Annals of Library and Information Studies
Vol. 55, December 2008, pp.281-291

Electronic mail use in research collaboration: observations from a Nigerian University

Wole Michael Olatokun
Department of Library and Information Studies, Private mail Bag 0022, University of Botswana, Gaborone.Email:wole.olatokun@mopipi.ub.bw/woleabbeyolatokun@yahoo.co.uk

A study of 102 research collaborators, conducted using semi-structured questionnaire revealed that the research collaborators employed e-mail for daily communication, file/document exchange, dissemination of results, and data collection. Widespread use of e-mail, its timeliness and cost-effectiveness were the main motivating factors. Also demonstrates that research collaborators' publication activities were greatly enhanced by their use of e-mail. Benefits derived from e-mail use include its flexibility, ensuring easy linkage with peers and colleagues, ease of file/document exchange, privacy and confidentiality of information, and its distance friendliness. Irregular power supply was the major constraint against e-mail use in research collaboration. Findings revealed that job position was the highest significant factor that contributed to e-mail usage, while motivations for using e-mail, benefits of e-mail, and e-mail usage collectively contributed to the productivity of the research collaborators. Concludes that e-mail use in research collaboration at the University of Ibadan contributed to the productivity of research collaborators and the benefits of e-mail use in research collaboration outweigh the constraints.

Introduction

From the second half of the twentieth century, the system of communication began to undergo a dramatic transformation at a rate that could never have been imagined [1]. Electronic mail (e-mail) is one of the essential resources on the internet that was invented in 1990 by Tim Berners-Lee and Cailliau. It has huge benefits inherent in it, especially its capability to blur all boundaries of geography, disciplines, time, cost, and being able to achieve virtually all that the conventional postal mail had not been able to achieve. The fact that e-mail, as well as other resources on the internet, was initially developed for scholarly use, and has become today an exceedingly important platform for both formal and informal scholarly communication and collaboration, has necessitated the need to investigate how its use has enhanced collaborative research.

Over the years, there has been increasing interest in research collaboration among researchers and within science policy circles. It is widely assumed that collaboration in research is a 'good thing' and that it should be encouraged. Numerous initiatives have been launched with the aim of developing collaboration among individual researchers - bringing them together, for instance, in new and larger centres of excellence, or alternatively in interdisciplinary research groups. Most governments have been keen to increase the level of international collaboration engaged in by researchers whom they support in the belief that this will bring about cost-savings or other benefits. The use of e-mail in collaborative research makes researchers communicate without the cost of travel and, perhaps, more easily transcend cultural barriers. It enables collaborators to contribute different skills, experiences, and perspectives to the collective work of the research team. While consistently found to be the most used tool for distance collaborative research[2], there are advantages and disadvantages of e-mail use. Significant aspects of e-mail use include universal platform, cost effectiveness, accessibility, and easy learning curve for research team members[3]. Other advantages include succinct messaging and the benefit of being able to send attachments quickly and efficiently. Of more benefit to the collaborative research team is the fact that both sender and recipient manage controlling the timing of their portion of the communication[4]. However, this can also be a disadvantage as lack of timeliness leads to poor communication or the undermining of the collaborative relationship. Another drawback presented by e-mail is

the low context nature of the communication, which requires the writer to clearly articulate the intended message[5]. This can lead to important concerns being obscured by other points in e-mail communication.

With the convergence of the technologies of telecommunication and computing breaking all barriers of distance, discipline, culture, as well as broadening the horizon extending the frontiers of knowledge, employing the use of e-mail in collaborative research can, in no small measure, translate to cutting-edge discoveries, which will help in the advancement of the scholarly endeavour of being the bedrock of innovation to the development of the globe in all perspectives. These have necessitated the need to investigate the use of e-mail as a collaborative technology that has inherent features which make its adoption in research collaboration pertinent. It is therefore necessary to investigate its use in collaborative research, so as to give an insight into how it is used by researchers in the collaboration or otherwise, or find out the inherent features it has to offer collaborative research.

