The impact of electronic information resource use on research output: experiences from Universities in Tanzania

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Abstract

This paper examines the impact of the use of electronic information resources on research output in the universities in Tanzania. Research for this paper was conducted in five public universities in Tanzania with varied levels of access to electronic information resources. The selection of the sample universities was purposive. Data was collected using face-to-face interviews, questionnaires and key informant interviews. Analysis of data employed descriptive and quantitative techniques. Empirical data revealed that the use of online information resources has a positive impact on various research activities and milestones such as research proposal submission, research proposal funding, research report writing and journal article publishing. The results therefore provide empirical support for a positive relationship between the use of electronic information resources and research output and publishing in general. This was demonstrated in the increased number of proposals prepared, submitted and funded, research reports submitted, journal articles published and chapters in books and books published with increased access to and use of electronic information resources. Results also show that although researchers who are actually using the scholarly databases are small in number the core group of researchers using these resources is growing and the use of resources is becoming more frequent and diverse. The major challenges observed include ineffective marketing strategies on the availability of the resources, inadequate training of end users, questionable content relevance of some of the resources and issues of sustainability of access given high levels of donor dependency for subscriptions. Finally, limited variations in terms of intensity of use of resources were observed between junior and higher ranking academics; and younger and older members of faculty. The paper makes a number of recommendations.

Introduction

By the turn of the century it was noted that access to and use of electronic information resources by researchers in Tanzania has gradually increased (Wema and Nawe, 2000). The University of Dar es Salaam Library started applying IT in the provision of information services to users in 1990, with the introduction of CD ROM search services, followed by Internet services for teaching, learning and research. Programme for Enhancement of Research Information (PERI) is one example of an initiative that aimed at increasing access to electronic resources among researchers in Africa. Tanzania is participating in this programme which is being funded by Sida/SAREC (in the case of Tanzania) and coordinated by International Network for Availability of Scientific Publications (INASP) and the University of Dar es Salaam Library. Through PERI online access is provided for full- text journal resources, databases and backup support for document delivery since 2000. License to access these resources has been country-wide for most databases. PERI project also includes a training component on electronic journal and electronic library resources management.

This paper examines the impact of the use of electronic information resources on research output and processes. The major questions addressed in this paper are whether the use of electronic information resources has positively influenced the quality and quantity of local research output in the public universities in Tanzania. The study draws on the theoretical insights from the diffusion of innovation theory (Rogers, 1983) and

knowledge gap hypothesis (Tichenor, et al. 1980). According to the research paradigm proposed by Tichenor et al. (1980) certain segments of a social system are more affected than other segments by increases in the flow of information.

Literature Review

Generally, the literature review (Bergart, 2002; Kyrillidon, 2001; Lin, 2001; Zhang, 2001; Shela and Greshan, 2000) showed that there is a positive relationship between the use of electronic information resources and the improvement in the quality and quantity of research output. However, the relationship is influenced by several factors that could be attributed to technology, infrastructure, nature of the organization (including decision-making processes) and individuals' attributes. Nonetheless, disagreements exist among social science researchers and scholars (Rogers, 1983; Tichneor, et al., 1980) on the impact of the diffusion of innovation in general or new technology in particular on a given social system. Rogers (1983) argues that, although adoption of innovations brings major positive changes to a social system and structure, it also has the potential to lead to social stratification and differences and increased knowledge gaps.

Kinengyere (2007) in her study on "The Effect of Information Literacy on the Utilization of Electronic Information Resources in Selected Academic and Research Institutions in Uganda" found that available information is not necessarily accessed and used by users. The study showed that the availability of information does not necessarily mean actual use because the users may not be aware of the availability of such resources, do not know how to access them, or do not know what the resources offer. In their study on **"**Student Attitudes towards Electronic Information Resources", Ray and Day (1998) noted that the main factors affecting students' access to electronic information and using them were limited time and lack of effective information retrieval skills.

