model in the determination of factors shaping researchers' adoption of open access.

The Omnibus Test of Model coefficients was found significant ($p < 0.001$) for both behavioural intention and usage behaviour of open access. These results implied the statistical evidence of the model's fitness to the collected data. With respect to the model's predictive ability, the model was found to correctly predict 79.7 percent of the observations with Nagelkerke R^2 of 0.27 in respect to behavioural intention, and 83.7 percent of the observations with Nagelkerke R^2 of 0.41 for the usage variables respectively. The overall explanatory ability of the model for behavioural intention and usage of open access was thus 68 percent ($0.27 + 0.41 = 0.68 * 100$). A model that fits data well is expected to have Omnibus tests of Model Coefficients significance of less than 0.001 and the model is considered useful if it results in an overall explanatory ability of at least 25 percent (Christensen and Bailey, 2000).

Based on the above findings, the research model was considered useful for use in determining factors affecting the adoption of open access scholarly communication by researchers in Tanzanian public universities. The binary logistic regression analysis results revealed that, except for the Internet Self-efficacy construct, the remaining five factors (constructs) were found to be important determinants for researchers' behavioural intention and/or usage of open access in scholarly communication. It should also be noted that, apart from testing their moderating roles against the main constructs, all the five moderators were also assessed to establish their direct effect towards researchers' behavioural intention and usage of open access. This was done for curiosity purposes, taking into account that most of the previous technology acceptance studies never attempted this test. Table 1 summarizes the results from the binary logistic regression analysis.

Table 1. Determinants of researchers' usage of open access.

Construct/factor	Behavioural intention on open access usage (n = 379)			Actual open access usage behaviour (n = 374)		
	B	SE	Exp(B)	B	SE	Exp(B)
AT	0.285*	0.135	1.330	0.332	0.186	1.393
FC	–	–	–	0.409*	0.176	1.505
EE	0.457**	0.143	1.579	–	–	–
SE	−0.090	0.140	0.914	−0.138	0.146	0.871
PE	0.275*	0.135	1.317	–	–	–
SI	−0.207	0.139	0.813	−0.517**	0.177	0.596
BI	–	–	–	1.759***	0.344	5.808
AG	−0.196	0.203	0.822	0.512*	0.244	1.669
AW	−1.076**	0.295	0.341	−1.887**	0.550	0.152
EE X AG	0.139**	0.042	1.149	–	–	–
EE X EXP	0.213**	0.065	1.237	–	–	–
EE X GDR	0.381**	0.116	1.464	–	–	–
FC X AG	–	–	–	0.122*	0.053	1.129
SI X AG	−0.029	0.038	0.972	−0.161**	0.053	0.851
SI X EXP	−0.076	0.058	0.972	−0.180*	0.074	0.835
SI X POS	−0.030	0.044	0.970	−0.194**	0.060	0.828
SI X GDR	−0.156	0.116	0.856	−0.445**	0.145	0.641

Notes: AT: attitude; EE: effort expectancy; FC: facilitating conditions; PE: performance expectancy; SI: social influence; SE: Internet self-efficacy; AG: age; AWR: awareness; EXP: experience; GDR: gender; POS: position B: odds ratio; Exp(B): exponentiated odds ratio; SE: standard error; significance level: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; –: Not applicable (no test done).

NB For correct interpretation of the above logistic regression based results, the Odds ratio (Exp (B) for factors with significant unstandardized regression coefficients (B) have been adopted. The two measures are commonly acceptable and have also been used by several other similar studies (Christensen and Bailey, 2000; Hartmann et al., 2002; Bewick, Cheek and Ball, 2005; Hernandez and Mazzon, 2007). Taking into account the nature of analysis in this part of the study, Exp(B) >1 against a specific factor implies that the modelled event occurrence increases; Exp(B) <1 implies decreasing chances of the modelled event occurrence; and Exp(B) of zero means that there are no chances for the modelled event to occur. For example, using Table 1, the first Exp(B) [1.330] against the attitude factor means higher chances of open access usage by individuals who had positive attitudes towards open access than those with negative attitudes. The reported percentages are calculated by subtracting 1.0 from the Exp (B) value multiplied by 100. Using the attitude factor as an example, this implies 1.330-1 = 0.33*100 = 33 percent.

Internet self-efficacy. The findings from this study revealed that Internet self-efficacy had no significant effect on behavioural intention and usage of open access. These findings confirmed those reported by the UTAUT model developers (Venkatesh et al., 2003) but contradict those reported by Schaper and Pervan (2007), in which the technology self-efficacy construct exhibited a higher level of significance in respect of intention to use innovations by their respondents. According to Venkatesh et al. (2003), technology self-efficacy is expected to have no direct significance with respect to technology intention usage due to its effect being captured by the existence of effort expectancy. Non-significance of Internet self-efficacy in this case is thus attributed to the presence and significance of effort expectancy towards researchers' behavioural intention of open access usage.