Objective of the study

The objective of this study was to investigate the use of electronic mail among academic staff of the Faculty of Agriculture and Forestry; and College of Medicine, University of Ibadan, Nigeria. Towards the attainment of this objective, the following research questions guided the study:

- What is the use of e-mail in research collaboration?
- What motivates e-mail use in research collaboration?
- What is the extent to which e-mail as been adopted as a communication tool in research collaboration?
- How has e-mail enhanced productivity in research collaboration?
- What is the nature of research collaboration for which e-mail is used for?
- What are the limitations of e-mail use in research collaboration?

Related studies

In reconciling the potential differences inherent in collaborative research, especially the myriad of challenges that present themselves, the application of e-mail in storage, organisation, sharing, and communication of information within and across groups facilitates and provides a medium through which the intricacies of collaborative research is becoming a thing of the past. Meeting these challenges with the effective use of e-mail in collaborative research can provide the foundation for building a common ground of understanding, especially in interdisciplinary teams, prevent duplication of effort, assist in problem solving, provide scaffolding for the generation of new ideas, facilitate the writing of papers and development of software and tools, establish good communication, aid in project management[6]. E-mail is quickly becoming the most popular and probably the most productive resource available on the internet for research collaboration over the years[7] and the ability to send messages in a cost and time effective manner is one reason for the rapid growth of the email technology. Much of the growth in e-mail utilization has occurred in educational settings, where e-mail facilities are now commonplace[8-10]. Educators are using this technology routinely as a method of communicating with faculty colleagues, researchers and students[11-14]. E-mail technologies have been used to facilitate group work and group interaction[15] and to promote the process of writing.

Unlike conventional mail, e-mail is a cost and time effective form of communication, features that are essential at the initial stages of research collaboration, when sharing of ideas, research tools are examined and preprints and analysis are sent to research collaborators. Messages can be sent and received from opposite sides of the globe within minutes providing the opportunity for almost immediate responses. E-mail is also more convenient; one does not need to find paper, envelope, address books, stamps or post box. All this can be done at the desktop. Recent advances in encryption and digital signature can provide security and authentication to email based communication. A major strength of using e-mail as a communication and research collaboration tool is that of its global nature. Infact, global research collaboration among researchers from diverse disciplines is now a reality. E-mail can provide direct access to hundreds of like-minded academics throughout the world, many of whom are at the forefront of research collaboration in their chosen fields. This characteristic make e-mail invaluable for research collaborators wishing to keep up with issues that concern their disciplines or to access information that would have

been impossible to obtain using conventional methods. It also empowers budding research collaborators who are able to converse directly with stalwarts of research collaboration from around the world. E-mail use in research collaboration portends the capability to offer an innovative method of fostering scholarly dialogue, providing flexible technology-based opportunities aimed at promoting an ethos of scholarship within a supportive environment. Exclusive to the e-mail as a collaborative tool is the capability to enable e-mail reminders that warn team members of upcoming events and meetings. The e-mail has been used to illuminate and understand events of team researchers, facilitating exchange of correspondence, thus ensuring effectiveness of collaborative research.

Arguments abound on the use of e-mail in collaborative research. Solomon argued that e-mail will win out over both alternatives of telephone and snail mail but sees not "the slightest hint of literacy resurgence in e-mail correspondence"[16]. "E-mail is inherently anti-contemplative" suggesting that "even in its *metier,* communicating information; computer correspondence persistently exemplifies another deficiency. At the beginning of a collaborative research project, informal communication is important to scientists who are developing methodologies and refining hypothesis. Colleagues at invisible colleges may be queried for details on construction of experimental apparatus or for data on related objects of study. In an earlier time, telephone calls and visits to other laboratories as well as conference interactions provided opportunities for communication. The ready availability of e-mail now makes such direct communication even easier and faster, less costly, than a telephone call or a visit[17]. Improved communication in collaborative research due to e-mail may contribute to an increase in the size of professional network - that is, increase collaborative research - consequently, a new form of research work has emerged, the "extended research group". E-mail enables collaborative researchers to overcome many barriers to communication due to geographic distance, such as time, costs and language. The main requirement is that all members of the group have internet addresses. E-mail was preferred to the telephone because scientists who travel may be hard to reach by phone, but can be contacted at their virtual address, because written messages allow time for formulating answers before responding, and because colleague whose native language is not English preferred written communications[18].