Johnston and McCormack (1996) in their study on "Integrating Information Technology into University Teaching" observed that "a perceived lack of various resources, such as time, equipment or funds, …lack of training and insufficient information on software …lack of knowledge and skills of staff, insufficient technical support staff and risks associated with implementing innovations in teaching, particularly those using technologies, as the most significant barriers to academic staff using information technology in their teaching".

The study by Nawe and Kiondo (2005) found that 21.7% of the respondents reported that the quality of research had improved significantly with the use of electronic information resources. Thirty three percent reported that the output of research had improved significantly, while 28.3% observed that quality of service to the community had improved significantly and 33.4% said that the output of service to the community had increased significantly. Results of this study also revealed that the quality of teaching and learning had improved significantly as a result of ICT application in library operations.

Methodology

The overall research design integrated qualitative and quantitative methodologies. Data was collected using questionnaire, interviews and focus group discussions in addition to the review of secondary data. Research was conducted in five public universities in Tanzania, namely University of Dar es Salaam, Sokoine University of Agriculture, Mzumbe University, Ardhi University and Muhimbili University of Health and Allied Sciences (MUHAS). The final sample comprised 222 members of teaching and research staff, selected using purposive and convenience techniques.

Findings and Discussion

Socio-demographic characteristics

Socio-demographic characteristics of researchers were anticipated to influence the use of electronic information resources and impact research output and publishing. The major socio-demographic characteristics examined were gender, academic rank of researchers, academic qualifications and age. Sample sizes by participating universities are shown in Table 1 below.

Table 1: Frequency and % distribution by institution

Name of Institution	Frequency	% distribution
UDSM-Main Campus	117	53%
SUA	61	28%
Mzumbe University	23	10%
Ardhi University	11	5%
MUHAS	8	4%
Total	**220**	**100%**

Eighty seven percent (87%) of all respondents were male and 16% female. Fifty seven percent (57%) were PhD holders while 43% reported Masters as the highest degree obtained. The mean age of the respondents was 48.6 years. Junior rank (ie Assistant to Lecturer positions) was 49% and senior rank (ie. Senior Lecturer to Professor Rank) was 51%. However this is not a typical age distribution pattern in the target population.

Use of electronic information resources

Findings of this study showed that the use of electronic information resources differed across resources, especially between the search engines, the free Internet resources on the one hand and the scholarly databases on the other. The majority (76%) of researchers reported using free Internet resources including the search engines, while only a small proportion uses scholarly databases. For example, 22% of researchers reported using the African Journals Online (AJOL) while 7% use Gale databases (see Table 2 for details). Additionally, the frequency of use also varied significantly between resources. For example, while the majority of researchers use free Internet resources, including general search engines on daily basis, the frequency of use of scholarly databases for the majority of researchers using the resources is once per month.

Table 2: Use of resources by frequency and % distribution

Name of Resources	Use	Don't use
Search engines	168 (76%)	54 (24%)
Other Internet resources	136 (62%)	86 (38%)
AJOL	48 (22%)	174 (78%)
Blackwell	38 (17%)	184 (83%)
Ebsco Host	38 (17%)	184 (83%)
Agora	38 (17%)	184 (83%)
Oxford University Press	28 (13%)	194 (87%)
Emerald	24 (11%)	198 (89%)
Springer	23 (10%)	199 (90%)
Wiley Science	20 (9%)	202 (91%)
Gale databases	15 (7%)	207 (93%)

Data shows minor differences between males and females and between academic ranks in relation to the use of electronic information resources.

Table 3: Use of e-resources by gender

Sex	Use	Don't Use	Total
Male	99 (55%)	80 (45%)	179 (100%)
Female	17 (47%)	19 (53%)	36 (100%)
Total	**116 (54%)**	**99 (46%)**	**215 (100%)**

Differences between academic ranks in the use of electronic information resources did not reveal any clear pattern of relationship and the differences were insignificant. The assumption that there is a potential inverse relationship between age and the use of new technology was not supported by data from this research. In this study rank was used as a proxy for age (see Table 4 below).