Attitude. Researchers' attitude to open access was found to significantly affect their behavioural intention towards open access usage but had no effect on their actual usage. Based on Exp(B), these results suggest that the respondents with positive attitudes towards open access scholarly communication were 39.3 percent more likely to use open access scholarly communication than those with negative attitudes. The results from this study are contrary to the belief of Venkatesh et al. (2003) that the attitude construct has no significant influence on behavioural intention of technology usage. However, other studies reveal that individuals' attitudes towards technology have a strong effect on technology use intention, supporting findings from this study (Louho, Kallioja and Oittinen, 2006). Open access proponents should thus strengthen campaigns in promoting this mode of

scholarly communication to ensure its support by the majority of the scholarly community.

Effort expectancy. The Exp(B) 1.579 for effort expectancy as noted from Table 1 implies that individuals who strongly believed that it would be easier for them to use open access outlets in scholarly communication were 57.9 percent more likely to adopt OA than those who felt the contrary. The findings with respect to the effort expectancy factor support other scholars, suggesting that this construct plays a significant role during early stages of new technology adoption (Venkatesh et al*., 2003;* Louho, Kallioja and Oittinen, 2006). The results are, however, contrary to observations made by Schaper and Pervan (2004) that many technology acceptance and usage studies found no significant influence of effort expectancy on behavioural intention. The effect of effort expectancy was significantly moderated by age, experience and gender. According to these findings, it was revealed that older and more experienced respondents in terms of Internet usage were 14.9 percent and 23.7 percent respectively more likely to publish in open access outlets in future than the younger and inexperienced respondents. The results from this study suggest that the probable reasons for the likelihood of less effort expectancy by older workers could be attributed to their experience in scholarly publishing. In other words, publishing in open access outlets was more dependent on authoring of publishing materials and older researchers had more advantage in this respect than the younger ones who had little experience. In most cases, an author is only required to submit the electronic version of the paper to the journal editors through email. This can be done easily regardless of an individuals' age, as email communication has become an ordinary tool for everyone in most academic communities.

It is also noted from these results that male respondents were 46.4 percent more likely to publish in open access outlets in future than female respondents. Moderating effects of gender towards effort expectancy with respect to behavioural intention of technology usage conform to the results reported by Venkatesh et al. (2003). The significance of more effort expectancy towards technology usage by women can be explained by less confidence and more reliance on assistance for usage of new technology by women as compared to men (Ilie et al., 2005; Steinerova and Susol, 2007). These findings suggest the need to provide more user-friendly interfaces for open

access outlets such as institutional repositories to facilitate both access and easy dissemination of scholarly content by researchers.

Performance expectancy. The findings from this study imply that individuals who agreed or strongly agreed with the expectation of the ability of open access to improve scholarly communication were 31.7 percent more likely to adopt open access than those who disagreed or strongly disagreed with such expectations. These findings further confirm the previous technology acceptance studies regarding the strength of the performance expectancy construct in predicting behavioural intention (Louho, Kallioja and Oittinen, 2006; Al-Shafi and Weerakkody, 2009). However, the current findings are contrary to those reported by Hutchison and Bekkering (2009) indicating the insignificance of performance expectancy on behavioural intention of technology adoption. These findings suggest that open access adoption may be enhanced through educating researchers on the potential benefits of this mode of scholarly communication in improving the accessibility and dissemination of scholarly content. In other words, scholars are likely to adopt open access only if they clearly understand the benefits of this mode over the traditional scholarly communication system.

Facilitating conditions. Facilitating conditions with and without age moderation significantly determined open access usage by researchers. These results imply that the respondents who agreed or strongly agreed with the adequacy of facilitating conditions for their open access usage were 50.5 percent more likely to use open access scholarly communication than those who responded to the contrary. With respect to the moderating effect of age, it is noted that facilitating conditions on open access usage were stronger for older researchers. This suggests that older researchers would need more assistance in using open access outlets, especially in accessing scholarly content, since as argued above, the dissemination of scholarly output is not considered a concern by the older and experienced researchers. The results from this study support other findings reported by Venkatesh et al. (2003) and Schaper and Pervan (2004). According to the cited authors, older workers are expected to attach more importance to receiving help and assistance on the job with respect to usage of new technology than the young ones. The overall implication of the above observations is the need for the improvement of

facilitating conditions in Tanzanian public universities for effective exploitation of open access scholarly communication in such institutions. For example, effective access and dissemination of scholarly content by researchers may only be guaranteed in the presence of adequate Internet bandwidth at their respective institutions, as well as skills on the part of the users of open access scholarly communication.

