Impact of Improved Internet Access and Other Factors on Researcher Behaviour and their Intellectual Property Output

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Abstract

The volume of intellectual property output of African universities and research institutions and their contribution to the global research discourse is very low, and it is not commensurate with the quality and quantity of researchers and academics in the region. Universities and Research institutions in Africa also have very limited visibility at the global level, leading to loss of competitiveness of the institutions, and consequently the competitiveness of their home countries. From its formative days, the UbuntuNet Alliance, while accepting that there are many factors that have led to this state of affairs, has posited that the isolation of Africa-based researchers from the global information infrastructure (GII) is a major contributing factor, and that the reduction of such isolation will lead to increased intellectual property output.

The Alliance developed a Theory of Change that focuses on the influence of connectivity on researcher behaviour as the key factor that needs to be examined to demonstrate the validity or otherwise of our thesis. To investigate this, the Alliance conducted a baseline study aimed at examining this hypothesis by tracking researcher behaviour over a period of at least five years. Baseline data collection started during 2010, running into mid-2011, and the findings were presented in a paper during UbuntuNet-Connect 2011 in Nairobi.

In this paper, we shall present the findings of a follow-up study based on data collected during 2013, and relate them to the baseline study published earlier.

In the follow-up study, we continued to use two instruments: one to collect data about the research environment within an institution and another to collect data on researcher perceptions, behaviour and outputs within the institution. Multiple administrative personnel completed the institutional tool at 29 participating institutions across 5 countries while 443 individual researchers from 38 different institutions were interviewed to complete the researcher tool. This was an improvement in the survey sample compared to the last survey where 271 individual researcher responses were collected from 16 participating institutions. Participating countries for both studies included Ethiopia, Malawi, Tanzania, Uganda and Zambia.

Amongst individual researchers that participated in the study, 356 (81.5%) were male and 81 (18.5%) female. 77.2% of the participants were below 44 years of age while 7.0% were 55 years or older. 17.4% of the respondents had attained a Bachelor's degree, 63% had Masters, while only 18.5% had attained a PhD.

The analysis of this data is ongoing at the time of submission of this abstract: we are therefore unable to provide a summary of the findings at this point in time.

1. Introduction

The volume of intellectual property output of African universities and research institutions and their contribution to the global research discourse is very low, and it is not commensurate with the quality and quantity of researchers and academics in the region. Universities and Research institutions in Africa also have very limited visibility at the global level, leading to loss of competitiveness of the institutions, and consequently the competitiveness of their home countries. From its formative days, the UbuntuNet Alliance, while accepting that there are many factors that have led to this state of affairs, *posits that the isolation of Africa-based researchers from the global information infrastructure (GII) is a major contributing factor, and that the reduction of such isolation will lead to increased intellectual property output.*

The Alliance developed a Theory of Change that focuses on the influence of connectivity on researcher behaviour as the key factor that needs to be examined to demonstrate the validity or otherwise of our thesis. To investigate this, the Alliance conducted a baseline study in 2011 to examine the hypothesis by tracking researcher behaviour over a period of at least five years (Tusubira et al. 2013). This paper presents the findings of a follow-up study based on data collected in 2013. The focus in this paper is specifically behavioural change as we do not expect significant changes in actual intellectual property output in the limited time between the surveys: while we do capture some data on intellectual property output, comparatives at this outcome level will be made over longer observation intervals.

2. Methodology

Just like the 2011 survey, the methodology for this study is based on the UbuntuNet Alliance Monitoring and Evaluation Strategy that incorporates basic elements of a program theory (UbuntuNet 2009). This includes both action theory—to capture the efforts of the Alliance and key partners in translating available resources to produce programme deliverables and a change theory to capture anticipated changes in the target audience as a consequence of these deliverables (Chen 2005). The target remains Africa-based researchers; the leverage mechanism is the presence of reliable, efficient, affordable and sufficient Internet bandwidth on the continent that is likely to contribute towards a positive outcome—improved intellectual property output at the global level. All of this occurs and is shaped by a dynamic context that includes the higher education institutions where the researchers are based, national communication sectors and policies, research funding initiatives and policies, etc.

For this follow-up study, we reviewed and improved upon the two survey instruments used in the baseline study—one to collect data about the research environment within an institution and another to collect data on researcher perceptions, behaviour and outputs within the institution. The individual survey was self-administered under the management of a researcher, who also interviewed different administrative personnel at a participating institution to complete the institutional survey.

26 institutions participated across 5 countries while 443 individual researchers from 38 different institutions were interviewed to complete the individual researcher survey. This is an improvement in the number of participants compared to the 2011 survey where 271 individual researcher responses were collected from 16 participating institutions.

1.1 Institutional returns

Valid and complete institutional returns were obtained from 26 participating institutions of higher learning—Tanzania (13), Zambia (5), Ethiopia (4), Uganda (3) and Malawi (1). The institutional survey captured information in the following major categories:

i. ICT in the Institution: ICT support unit, Internet and email access, ICT in education functions, ICT in research, ICT curricula, data and network security
ii. Library: Automation, access to online resources, user training (information literacy);
iii. Research and intellectual property: documentation, dissemination, commercialisation;
iv. Research support services.

1.2 Individual returns

Valid individual returns were obtained from 443 academic staff of 38 higher institutions of learning in Ethiopia (227), Uganda (76), Tanzania (61), Malawi (51) and Zambia (28). The individual survey captured information in the following major categories:

i. Demographic characteristics: gender, age, academic rank; qualification; duration of employment by current institution; main employment assignments;
ii. Research policy: existence and satisfaction;
iii. Sources of research funds;
iv. Library: resources and satisfaction;
v. Laboratories and equipment: sufficiency and satisfaction;
vi. Computers: access, ownership, usage, and applications used;
vii. Internet: access, quality, utilisation;
viii. Conduct of research: individual leadership, volume, time allocation, collaboration;
ix. Research output: type, where published, attitude to creative commons;
x. Barriers to and motivation for research.

3. Analysis of Institutional Survey and Findings
3.1 ICT in the Institution

The research-enabling environment within institutions has greatly improved since the last survey, particularly in regard to ICT. More institutions had developed policies supporting the integration of ICT within various functions as highlighted in Figure 1. Six out of 24 institutions also reported having developed an Intellectual Property (IP) policy to ensure that intellectual property generated using publicly funded research is used for the wider benefit of society and that institutional staff were appropriately rewarded for their role.
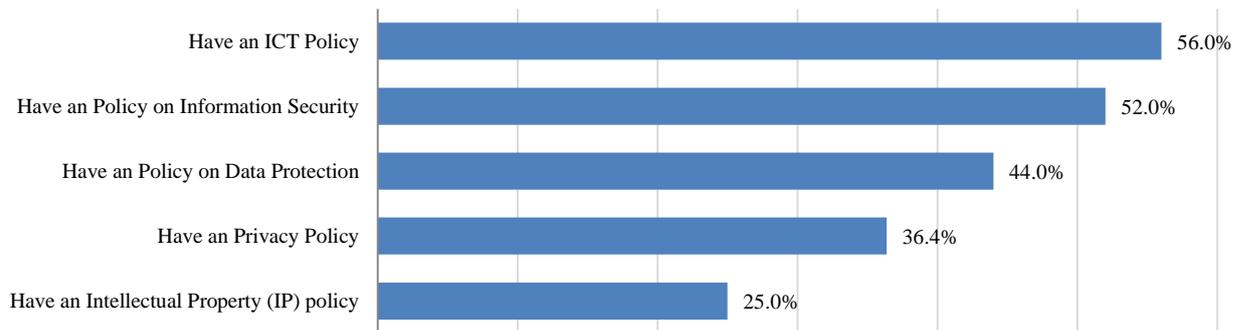
Figure 1: Percentage of participating institutions that had policies relating to ICT and research

Institutional access to quality Internet bandwidth has improved with 18 of 26 (69.2%) participating institutions reporting access to fibre compared to only seven of 16 (43.8%) during the last survey. 13 of 26 institutions (50.0%) had more than 10Mbps in terms of Internet bandwidth compared to only 5 of 16 (31.3%) in 2011. This improvement in connectivity is also reflected in the ratios of bandwidth to the number of computers, academic staff and students, as presented in Figure 2. Despite these improvements, access to bandwidth is still way below expected averages (Obama 2013) as trends towards online research and learning gain momentum (Singh & Lewa, 2014).
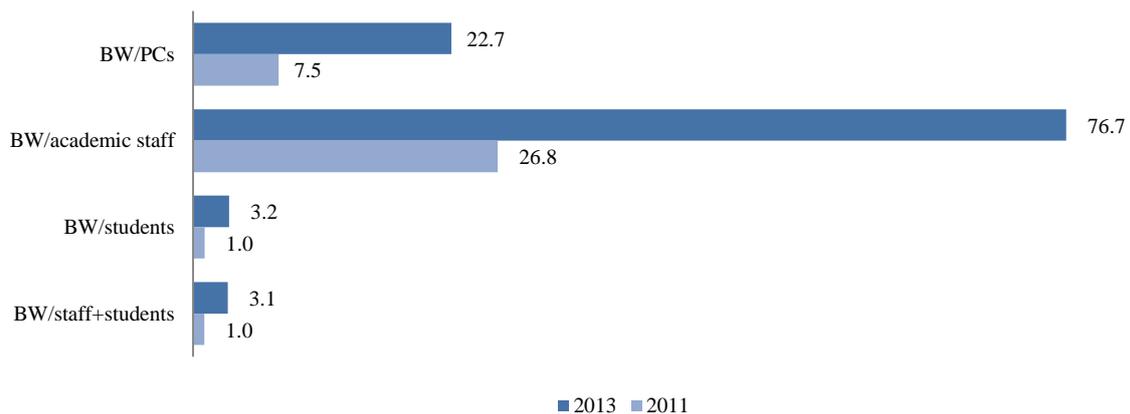

Figure 2: Ratio of bandwidth to number of computers, academic staff and students across participating institutions

3.2 Research publications and other outputs

The data in this section is included for completeness: as explained in the introduction to this paper, comparatives will be examined over a longer period of time.