Table 4: Use of e-resources by academic rank

Academic Rank	Use	Don't Use	Total
Assistant Lecturer	28 (50%)	28 (50%)	56 (100%)
Lecturer	26 (53)	23 (47%)	49 (100%)
Senior Lecturer	35 (58%)	25 (42%)	60 (100%)
Associate Professor	19 (53%)	17 (47%)	36 (100%)
Professor	10 (67%)	5 (33%)	15 (100%)

Researchers provided a number of reasons for the use of electronic information resources and the three major ones were checking or searching for bibliographic information and for accessing full-text articles (see Table 5 below of details).

Table 5: % distribution by reasons for accessing electronic resources

Reason for accessing e-resource	%
Searching for new bibliographic information	57.7%
Accessing full-text articles whose details were previously known to you	55.9%
Checking bibliographic information on a previously known item	52.7%
Perusing abstract	50.0%
Accessing full-text of articles whose details were retrieved from database	43.7%
Browsing tables of contents of journals	36.5%

In general, search engines and free Internet resources were ranked high in terms of their usefulness (see table 6 for details). However, findings showed a positive relationship between usage and perception of usefulness, implying that because researchers use the resources frequently they may end up perceiving them as being useful. Findings did not reveal any significant relationship between researchers' perceptions of usefulness and content specialization subject-wise of a specific resource. For example, researchers at MUHAS (which is a medical university) did not report finding Cochrane Library (with health and medical content only) more useful than researchers from other universities. The only exception was AGORA where 46% of researchers from SUA (the agricultural university) perceived it as between very useful and somehow useful while none of the other universities had comparable percentages. The nearest was UDSM with 14% of its researchers claiming AGORA was very useful to somewhat useful.

Data showed that generally respondents who are using the resources found them useful. For example, all those who are using search engines and free Internet resources claimed that they find them useful (see Table 6 for more details).

Table 6: Resources by perception on usefulness

Name of the resource used	Useful	Not useful	Total
Free Internet resources	134 (100%)	0 (0%)	134 (100%)
Search engines	126 (100%)	0 (0%)	126 (100%)
AJOL	70 (95%)	4 (5%)	74 (100%)
Ebsco Host	49 (88%)	7 (12%)	56 (100%)
Emerald	45 (88%)	6 (12%)	51 (100%)
Blackwell	44 (88%)	6 (12%)	50 (100%)
Oxford University Press	43 (88%)	6 (12%)	49 (1005)
Agora	44 (83%)	9 (17%)	53 (100%)
Springer	37 (79%)	10 (21%)	47 (100%)
Gale databases	27 (79%)	7 (21%)	34 (100%)
Wiley Science	41 (77%)	10 (23%)	53 (100%)

Results showed that generally researchers preferred using electronic rather than print formats of information resources. Fifty six percent (56%) of the sample respondents indicated a preference for electronic formats while 33% preferred printed versions and 12% have no preference. Explanations for preference for electronic formats include ability to search resources more efficiently, capability of searching huge databases at once compared to print resources and the possibility of searching for these from sites outside of the libraries such as offices and off-campus sites. With this positive predisposition toward electronic information resources by researchers it is critical for service providers such as libraries and computing units in the universities to take the necessary actions to address obstacles such as technical inadequacies that inhibit the effective and efficient use of the resources.

Awareness and use

Generally there is an insignificant relationship between awareness and use of electronic information resources. Fifty seven percent of researchers who were aware of the availability of electronic databases and scientific journals that staff and students can have access to use them. The remaining 43% did not use these resources although they were

aware of their availability. Respondents gave a number of reasons for not using these resources while they were aware of their existence. Among reasons given by a fairly large proportion of respondents include lack of skills to use the resources and difficulties in accessing the resources. Fewer respondents reported lack of interest, preference for print formats and unavailability of databases in their areas of interest as reasons for not using the electronic resources while they were aware of their availability.