Social influence. As noted from Table 1, social influence was found to be a determinant of open access usage, both independently as well as when moderated by gender, experience and position. The implication from these findings is that the respondents who considered social influence to be of less or least importance as an influential factor to their usage of open access were 40.4 percent less likely to use open access than those who responded to the contrary. The findings of this study are contrary to other technology acceptance and usage studies that established social influence as a determinant of usage intention rather than usage behaviour (Venkatesh et al., 2003; Schaper and Pervan, 2007). This could partly be attributed to the wide context with regard to social influence as used in this study. While in most of the previous studies social influence by peers, colleagues or other influential individuals was significant, in the current study it is organizational influence, including employers and research funding bodies, that was considered to significantly influence the researchers. Imperatively, interventions by organizations (such as mandating open access publishing) that influence researchers have been known to dramatically increase open access adoption (Pinifield, 2005; Sale, 2006). The findings of this study therefore suggest the need for universities in the study area to consider the development of policies that are likely to enhance the adoption of open access. Such policies may include a mandatory requirement that their employees deposit research output in institutional repositories and/or a suitable reward system that targets open access publications.

With respect to the role of moderators, the effect of social influence is also expected to be stronger for older researchers, those from higher positions and women, as well as those with limited experience. The assumption is that the older respondents also belong to higher ranks or positions. According Venkatesh et al. (2003), older workers are more likely to place increased salience in social influence, with the effect declining as experience technology usage increases.

With regard to the moderating effect of gender on social influence, it is acknowledged that the use of technology by women depends more on social collaboration, while for men it is determined by their individual work preferences and competition (Steinerova and Susol, 2007). Thus, based on the social construction theory, women tend to be more influenced than men by the opinions of others before deciding to use a new technology (Venkatesh et al., 2003; Ilie et al., 2005; Steinerova and Susol, 2007).

Behavioural intention. Among the six main constructs assessed, researchers' behavioural intention was the strongest determinant of open access usage. Based on the findings of this study, it is noted that behavioural intention was the strongest predictor (p<0.001) of open access usage when compared to other constructs. The implication of these results is that the majority of the scholars in Tanzanian public universities generally supported open access publishing. The results from this study corroborate previous findings revealing behavioural intention to be a consistent determinant of actual usage of technology by the respondents (Venkatesh et al., 2003; Louho, Kallioja and Oittinen, 2006; Schaper and Pervan, 2007). These findings therefore suggest that improving factors that affect researchers' behavioural intention of open access will ultimately increase the adoption of this mode of scholarly communication.

Direct effect of moderators. In addition to its moderating effects, age was also established to directly affect both researchers' behavioural intention and usage of open access, while awareness was found to have an effect only on the latter. Other moderating factors were found to have no direct effect on behavioural intention and usage of open access by the respondents. Based on these findings, the respondents who were not aware of open access were 57.9 percent less likely to publish in open access outlets in future than those who were aware of this mode of scholarly communication. Similarly, with respect to age, the findings imply that elder respondents were 66.9 percent more likely to publish in open access outlets than the young ones. The impact of awareness on researchers' usage of open access is low when compared to their behavioural intention of open access usage, as noted previously. In the current findings, it is observed that the respondents who were not aware of open access were 84.8 percent less likely to have published in open access outlets. These findings suggest the

importance of creating open access awareness in the scholarly community to ensure its wider uptake. According to Suber (2004), the reason for some scholars not considering publishing in open access may not be their opposition to OA, but their unfamiliarity with that mode of scholarly communication.

Conclusions and recommendations

The study findings demonstrate that the UTAUT model is suitable in guiding the understanding of the contributing factors with respect to researchers' acceptance and usage of open access. Results of the data analysis supported the model well, as all except one of the conceptualized factors deemed to affect open access adoption were confirmed. The significant Omnibus Test of the Model Coefficients, as well as the 68 percent overall explanatory ability exhibited in the validated research model, also testified the potential of the UTAUT model application in open access adoption studies.

Based on the study findings, it has been established that attitude, awareness, effort expectancy and performance expectancy are the main significant predictors of researchers' intentions to use open access. The ultimate usage of open access by the researchers was established as being influenced by age, awareness, behavioural intention, facilitating conditions and social influence. Age, experience, gender and position (rank) of the researchers have also been established as important moderators of the main factors that determine researchers' acceptance and usage of open access. The influence of effort expectancy towards researchers' behavioural intention of open access usage has been established as being moderated by age, experience and gender. Similarly, the effect of social influence towards open access usage by the researchers was found to be moderated by age, gender, experience and position/rank. Age was

established as the only moderator which affected facilitating conditions in influencing researchers' actual usage of open access. In addition to its moderating effect, age was further established to play a direct role in influencing researchers to adopt open access.