There is slight improvement in terms of institutional documentation of research outputs and dissemination across participating institutions. Eleven of 26 (42.3%) participating institutions in the current survey had readily accessible data on research outputs compared to only six of 16 from the last survey (37.5%). Please note that while the 2011 survey considered publications for the prior five years, the 2013 survey only considered publications for the two years between the surveys. Total number of research outputs per category across all participating institutions are summarised in Figure 3.
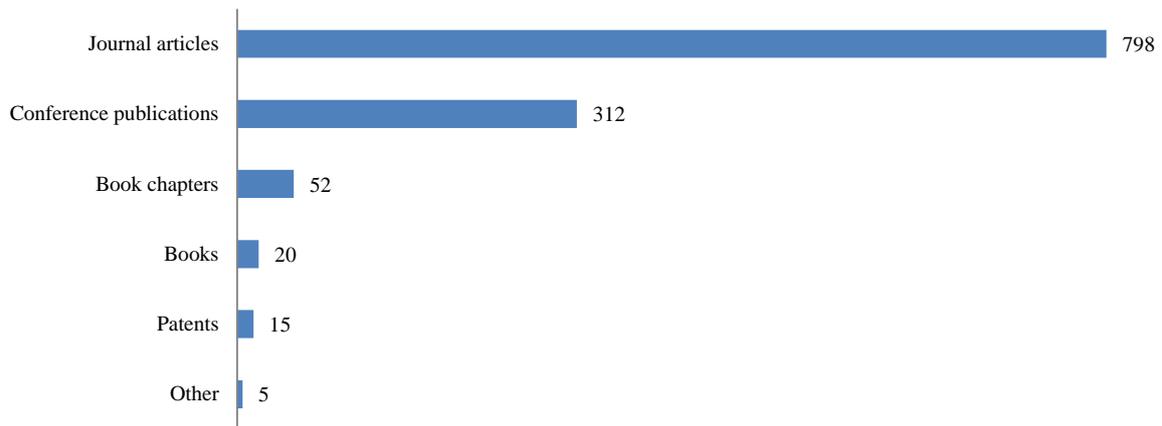
Figure 3: Total number of research publications and outputs reported by participating institutions over the last two years

Four institutions—University of Dar es Salaam (1), Sokoine University of Agriculture (8), Hawassa University (4) and Mzuzu University (2), each reported at least one patent (actual number in brackets) as a research output over the last two years. This is a great improvement from the last survey where no participating institution reported any patents over a five-year period.

Intellectual output per capita across all participants (total number of publications divided by the total number of academic staff) has improved compared to the last survey, but is still low as indicated in Figure 4.

Total research outputs/total academic staff

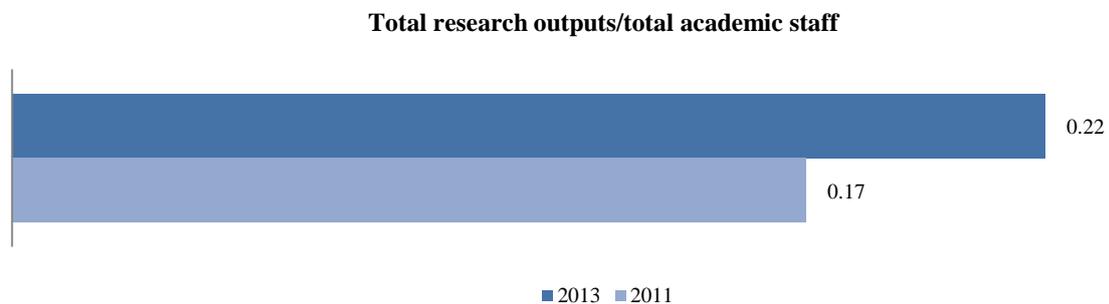Figure 4: Research per capita (ratio of research output to number of academic staff) for all participating institutions

3.3 Research support services

While research support services have continued to improve as highlighted in Figure 5 since the last survey, research funding is still a major challenge. Research funding predominantly comes from international agencies, signifying who sets the research agenda and priorities.

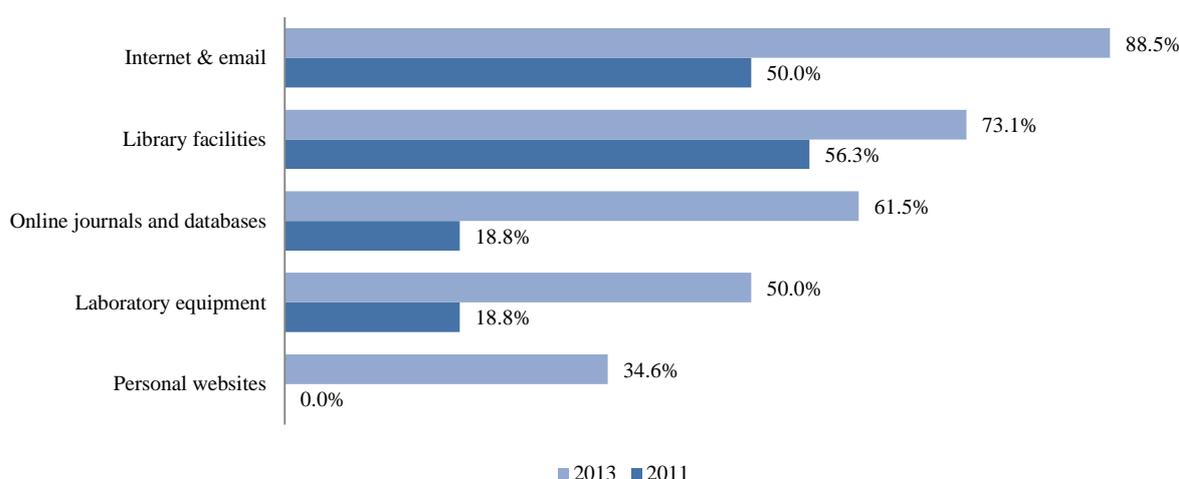**Do you have access to any of the following resources for research?**

Figure 5: Percentage of participating institutions with access to different research support services

4. Analysis of Individual Survey and Findings
4.1 Demographic characteristics

The demographic characteristics of researchers responding to the individual survey are summarised in Table 1. Amongst individual researchers that participated in the study, 356 (81.5%) were male and 81 (18.5%) female. 77.2% of the participants were below 44 years of age while 7.0% were 55 years or older. 17.4% of the respondents had attained a Bachelor's degree, 63% had Masters, while only 18.5% had attained a PhD.

Table 1: Demographic characteristics of individual respondents

Rank	Attribute	Frequency	%-share
Gender	Female	81	18.3%
	Male	356	80.4%
Missing data		6	1.4%
Cumulatively		443	100.0%
Age	Younger than 22	4	0.9%
	22-32	180	40.6%
	33-43	158	35.7%
	44-54	69	15.6%
	55-65	26	5.9%
	Older than 65	5	1.1%
Missing data		1	0.2%
Cumulatively		443	100.0%
Highest degree attained	Bachelors	77	17.4%
	Masters	279	63.0%
	PhD	82	18.5%
Missing data		5	1.1%
Cumulatively		443	100.0%

Academic rank	Professor	8	1.8%
	Ass. Professor	35	7.9%
	Senior Lecturer	40	9.0%
	Lecturer	235	53.0%
	Assistant Lecturer	67	15.1%
	Tutor	14	3.2%
	Research Associate	3	0.7%
	Other	26	5.9%
Missing data		15	3.4%
Cumulatively		443	100.0%
Duration at current academic rank (years)	Less than 1 year ago	67	15.1%
	1-5 years ago	266	60.0%
	6-10 years ago	62	14.0%
	11-15 years ago	27	6.1%
Missing data Cumulatively	More than 15 years ago	9	2.0%
		12	2.7%
		443	100.0%