Explanations given for limited use of the resources provide an opportunity for libraries to introduce a number of interventions in their service provision, among which include changes in the information literacy programmes, selection procedures that will be more participatory to ensure access to relevant resources and increased marketing of the resources emphasizing the strengths of the electronic journal resources.

Training and use of e-resources

Training in the use of electronic information resources is assumed to have a significant impact on the ultimate use of these resources and this is one reason why libraries spend a substantial amount of their meagre resources (financial and human) on information literacy (IL) training. In the electronic environment libraries must enable library staff and users to acquire new skills and capacity to effectively utilize e-resources. Thus the training of library staff and users to acquire knowledge and skills to search for e-resources and evaluate them is an important area. The practice elsewhere has been for libraries and universities to require students to take courses in IL, others conduct short training courses in the library for library users and still many other libraries include sessions on e-resources during the orientation period.

However the findings of this research did not reveal any significant relationship between training in the use of these electronic information resources and their actual use. Sixty two percent of respondents who answered the question on training reported to have been trained in the use of e-resources. Among those respondents who reported to use electronic databases and journal resources 58% have been trained formally in the use of these resources. The remaining 32% have never been trained and thus their effective utilization of such resources is questionable. Findings also revealed that 44% of all respondents who have been trained in the use of electronic information resources are not users of these resources for reasons that include lack of interest, limited access and preference for print rather than electronic resources**.** An interesting finding was that 11% of those who have been trained formally in the use of e-resources reported not use them because they claimed they did not know how to. The implication here is that the type of training provided was probably not effective or appropriate and thus IL training needs to be reviewed and evaluated regularly in collaboration with users. The explanation that the training provided is not effective is supported by the fact that 40% of respondents were not satisfied in the way the libraries were training its users with the use of electronic information resources.

The major weakness of the end-user training practices in the universities where training was undertaken was the lack of a programme for the entire community. The training focused on particular groups such as graduate students whom the library staff think need

training the most. However, without a comprehensive programme the most appropriate period for the training of end-users is not taken into consideration. Perhaps the most important issue is to figure out how best end-user training can be integrated into the academic programmes for both staff and students.

Impact of the use of electronic information resources on research

Seventy three percent (73%) of researchers reported that the use of electronic information resources has had a positive impact on their research activities in a number of ways, which include, access to a wide range of research information and findings, improved research techniques, accessing up-to-date information on research topics, enhancing research skills and enabling researchers to find new research areas and frontiers.

Data showed a positive relationship between the use of electronic information resources and research activities/milestones, such as research proposal submission, research proposal funding, research report submission and publishing of research findings (see table 7 below for details). Although other factors could influence these milestones and the research process in general, what researchers in the universities reported was that access to and use of electronic information resources was a major contributing factor in influencing success in research endeavours in the universities.

Table 7: E-resource use status by successful research activities (milestones) between 2001 and 2005

Milestone/Activity	Use e-resources	Don't use e-resources	Total
Submitted research proposal	75 (56%)	58 (44%)	133 (100%)
Research proposals funded	64 (55%)	52 (45%)	116 (100%)
Research reports submitted	57 (53%)	50 (47%)	104 (100%)

Publishing is an important milestone in any research activity because it is essentially about the dissemination of research findings. Generally researchers in the sample had positive attitudes on the impact of the use of electronic information resources on the publishing of their research findings, except for publishing books, as seen in data on Table 7.

Table 7: Perceptions of the impact of electronic information resource on publishing research findings

Type of publishing	Positive Impact	No Impact	Total
Publishing journal articles	144 (81%)	34 (19%)	178 (100%)
Publishing research report	132 (79%)	36 (21%)	168 (100%)
Publishing books	47 (36%)	85 (64%)	132 (100%)

The reasons provided by researchers for the central role that electronic information resource use plays in publishing include availability of literature, improvement in writing skills, access to up-to-date data and information, improvement in presentation of research findings and improvement in the overall quality of research reports and publications. This

perception is also supported by data on the actual relationship between publishing and e-resource use.