An essential facility of e-mail communication in collaborative research is that the message might be sent from the originating to intermediating computer on the internet. The intermediating computer may then store the message pending forwarding when the intended recipient computer connects to the internet. Also, e-mail has the ability to send any computer-created document or file as an attachment to an e-mail message of a collaborative researcher. Hence, large documents containing formatted text, numeric data and images (logos, photographs, signature e.t.c) can be sent by e-mail, much faster than post or courier, and much cheaper than fax[19].

Generally speaking, debates on the role and use of electronic mail as a communication technology in collaborative research have been characterised by dialectic of two strategies. On the one hand, collaborative research has aimed at devising strategies for building coordination support to reduce the complexity of coordination through e-mail for intra-group regulation. On the other, efforts have been made to devise strategies that aim at flexible means of interaction which do not regulate interaction but rather leave it to the user to cope with the complexity of coordinating their activities[20-21]. These wider concerns, however, must all be related somehow to cooperative effort: They "refer to actors taking heed of the context of their joint effort"[22].

Methodology

Research design, population, and sampling procedures

The study adopted the survey research design. The study population comprised academic staff of the Faculty of Agriculture and College of Medicine, of the University of Ibadan that use email in research collaboration. 'The Essential Electronic Agricultural Library' (TEEAL), and the electronic "entrepez pubmed" provided the list and e-mail usage of research collaborators in the Faculty of Agriculture and College of Medicine respectively. In all, 102 research collaborators constituted the population size of the study. The population was divided into sampling units based on faculty/college. The sampling units were the Faculty of Agriculture and College of Medicine at the University of Ibadan. The sampling frame was made up of forty-one academic staff of the Faculty of agriculture, while the academic staff from

Table 1 — Frequency distribution of respondents use of e-mail in research collaboration

E-mail use	Daily	Monthly	Not at all	Percent	Total
Communication	100			100.0	100
File/document exchange		100		100.0	100
Dissemination of results		96	4	100.0	100
Data collection		68	32	100.0	100
Idea sharing		87	13	100.0	100

Table 2 — Respondents' motivation for e-mail use in research collaboration

Motivation	Yes	No	Percent	Total
Timeliness of information exchange	93	7	100.0	100
Cost-effectiveness	86	14	100.0	100
Adequate knowledge of e-mail		100	100.0	100
Widespread use among academics	94	6	100.0	100
Conformity with modern trend		100	100.0	100

the College of Medicine was sixty-one, totalling 102 research collaborators. All the research collaborators were included in the study since they all possess the characteristics of the data required for this study (email usage).

Data collection and analysis

The data collection instrument used was a semi-structured questionnaire that was made up of two sections. Section 1 elicited demographic data, while Section 2 collected data on various issues regarding the use of e-mail in research collaboration. Copies of the questionnaire were administered personally by the researcher. Out of the 102 copies of the questionnaire administered, 100 useable copies were returned, while two were returned unfilled. This gave a response rate of 98%. The responses from the completed questionnaires were coded and analysed using the Statistical Package for the Social Sciences (SPSS) 13.0 version. Descriptive statistics namely frequency and percentage distributions were used in the analysis of the data collected. Also, One-way ANOVA, Multiple regression, and Tukey HSD Post Hoc Tests were further used in analysing the resulting data to find out relationships between variables.

Results

Demographic information

Gender distribution of respondents

The results presented in Figure 1 show that male research collaborators constitute the majority of the respondents.

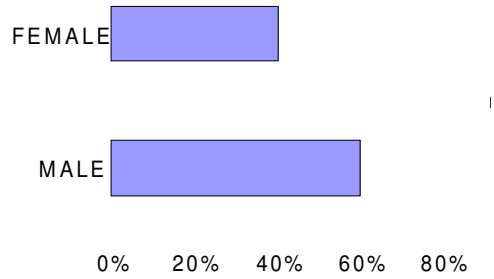

Fig. 1 — Gender distribution of respondents

Patterns and frequency of e-mail use in research collaboration

Table 1 presents results of the analysis of the frequency of use of email in research collaboration.