4.2 Conduct of Research

Although only 52.9% of individuals indicated being involved in research at their institutions in 2013 compared to 61.5% in 2011, analysis of time allocation to different activities shows that individuals spent more time on teaching and research–related activities as highlighted in Figure 6. Interestingly, time allocations increased mostly for consultancies (from 7.7% in 2011 to 9.7% in 2013), research (from 18.7% in 2011 to 20.1% in 2013) and outreach/public engagements (from 7.9% in 2011 to 9.1% in 2013). Time allocated to administration fell the most from 20.5% in 2011 to 14.5% in 2013.
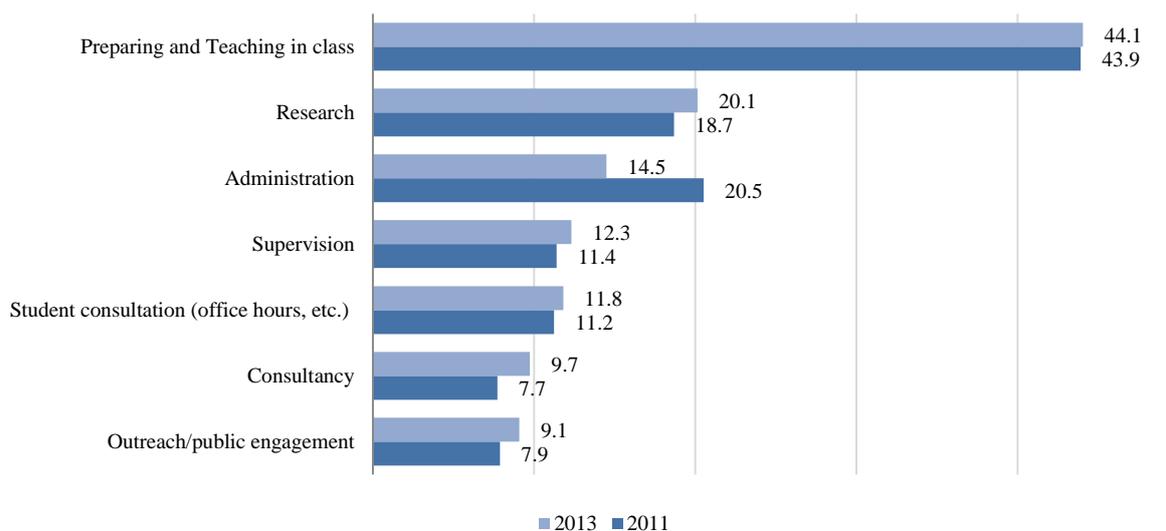
Figure 6: Comparison between the two surveys of percentage time spent on different activities in a month

Similar to the 2011 findings, more individuals felt they devoted sufficient time to teaching (88.1%) compared to those that felt they devoted sufficient time to research (33.3% as indicated in Figure 7). While the proportion of individuals satisfied with time devoted to research increased from 22.9% to 33.3% in 2013, there is still plenty of room for improvement.

On the whole, would you say that you are devoting sufficient time to your RESEARCH within normal working hours?
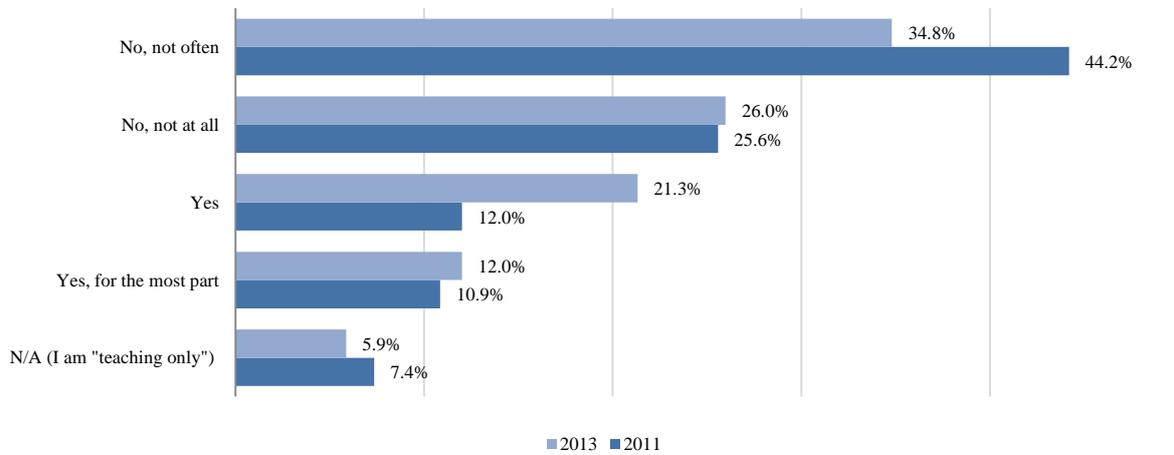

Figure 7: Comparison of time devoted to research in normal working hours

The majority of research collaboration still involved research projects, with the proportion of individuals involved in research projects increasing from 68.1% in 2011 to 77.4% in 2013. Research collaboration networks are still largely local, with only 41.6% reporting any collaboration outside of their institution and 32.6% outside of their country.

Tools used to facilitate research collaboration are highlighted in Figure 8. While there was increased reliance on various online platforms, use of research videos improved most, increasing from 1.9% in 2011 to 10.4% in 2013. Online discussion forums and publication databases also showed growth. This growth could be partly explained by improved access and connectivity at participating institutions.

What tools do you use to facilitate research collaboration? (multiple-select)
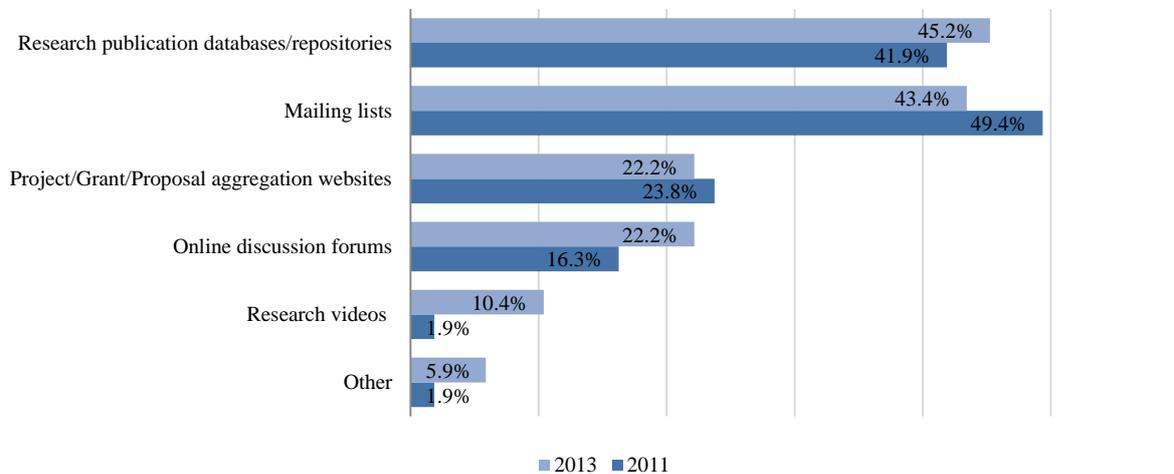
Figure 8: Comparison of collaboration tools

4.3 Research output

For research output, the 2013 survey looked at outputs over the last one year as opposed to the 2011 survey that covered a five-year period. Journal articles were the most common type of research output produced by individuals over the last year, followed by conference publications and technical reports and books as highlighted in Figure 9. There were no patents reported as output by any individual, although some institutions reported some in the 2013 survey.

Figure 9: Number of different types of research publications produced by all individuals during the preceding 12 months

Given the process of research, one would expect a higher number of conference publications given the volume of journal articles reported. This is based on the assumption that research is first published at conferences, critiqued and later synthesised into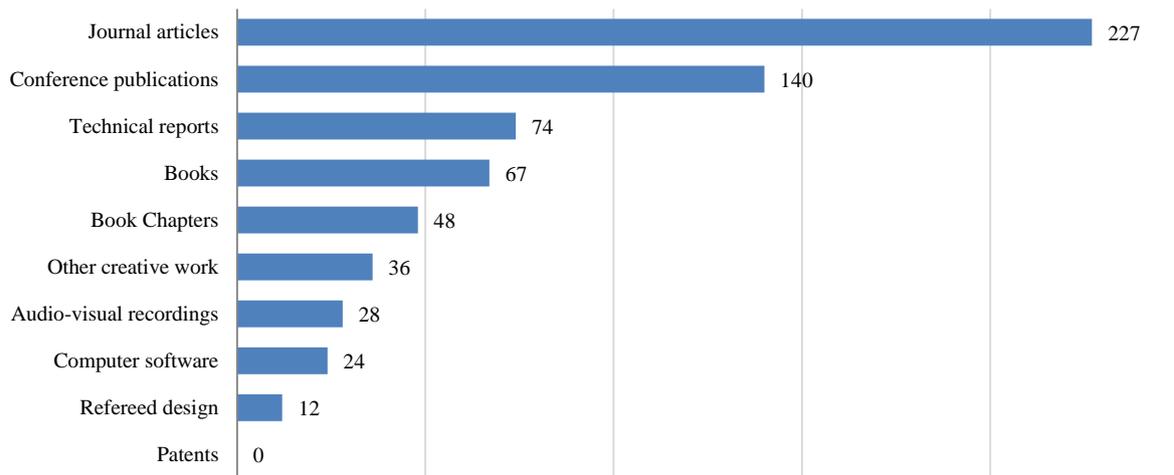 journal articles. This anomaly maybe explained by promotional policies at institutions that greatly favour journal articles compared to other types of research outputs. Cost of participating in conferences may also be another barrier, given that the majority of these are held outside Africa, (see Figure 11).