When data is cross-tabulated for users and non-users of electronic information resources and publishing between 2001-2005 differences emerged between researchers who were using and those who were not using electronic information resources and their ability to publish, as seen in table 8 below. Therefore a positive relationship was observed between the use of electronic information resources and publishing of research findings.

Table 8: Publishing activities/milestones by e-resources use between 2001 and 2005

Research Milestone/Activity	Use e-resources	Don't use e-resources	Total
Journal articles published	57 (58%)	41 (42%)	98 (100%)
Books published	15 (68%)	7 (32%)	22 (100%)
Chapters in books published	24 (63%)	14 (37%)	38 (100%)

Data revealed increased intensity of research activities between 2000 and 2005 by lecturers to professorial ranks which could partly be attributed to increased use of electronic information resources (see Table 9 for details). The period between 2000 and 2005 in Tanzanian Universities was characterized by increased access to electronic information resources through PERI, free Internet resources and other programmes. It was a period of greater sensitization in the use of ICT and ICT-related resources in the Universities and particularly in the libraries. Data therefore supports the research hypothesis that the use of electronic information resources will lead to increased research output, including the improved ability to write fundable research proposals and timely completion of research reports. Data in Table 9 also shows that the use of electronic information resources was related to publishing of research findings (an indicator of research quality) as revealed by increased rates of journal article publishing between 2000 and 2005. This finding therefore supports the other research hypothesis that the use of electronic information resources is related to enhancing the quality of research.

Table 9: Research outputs by years for lecturers to professorial ranks

Research Activity	1990-1994	1995-2000	2001-2005	% increase between 2000 and 2005
Research Proposals submitted	42	89	103	16%
Research Proposals funded	35	78	99	27%
Research Reports Submitted	36	63	85	35%
Journal Articles Published	45	70	86	23%

Conclusions and Recommendations

Conclusions

The findings of this research have revealed that the use of electronic information resources and specifically the online resources had a positive impact on various research activities and milestones such as research proposal submission, research proposal funding, research report writing and journal article publishing. The results therefore provide empirical support for the hypotheses that the increased flow of information because of increased access to and use of electronic information resources is related to increased research output and enhancement of the quality of research. In this study it was observed that there was a positive relationship between the use of electronic information resources and research output and publishing as demonstrated by an increased number of proposals prepared, submitted and funded, research reports output and journal articles published, and chapters in books and books published during the time when the electronic information resources were being made available.

Several conclusions are drawn from this study. First, a fairly large proportion of researchers is not aware of the availability of scholarly databases but is aware of free Internet resources such as general search engines. This implies that marketing strategies used by various libraries in the universities are not reaching the target population and thus needs to be improved. Second, the use of scholarly databases is limited although the core group of researchers using the resources is growing. However, the use of free Internet resources is significantly high and the frequency of use is almost on a daily basis. Third, the training of end users in the use of electronic information resources was far from adequate and comprehensive. Fourth, the content relevance of some of the resources could have been one of the limitations in the use of the resources. Fifth, from the point of view of institutions issues of sustainability were not built into the programmes such as PERI. Most of these programmes were donor-funded to a large degree. Finally, the use of electronic information resources by academic ranks and age appeared to be an equalizing force in the academic communities as junior and higher ranking academics, and younger and older academics were using these resources with very minor variations.

Recommendations

Based on the research findings and conclusions drawn the paper makes the following recommendations. First, libraries and universities should devise a formula to ensure reasonable budget allocation to electronic information resources (journal subscriptions) to ensure sustainability of access to such resources. This will be more cost effective if it is done within the framework of the Consortium of Tanzania University Libraries. Second, libraries, in collaboration with the end-users design marketing strategies that work to increase awareness and eventually usage of the electronic information resources. Third, libraries in collaboration with end users should design and implement information literacy programmes that are effective, for example, training materials that are content/subject specific. Finally, libraries, and universities in general should ensure that adoption of change is mainstreamed in their strategic plans to create a technologically comfortable working environment (including provision of supportive services) that recognises the extra workload as perceived by the staff through incentives.

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