The significance of the above factors implies that planners and implementers of open access projects should pay attention to those factors in order to ensure success from such investments. For example, the significance of the awareness factor implies that open access adoption may be enhanced by making sure that this mode of scholarly communication is well understood by the research community. Similarly, the widespread use of open access may happen only when other significant facilitating factors (such as adequate ICT facilities, including computers and good Internet connectivity, and supportive open access policies – incentives such as recognition OA publications in career development – are in place.

A further validation of the developed open access model within higher learning institutions, including private universities and other tertiary institutes within Tanzania and beyond is recommended. This is particularly important as the applicability of the UTAUT model with respect to the acceptance and use of open access, especially in developing countries, has received little attention when compared to other technology contexts.

Acknowledgement

Appendix 1: Factor analysis results extracted from the rotated component matrix.

Survey items	Component					
	1(SI)	2(PE)	3(FC)	4(EE)	5(AT)	6(SE)
Will publish in open access outlets if your institution would look favourably on you for publishing in such outlets	**0.877**	0.168	0.058	0.086	0.102	0.032
Will publish in open access if your institution requires you to publish in such outlets.	**0.856**	0.138	0.037	0.062	0.113	0.053

Survey items	Component					
	1(SI)	2(PE)	3(FC)	4(EE)	5(AT)	6(SE)
Will publish in open access if your research funding urgency requires you to publish in such outlets	**0.845**	0.125	0.103	0.141	0.155	0.036
Will publish in open access if your funding research urgency would look favourably on you for publishing in such outlets	**0.812**	0.082	0.092	0.043	0.170	0.033
Will publish in open access if leading researchers in your discipline publish in such outlets	**0.717**	0.072	0.097	0.062	0.319	0.020
Will publish in open access if your close colleagues publish in such outlets	**0.646**	0.082	0.132	0.039	0.338	0.138
Open access outlets enable researchers in developing countries to access literature more easily	0.167	**0.874**	0.062	0.122	0.052	0.043
Open access outlets improve accessibility to literature because it is free	0.174	**0.861**	0.001	0.175	0.112	−0.007
Open access outlets expose scholarly work to a large potential readership	0.130	**0.843**	0.071	0.147	0.062	−0.060
Open access outlets increase research impact by such works being highly used and cited	0.100	**0.784**	0.130	0.214	0.172	0.061
Open access outlets enable scholars to publish more quickly	0.075	**0.577**	0.250	0.354	0.129	0.121
Guidance is available for me to use the Internet for publishing my research output	0.024	0.039	**0.801**	0.186	0.085	0.026
I have the necessary resources to publish my work in open access outlets	0.057	0.146	**0.793**	0.092	0.068	0.021
Guidance is available for me to use the Internet effectively for information access	0.123	0.113	**0.782**	0.118	−.008	0.051
I have the necessary knowledge to publish my work in open access outlets	0.069	0.028	**0.757**	0.128	0.043	0.171
My institution recognizes open access publications for my career development	0.127	0.047	**0.746**	0.140	0.54	−0.031
Learning to publish my work in open access outlets (is) would be easy for me	0.127	0.157	0.100	**0.816**	0.071	−0.005
It will be easy for me to become skilful at publishing my work in open access	0.108	0.146	0.079	**0.777**	0.183	0.034
I believe the interaction with open access publication system is clear and understandable	0.007	0.161	0.195	**0.725**	0.140	0.104
I clearly understand the implications of publishing in open access outlets	0.048	0.129	0.235	**0.633**	0.165	0.165
I (will) find it easy to access open access scholarly content from the Internet	0.123	0.337	0.171	**0.624**	0.017	0.097
Publishing in open access is a good idea	0.422	0.167	0.009	0.096	**0.735**	0.028
Accessing and use of open access materials is a good idea	0.368	0.159	−0.076	0.129	**0.715**	−0.009
Publishing in open access outlets would make my work more interesting	0.208	0.014	0.089	0.127	**0.710**	0.091
Open access content is beneficial to the scholarly community	0.377	0.194	0.044	0.130	**0.698**	0.004
Publishing in open access outlets is easy for me	0.003	0.067	0.247	0.222	**0.578**	0.260
I feel confident publishing my research on the Internet	0.023	0.010	0.211	−0.063	0.157	**0.783**
I feel confident in publishing on the Internet without assistance	0.028	0.071	−0.032	0.176	0.016	**0.772**
I feel confident in designing personal websites	0.031	−0.097	0.165	0.019	0.178	**0.693**
I feel confident in searching information on the Internet	0.117	0.089	−0.099	0.146	−0.079	**0.602**

Notes: 1 (SI) - social influence; 2 (PE) – performance expectancy; 3 (FC) – facilitating conditions; 4 (EE) – effort expectancy; 5 (AT) – attitude; 6 (SE) – Internet self-efficacy.

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