In addition, while the number of journal articles (227) or conference publications (140) may appear high, they were produced by only a fraction of individuals. Only 108 individuals produced all journal articles while only 78 individuals produced all conference publications. Of these, 48 individuals produced at least both a conference paper and a journal article. Out of the 443 individuals, 309 did not produce any research output over the previous 12 months (Figure 10).
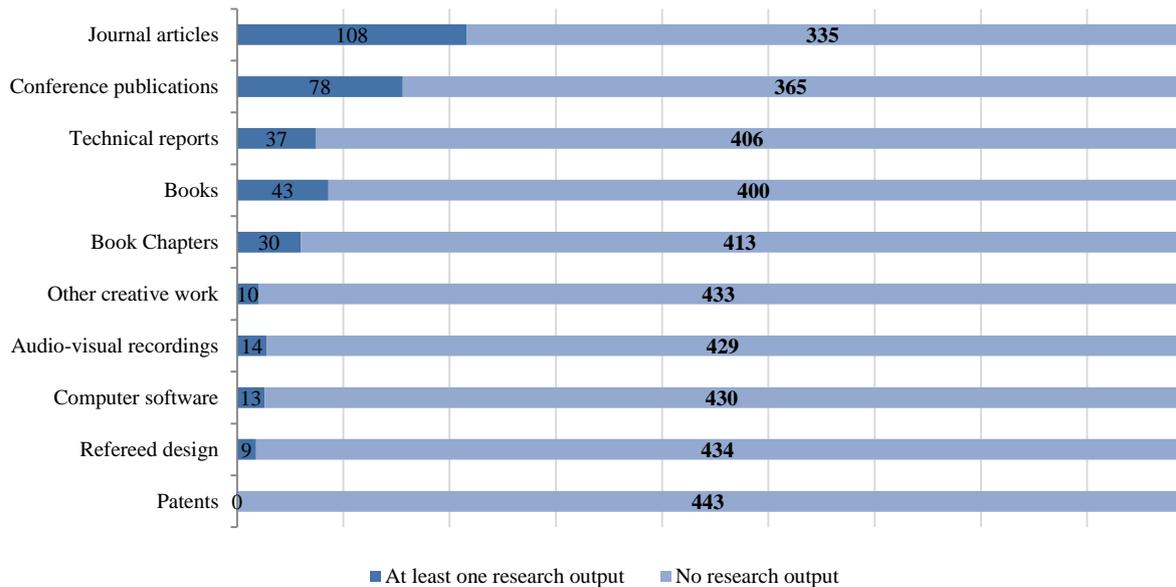
Figure 10: Number of individuals without any output in the indicated categories over the previous 12 months

Choice of publication channel was influenced by a number of factors as highlighted in Figure 11. Promotional policies within institutions were ranked as the biggest influence indicating that institutions have a tool at their disposal that they can use to influence how research is done and disseminated at the institution. As an example, 76.8% of individuals supported open access publishing and 81.5% were willing to share their research findings free of charge: if promotional policies favoured this, it could lead to the creational of online institutional repositories to share research and promote work done at a particular institution – also leading to greater institutional visibility and easier access to research funding. This becomes a virtuous cycle.

Funding limitations (70.8%), visibility with speciality (68.6%) and research policies (58.9%) were some of the other reasons given that influenced publication channels for research outputs.

What influences how you select where to publish? (multiple-select)
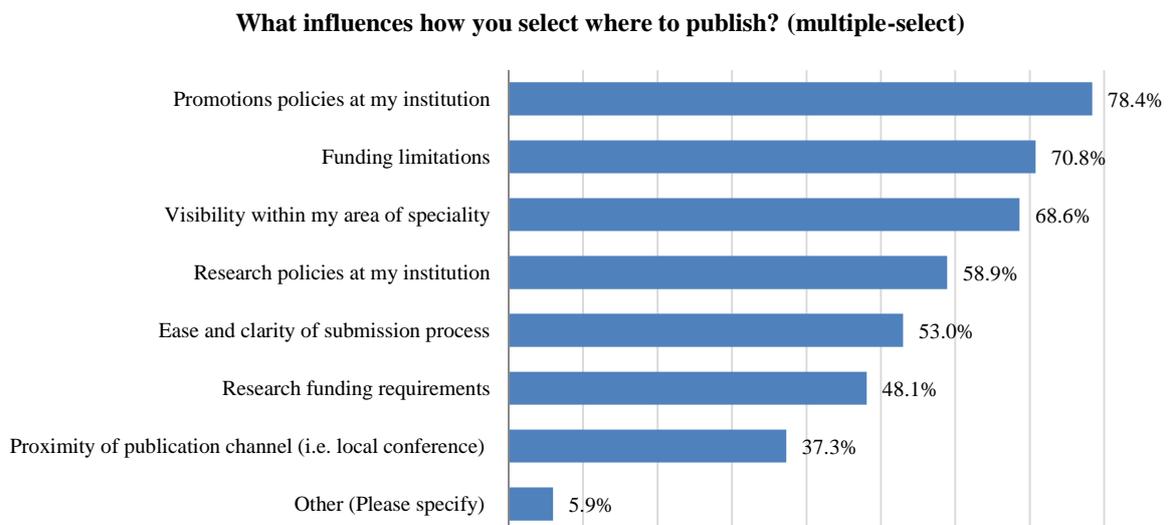
Figure 11: Influences for publication channels

4.3.1 Motivation for and barriers to research

Individuals indicated different motivation to participate or undertake research as presented in Figure 12. Individual promotion (57.4%) and recognition through awards (40.3%) are important tools that institutions can use to drive uptake of research because they are still perceived as more important than higher remuneration by more individuals (Ragasa 2011).[1]

What would best motivate you to get involved in research? (multiple-select)
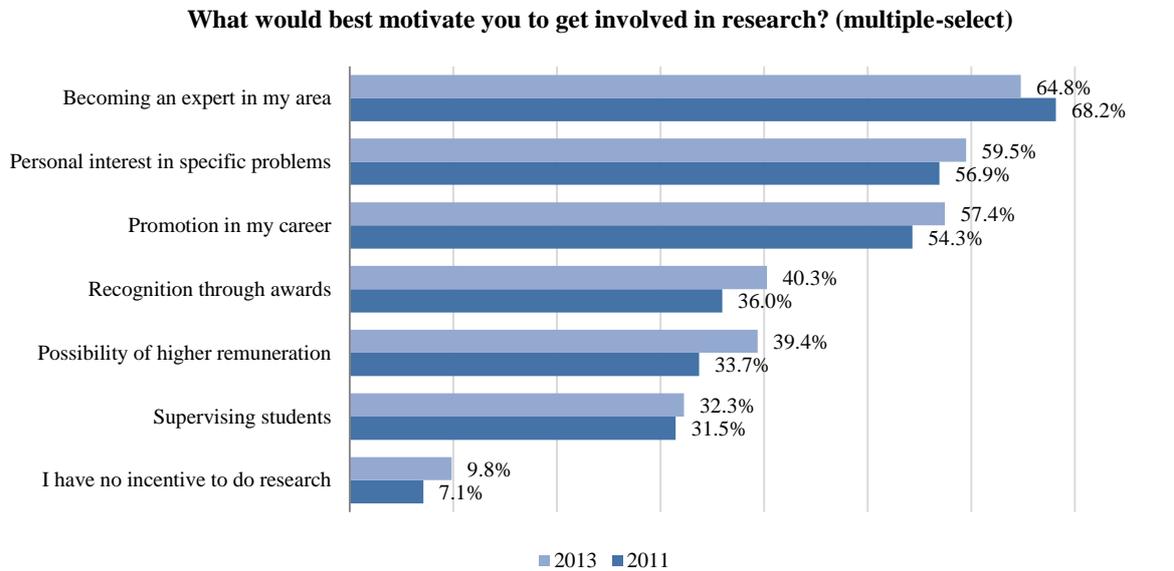
Figure 12: Motivations for research (ranked by 2013 findings)

Comparing research motivation between individuals involved in research and those that are not unearthed some interesting observations (Figure 13). Individuals not currently involved in research are more motivated by the possibility for higher remuneration and supervising students compared to their counterparts involved in research who are more interested in promotion and personal interest in specific problems.

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[1]Ragasa, C., Do Organizational Factors Affect Individual Scientist's Productivity? A Comparative and Multilevel Analysis of Nigeria and Ghana Agricultural Research Systems, International Food Policy Research Institute, 2010.