The results in Table 1 shows that one hundred respondents (100%) use email for "daily communication" while all the respondents rated "file/ document exchange monthly" as what e-mail is used for in research collaboration, an extent of 96% rated "dissemination of results monthly" as what they employed the use of e-mail in research collaboration. "Idea sharing" and "data collection" accounted for 87% and 68% of respondents' use of e-mail in their research collaboration respectively. Thus, communication was the major purpose for which respondents employ the use of e-mail in research collaboration.

Motivation for e-mail use in research collaboration

Table 2 presents the results of analysis of the motivating factors for email use in research collaboration.

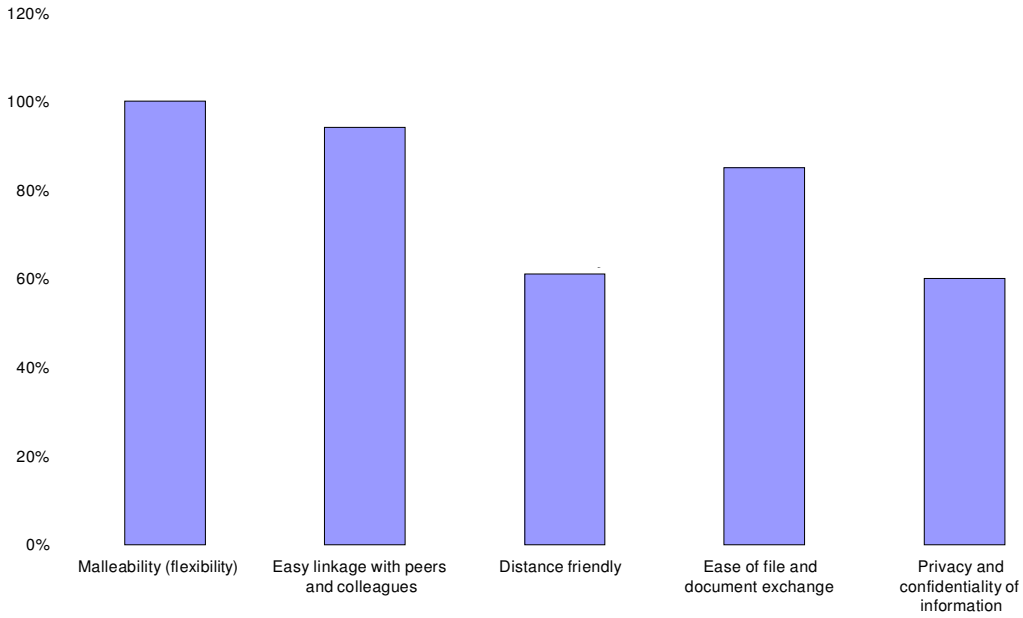

Figure 2 — Respondents' benefits from the use of e-mail in research collaboration

Table 3 — Impact of e-mail use in research collaboration

Productivity parameters	Yes	No	Percent	Total
Visibility		100	100.0	100
Increased Output (Published paper/articles)	100		100.0	100
Enhanced ability to win research grants	60	40	100.0	100
Increased income earning	3	97	100.0	100

The results in Table 2 reveal that "widespread use among academics" stood out as the chief motivation for e-mail use in research collaboration. An extent of 93% of respondents affirmed to the "timeliness of information exchange" as the next motivation for using e-mail in research collaboration, while e-mail's "cost-effectiveness" was reported by 86% of the respondents as a motivation in their collaboration activities. However, "conformity to modern trend" was never a motive for e-mail use in research collaboration.

Benefits of e-mail use in research collaboration

The result of the analysis of the benefits of email use to the research collaborators is presented in Figure 2.

Figure 2 shows that e-mail's "flexibility" ranks highest as depicted in the illustration above, while "easy linkage with peers and colleagues", "ease of file/document exchange", "privacy and confidentiality of information" and "distance- friendly" follow in decreasing order.