What would best motivate you to get involved in research? (multiple-select)

Becoming an expert in my area	68.7% / 60.8%
Personal interest in specific problems	57.4% / 59.5%
Promotion in my career	53.8% / 59.9%
Recognition through awards	39.5% / 39.6%
Possibility of higher remuneration	42.6% / 35.1%
Supervising students	37.4% / 27.0%
I have no incentive to do research	11.3% / 9.0%

■ not involved in research   ■ involved in research
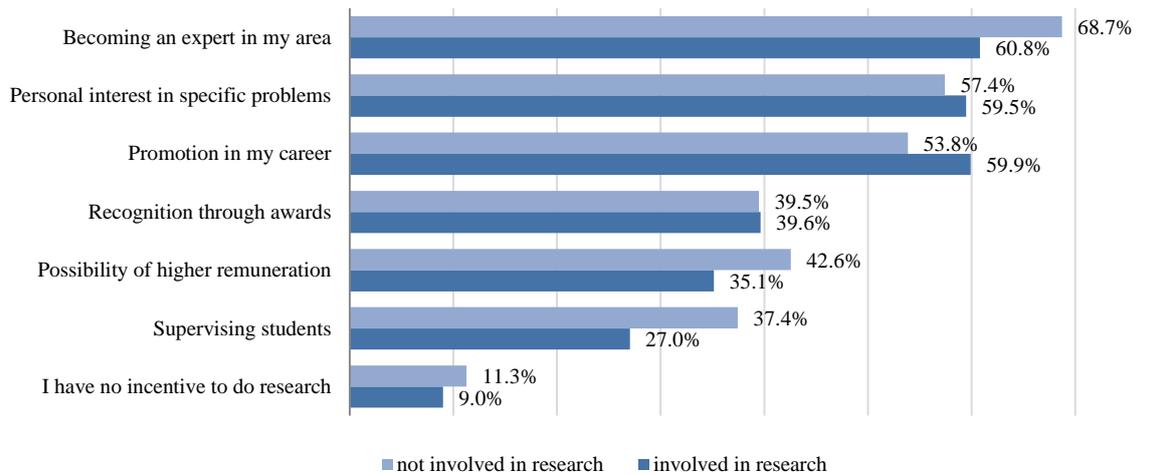
Figure 13: Comparison of research motivations between individuals involved in research and those not involved in 2013

Inadequate research facilities/laboratories (53.3%) and lack of sufficient time for research (42.8%) are still the two biggest obstacles to research as indicated in Figure 14.

What do you consider the biggest obstacles for you to undertake research? (multiple-select)

Inadequate research facilities/laboratories	53.3% / 55.8%
Lack of sufficient time	42.8% / 55.8%
My remuneration is not adequate	34.8% / 21.0%
I have no incentive to do research	33.9% / 28.5%
The teaching load is too much	31.1% / 32.2%
Family obligations	11.4% / 12.7%

■ 2013   ■ 2011
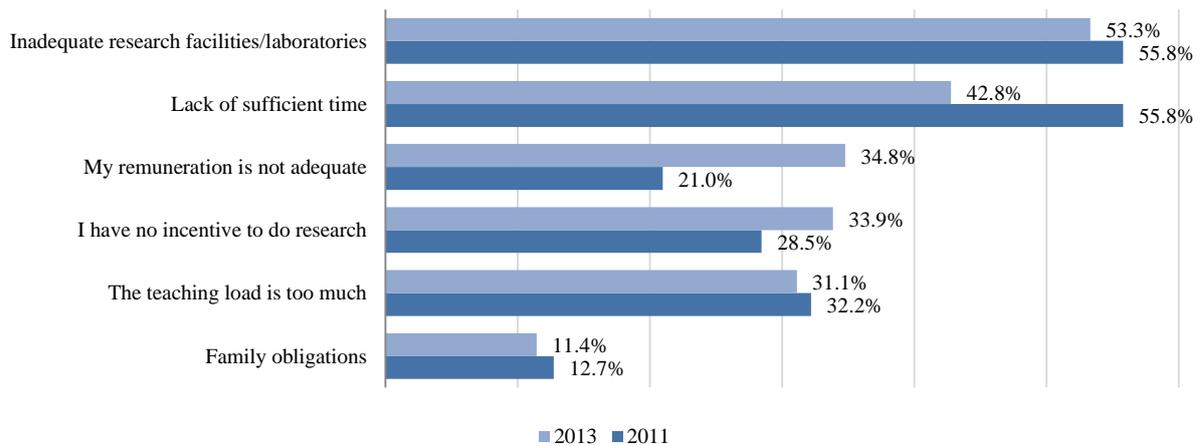
Figure 14: Obstacles to undertaking research (ranked by 2013 findings)

While complaints about the teaching load were not as pronounced in 2013 (ranked 5th) as they were in 2011 (ranked 3rd), balancing teaching and research obligations is still a big challenge as emphasised by comparing individuals involved in research and those that are not involved. The perception gap between researchers and non-researchers is most pronounced when considering the effect of the teaching load as displayed in Figure 15. Overall, the perception gap across various obstacles implies that institutions still have more work to do in terms of better time allocation to encourage and enhance research especially for staff that is expected to participate in both teaching and research activities.

What do you consider the biggest obstacles for you to undertake research? (multiple-select)

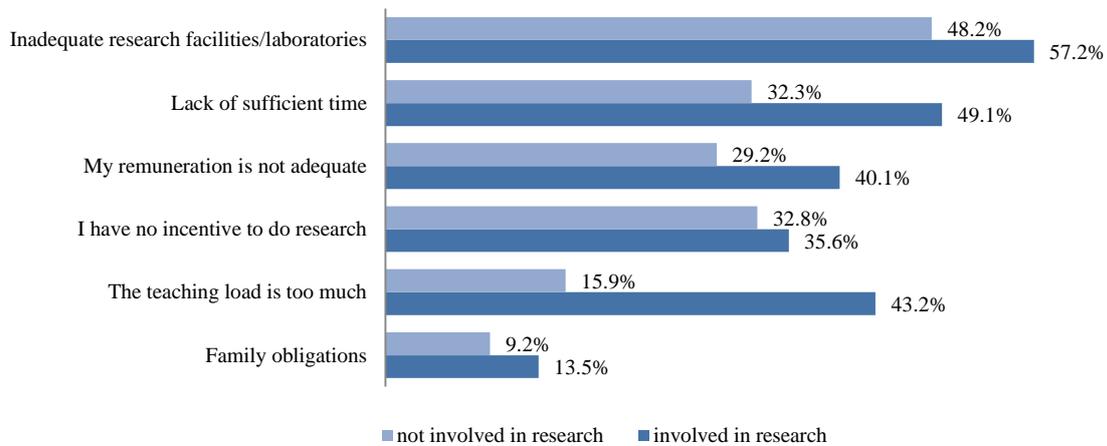Figure 15: Comparison of research obstacles between individuals involved in research and those not involved in 2013

4.3.2   Library resources

Most daily users of the library on campus rely on electronic access (21.5%) as opposed to physical visits to the library (10.1%) as indicated in Figure 16. While physical visits are still important, they happen more on a weekly or monthly basis. Interestingly, the total number of online visitors on a monthly basis both from on and off campus (310) is about to equal that of physical visitors (326) highlighting the paramount importance of a good campus network as well as offering e-services from the library. Globally, there has been an increase in online usage and a decrease in physical visits to the library.

How often do you access library services this way at your institution?
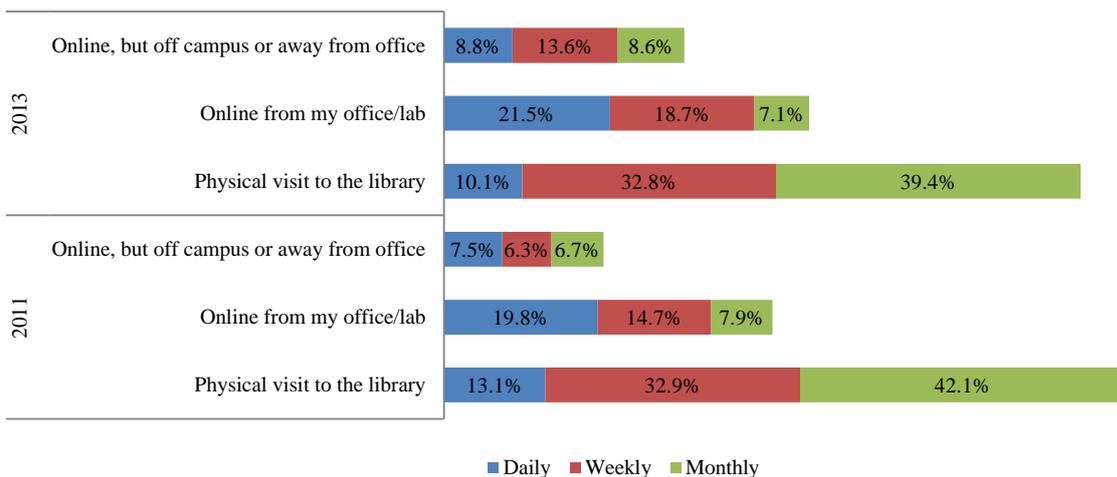
Figure 16: Access type and frequency for library resources

Individuals reported better satisfaction with e-services from libraries in general as presented in Figure 17 showing the progress made by institutions in offering such services. Despite this progress, a substantial proportion of library users shown in Figure 17indicated lack of availability of particular e-services from the library, highlighting the need to either provide such services or to sensitise library users if such services are already available.

How would you rate your level of satisfaction with Library services at your Institutional (satisfied & very satisfied)

Service	2013	2011
Online library catalogue	39.4%	23.5%
Access to e-journals	36.4%	25.2%
Access to online databases	33.8%	24.8%
Access to e-books	30.1%	15.5%
Access to CD-ROMs and other multimedia sources	28.2%	14.2%
Electronic theses and dissertations	27.3%	9.3%
Online publications database/repository	21.3%	15.7%

■ 2013 ■ 2011

Figure 17: Individuals that were either satisfied or very satisfied with various types of library services

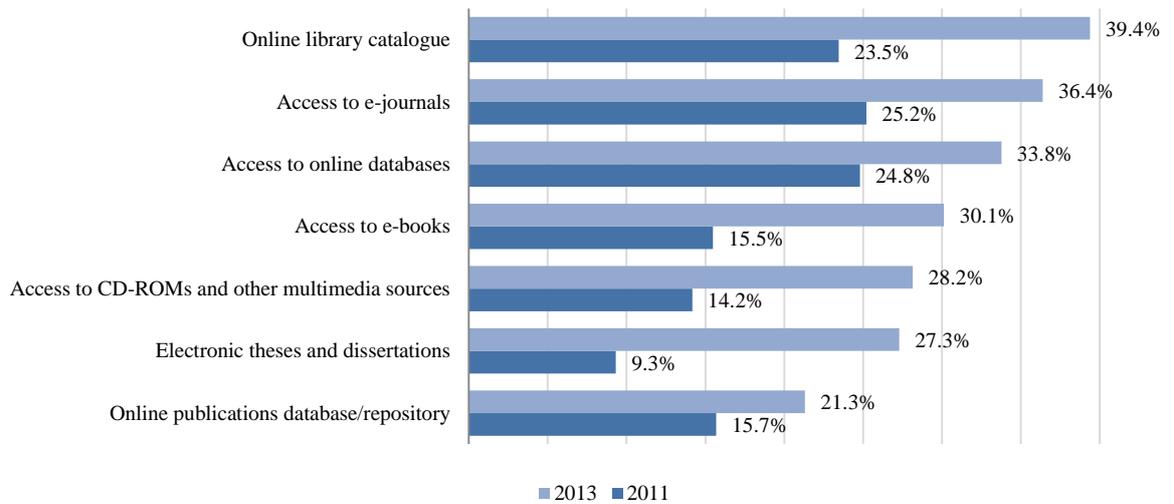| Service	Value
Online publications database/repository	38.4%
Access to CD-ROMs and other multimedia sources	33.8%
Access to online databases	31.7%
Online library catalogue	30.3%
Electronic theses and dissertations	29.9%
Access to e-books	27.8%
Access to e-journals	27.5%
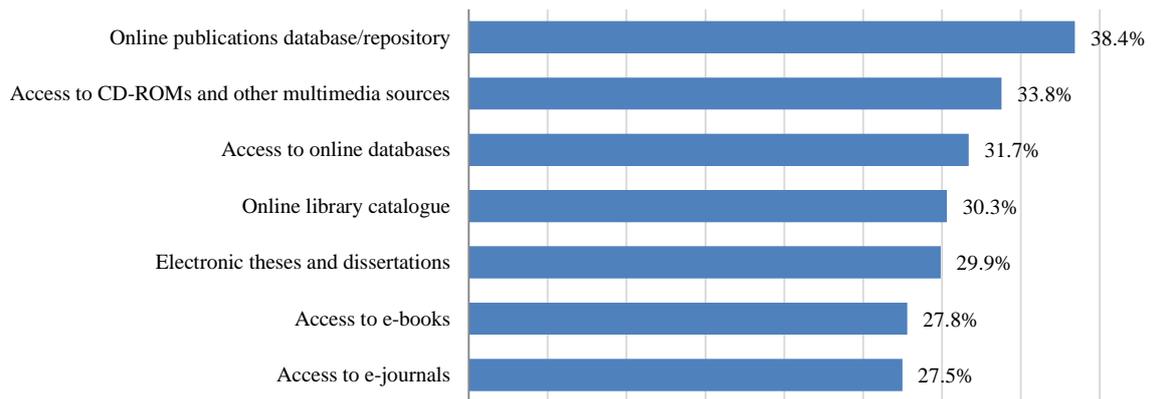
Figure 18: Individuals reporting lack of availability of particular e-services at their institutional library in 2013

4.3.3 Computers and Software

There was a slight increase in the number of individuals reporting access to computers (97.9%) in 2013 compared to 2011 (95.9%). Computer ownership was also no longer the preserve of institutions with only 67.0% of the computers belonging to institutions in 2013 compared to 86.8% in 2011. Individual ownership of computers increased from 12.8% in 2011 to 18.4% in 2013.

In terms of use, teaching and research still predominate as indicated in Figure 19. Use of computers in all areas has improved between the two surveys. Functions where individuals indicated increased usage of computers included personal matters, student consultation and supervision.

What do you use this computer for?

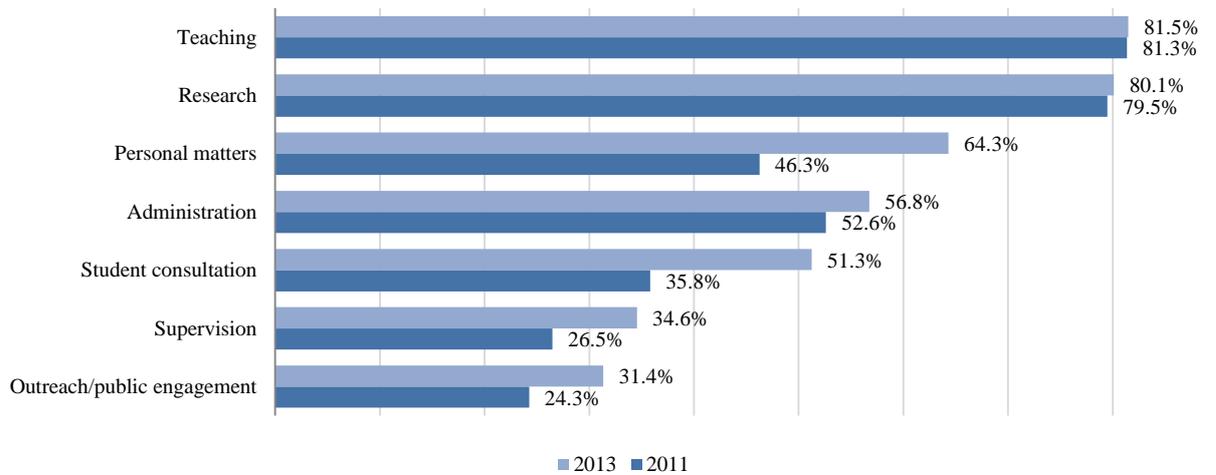|	
Teaching	81.5% / 81.3%
Research	80.1% / 79.5%
Personal matters	64.3% / 46.3%
Administration	56.8% / 52.6%
Student consultation	51.3% / 35.8%
Supervision	34.6% / 26.5%
Outreach/public engagement	31.4% / 24.3%

■ 2013 ■ 2011

Figure 19: Use of computers (ranked)

In terms of software, more individuals now procure their own software as opposed to relying on institutions: 33.3% of individuals provided their own software in 2013 compared to 27.0% in 2011, indicating a willingness by users to invest more in their own computing resources.

Word processing (98.6%) and presentation (97.2%) software continued to dominate in terms of software relevant to research. While browsers have gained prominence reflecting improving access and connectivity within institutions for research purposes, important research support software like statistical packages, reference management as well as modelling and simulation software are yet to be widely adopted.

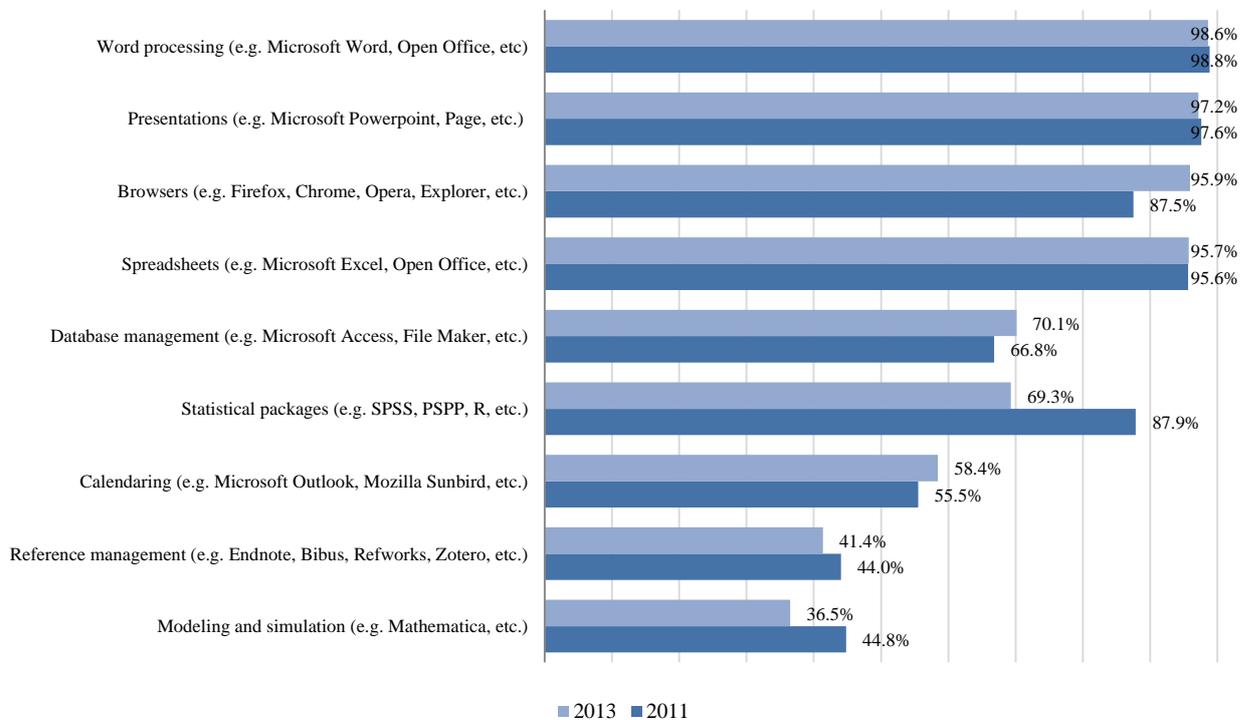|	
Word processing (e.g. Microsoft Word, Open Office, etc)	98.6% / 98.8%
Presentations (e.g. Microsoft Powerpoint, Page, etc.)	97.2% / 97.6%
Browsers (e.g. Firefox, Chrome, Opera, Explorer, etc.)	95.9% / 87.5%
Spreadsheets (e.g. Microsoft Excel, Open Office, etc.)	95.7% / 95.6%
Database management (e.g. Microsoft Access, File Maker, etc.)	70.1% / 66.8%
Statistical packages (e.g. SPSS, PSPP, R, etc.)	69.3% / 87.9%
Calendaring (e.g. Microsoft Outlook, Mozilla Sunbird, etc.)	58.4% / 55.5%
Reference management (e.g. Endnote, Bibus, Refworks, Zotero, etc.)	41.4% / 44.0%
Modeling and simulation (e.g. Mathematica, etc.)	36.5% / 44.8%

■ 2013 ■ 2011

Figure 20: Relevance (relevant or very relevant) of different software to research (ranked)

4.3.4   Internet: access, quality, utilisation

A higher proportion of individuals reported that their institutions had a campus network in 2013 (84.3%) compared to 2011 (77.4%) reflecting the progress made by institutions in investing in ICT infrastructure to support their research, teaching, and administrative functions. Only 0.7% of respondents indicated that their institutions did not provide Internet access in 2013 compared to 6.3% in 2011.

Staff access to Internet at the institution via individual PC or laptop increased from 73.4% in 2011 to 79.3% in 2013, while access via shared PCs in a lab setting decreased from 13.9% in 2011 to 8.5% in 2013. On the whole institutions appear to have done a good job of investing in PCs as a way to improve access. More individuals also reported having invested in Internet access at home with 47.8% reporting owning Internet access at home in 2013 compared to 35.7% in 2011.

The survey registered changes in individual perception of Internet reliability and speed at the institution. For reliability, the perception change was wide with 49.1% indicating that institutional Internet was either unreliable or very unreliable in 2013 compared to 37.2% in 2011. For speed the perception change was much wider with 72.3% indicating that institutional Internet was either slow or very slow compared to 46.4% in 2011. This resonates with our argument in the theory of change that as researchers relied more on online resources and applications, they would expect and demand better access and increased reliability, making the sustainability transition from push driven to pull driven demands for improved access.

How would you classify the reliability of the Internet service at your institution?

2013	49.1%	3.2%	47.7%
2011	37.2%	13.5%	49.2%

■ unreliaible   ■ not sure   ■ reliable
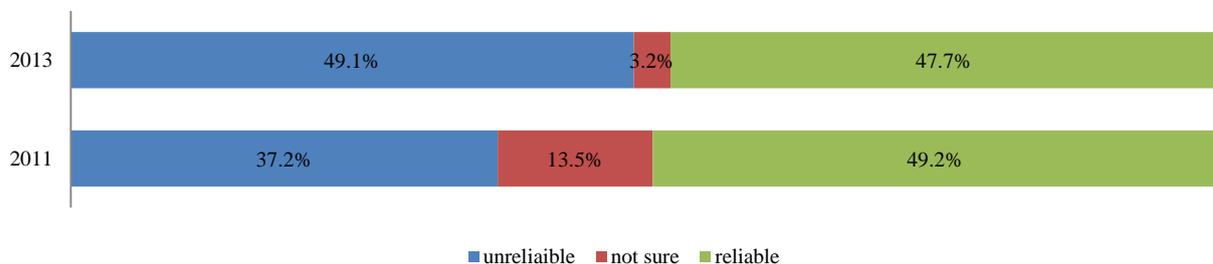
How would you classify the speed of the Internet service at your Institution?

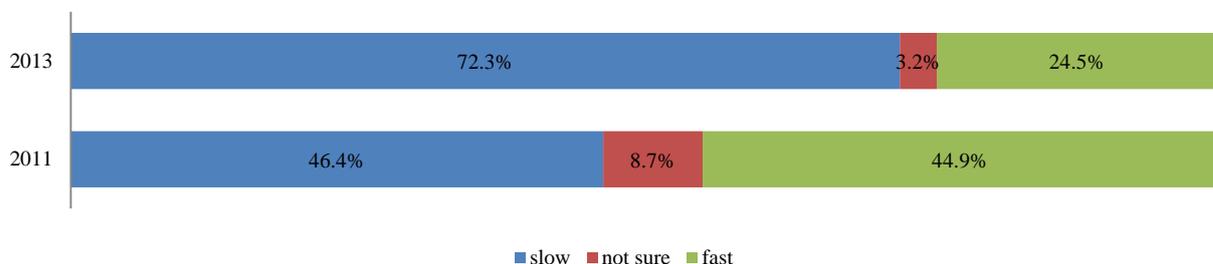|			
2013	72.3%	3.2%	24.5%
2011	46.4%	8.7%	44.9%

■ slow   ■ not sure   ■ fast

Figure 21: Changing staff perceptions about Internet reliability and speed within their institutions

The perception change is reflected in the level of satisfaction with Internet services at the institution summarised in Figure 22. Besides Internet access, there was a decline in satisfaction with every type of Internet service offered by the institution between 2011 and 2013. There is nothing tangible to indicate that institutions have toned back, rather many institutions are striving to offer more and better services. Rather, user expectations appear to

be moving much faster than institutions can move, resulting in lower levels of satisfaction with their services.

Level of satisfaction with Internet services (satisfied or very satisfied)

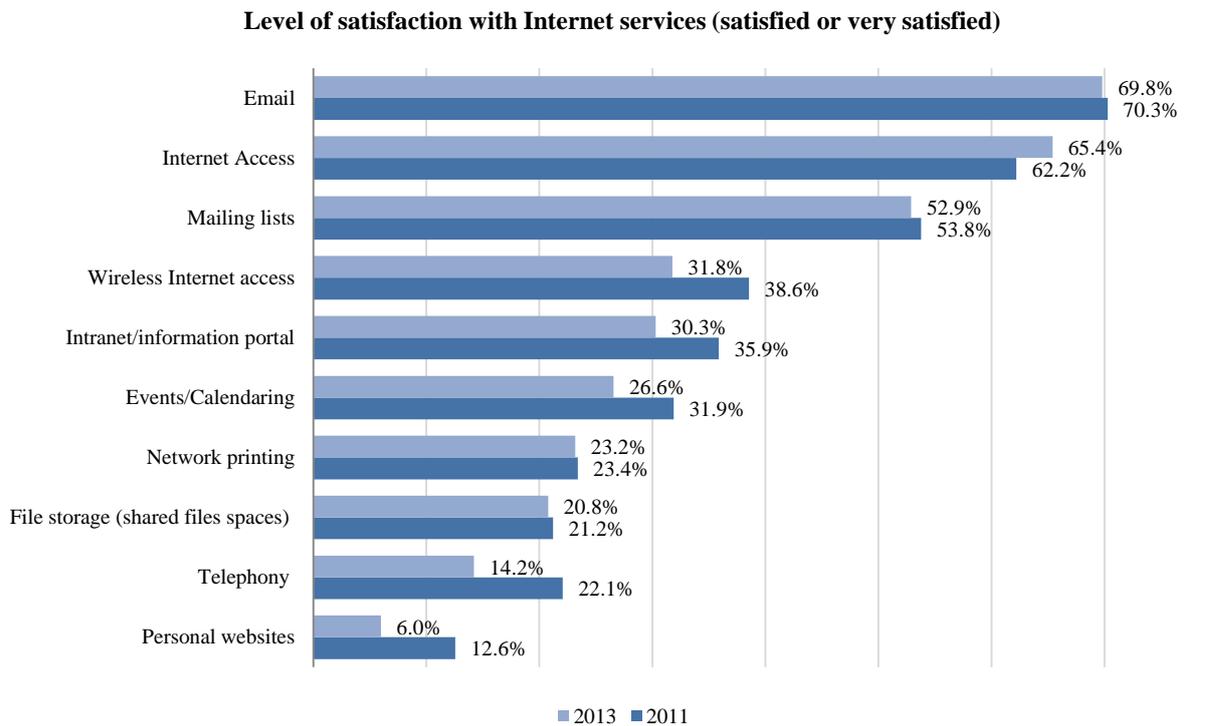| Service	2013	2011
Email	69.8%	70.3%
Internet Access	65.4%	62.2%
Mailing lists	52.9%	53.8%
Wireless Internet access	31.8%	38.6%
Intranet/information portal	30.3%	35.9%
Events/Calendaring	26.6%	31.9%
Network printing	23.2%	23.4%
File storage (shared files spaces)	20.8%	21.2%
Telephony	14.2%	22.1%
Personal websites	6.0%	12.6%

■ 2013 ■ 2011

Figure 22: Satisfaction with Internet services at the institution

Academic use of the Internet is growing as more individuals engage in learning and research activities as shown in Figure 23. People engaged in research activities tend to spend 3 or more hours per day compared to those engaged in administrative or entertainment activities. This may partly explain the poor perception of institutional Internet service because as individuals increasingly rely on it for learning and research, their expectations of speed and reliability will inevitably be higher.
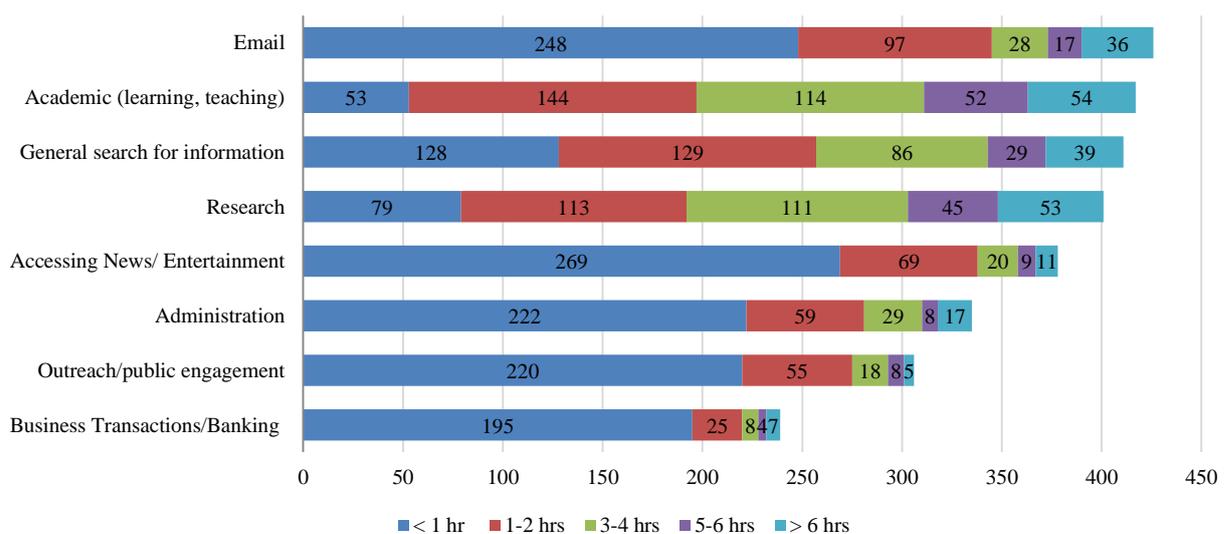
Activity	< 1 hr	1-2 hrs	3-4 hrs	5-6 hrs	> 6 hrs
Email	248	97	28	17	36
Academic (learning, teaching)	53	144	114	52	54
General search for information	128	129	86	29	39
Research	79	113	111	45	53
Accessing News/ Entertainment	269	69	20	9	11
Administration	222	59	29	8	17
Outreach/public engagement	220	55	18	8	5
Business Transactions/Banking	195	25	8	4	7

■ < 1 hr ■ 1-2 hrs ■ 3-4 hrs ■ 5-6 hrs ■ > 6 hrs

Figure 23: Number of individuals and intensity of daily Internet use for different activities

5. Summary of Key Findings

The key findings are summarised in this section.

At the institutional level:

i. On average, there has been improvement in connectivity with bandwidth per institution increasing from 12.8MB (2011) to 15.8MB (2013). Improving access to connectivity was also corroborated by a better ratio of bandwidth to connected computers that improved from 7.5kb/computer (2011) to 22.7kb/computer (2013) as well as the ratio of bandwidth to the combined total of staff and students that rose from 1.0kb/person (2011) to 3.1kb/person (2013).

ii. Institutions are doing a better job of tracking their research and research data and some of it is starting to appear online. Eleven of 26 (42.3%) institutions in 2013 had readily accessible data on research outputs compared to only six of 16 (37.5%) in 2011. At the institutional level, the 2013 survey captured 1,187 research outputs (for the past 2 year period) compared 1,309 captured in 2011 (for past 5 year period). Despite this, research output per academic staff is still low, improving from 0.17 outputs per academic staff in 2011 to 0.22 in 2013.

We look at changes at the institutional level as the driver, and the changes in researcher behaviour as the result. We continue underscoring that we are looking at contribution rather than attribution, noting however that during the period considered, it was bandwidth that increased significantly while most parameters around the researcher environment have remained constant.

Among the academic staff:

i. More individuals are involved in research projects, increasing from 68.1% in 2011 to 77.4% in 2013. Research networks however remain largely local, with only 41.6% reporting any collaboration outside of their institution and 32.6% outside of their country.

ii. Researchers increasingly accessed the library away from the physical premises by relying on electronic access on a daily basis (Figure 16). While physical visits still occurred, they happened more on a weekly or monthly basis.

iii. Individuals are spending more time on teaching and research–related activities as highlighted in Figure 6. Time allocations increased mostly for consultancies (from 7.7% in 2011 to 9.7% in 2013), research (from 18.7% in 2011 to 20.1% in 2013) and outreach/public engagements (from 7.9% in 2011 to 9.1% in 2013). Time allocated to administration fell the most from 20.5% in 2011 to 14.5% in 2013.

iv. To support research, individuals increasingly relied on various online platforms like videos, online discussion forums and publication databases (Figure 8). Use of videos for research improved most, increasing from 1.9% in 2011 to 10.4% in 2013.

v. Individual researchers have shown increasing willingness to invest more of their own money in their own computing resources. In terms of hardware, personal ownership of computers increased from 12.8% in 2011 to 18.4% in 2013 while in terms of software, 33.3% of individuals provided their own software in 2013 compared to 27.0% in 2011. More individuals also reported investing in Internet access at home in 2013 (47.8%) compared to 2011 (35.7%).

vi.   Individuals engaged in research activities tended to spend 3 or more hours per day using the Internet compared to those engaged in administrative or entertainment activities (Figure 23).

vii.   Despite obviously improving access and improving campus networks, there was a decline in individual satisfaction with every type of Internet service offered by the institution between 2011 and 2013 (Figure 22). Researcher perception relating to Internet reliability and speed at their institution is also changing. 49.1% indicated that institutional Internet was either unreliable or very unreliable in 2013 compared to 37.2% in 2011; while 72.3% indicated that institutional Internet was either slow or very slow compared to 46.4% in 2011. This resonates with our argument in the theory of change that as researchers relied more on online resources and applications, they would expect and demand better access and increased reliability.

viii.   Comparing research motivation between individuals involved in research and those that are not unearthed some interesting observations (Figure 13). Individuals not currently involved in research are more motivated by the possibility for higher remuneration and student supervision compared to their counterparts involved in research who are more interested in promotion and personal interest in specific problems. This provides institutions with some leverage to use in encouraging and nurturing more research. Commercialization of research is still non-existent. Among all the 26participating institutions, 4 universities reported 15 patents amongst them over the last 2 years. While this is an improvement on 2011, where no patents were reported, it is still way below expectation.

6. Emerging Policy Recommendations to Institutions

While our research is aimed at testing whether or not improved access changes researcher behaviour in a way that leads to increased intellectual property output, the findings point to the following policy actions that institutions need to carry out to spur research and research output:

i.   It is very clear that current teaching loads do not leave staff sufficient time for research, and this needs to be addressed.

ii.   Promotion and recognition are key drivers for researchers, and promotion and recognition policies need to take this into account. This can extend to similar rewards for multi-disciplinary research endeavours that bring individuals from different disciplines and units together within the institution, and across institutions and national boundaries, to foster better research collaboration.

iii.   Increasingly, online visibility of research output is becoming a major factor in recognition, and with that come opportunities for both collaboration and research funding. Institutions need to examine how they can exploit online research repositories under some of the commons approaches to research publication. This also links to internal quality assurance (as opposed to relying entirely on external referees) of research accepted in institutional repositories as a basis for promotion.

iv.   Individuals increasingly access library resources using online channels. Institutions need to empower their libraries to serve users both on and off campus using such channels and to increase the range of services available online. Users are also increasingly relying on mobile devices, making wireless access a priority.

<ol type="i" start="5">
<li value="5">Individual ownership of computers is increasing across institutions. This is a trend that institutions need to encourage through policies that address both staff and students. This should be combined with schemes of access to software applications and tools that institutions are best placed to secure under competitive terms.
<li value="6">Institutions need to recognise the that there is an increasing demand for better access which is dependent on the quality of campus networks as well as external bandwidth. This will require increased ICT budgets as well as collaborations with other national institutions through national research and education networks. It should be noted that there is currently a very high suppressed bandwidth demand in most institutions, as has been evidenced by traffic growth as prices go down and campus networks improve.
<li value="7">The routine collection of data both about research and ICT resources would enable institutions to carry out their own analyses so that they can shift to evidence based policy when addressing the improvement of research output. This would also enable benchmarking to be carried out more easily and cheaply.

7. Conclusion

The focus of this second paper in the research series was tracking researcher behaviour. It has been noted that in all key aspects, researcher behaviour is changing in ways that should lead to enhancement of research and research output. Especially important is the fact that even as institutions have taken major steps in improving campus networks and increasing international bandwidth, the level of satisfaction about sufficiency and quality of bandwidth and other ICT services is going down as was postulated in our Theory of Change. It is this dissatisfaction that then becomes the permanent internal driver for continuing improvement as the research culture picks up.

In addition to the main theme of the paper, we have noted several areas where institutions need to take action to improve their research environments and motivate researchers: we recognize, as we have always stated, that increased bandwidth makes a contribution to increased intellectual property output, but the entire research eco-system needs to be addressed in order to maximize such impact.

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