Productivity and e-mail use in research collaboration

Figure 3 presents the results of analysis of email use and research productivity of the respondents.

Productivity of respondents using e-mail in research collaboration was very high with a percentage of 94%. Virtually all the respondents submitted that they had been productive in their use of e-mail in research collaboration. There seems to be a notion of e-mail being an indispensable tool to respondents' productivity.

The results presented in Table 3 show that "increased output (published paper/articles)" has been of optimum impact to their productivity in the use of e-mail in research collaboration, although, "enhanced ability to win research grants" also strongly impacted respondents' productivity by an extent of 60%. A noticeable highlight of the results in Table 3 revealed that 97% of the respondents reported that "increased income earning" was not of impact to their productivity using e-mail in research collaboration.

Table 4 — Limitations to respondents use of e-mail in research collaboration

Possible limitations	Never	Sometimes	Always	Percentage	Total
High cost	100			100.0	100
Unreliable/poor internet infrastructure		100		100.0	100
Epileptic power supply		3	97	100.0	100
Risk of virus infection	100			100.0	100

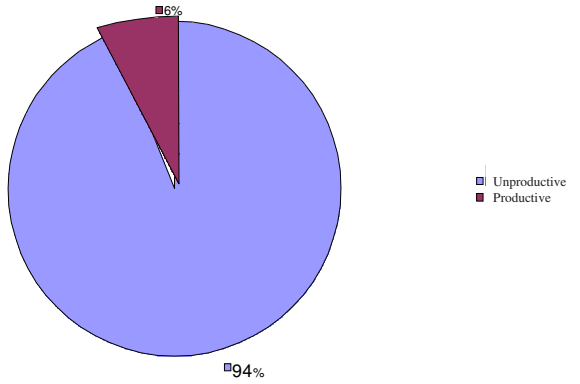

Figure 3 — Respondents' research collaboration productivity and use of e-mail

Extent of limitations of e-mail use in research collaboration

Table 4 gives the frequency distribution of the limitations against e-mail use in research collaboration.

From the results presented in Table 4, 97% of the respondents submitted that "epileptic power supply" was always a major constraint in their use of e-mail in research collaboration, however, all the respondents affirmed that "unreliable/poor internet infrastructure" sometimes militate against their use of e-mail in research collaboration. It was further revealed that "high cost and risk of virus infection" were never limiting factors in the use of e-mail in research collaboration.

Respondents academic position and e-mail use in research collaboration

Using independent measures, analyzing with one-way ANOVA, the result shows that there is a difference in e-mail use in research collaboration among research collaborators based on their job position, the test was significant at 95% confidence level as percentage error was found to be less than .05, which signifies that the mean differences on e-mail use among the research collaborators based on their job position was significantly different at .05 level of significance. (F (3, 99) = 4.9, P<.05) (Tables 5a & 5b).

Table 5a — Descriptive statistics showing the mean and standard deviation based on e-mail use

Variables	N	Mean	Std.
Lecturer I	5	3.600	.8944
Lecturer II	29	3.689	.7608
Senior lecturer	41	3.854	.7925
Professor	25	2.280	.8426
Total	100	3.900	.8226

Further analysis using Tukey HSD Post Hoc Test shows a level difference among research collaborators job position which is shown inTable 5c.

The results presented in Table 5c reveal that the mean difference between lecturer I (M=3.600 , SD= .8944) and lecturer II (M=3.689, SD=.7608) (Mean difference = .345, S.E = .322, p = .708) and lecturer I and senior lecturer (M=3.854, SD=.7925) (Mean difference = .439, S.E = .315, p = .507) were not significant as they did not satisfy the 95% confident interval with the percentage error found to be above .05 significance level. The mean comparison of senior lecturer (M=3.854, SD=.7925) and lecturer II (M=3.68, SD=.7608) showed that the percentage error was above the 95% confidence level or above the .05 level of significance. However, it was demonstrated that research collaborators that were professors (M=2.280, SD=.8226) (Mean difference = .345, S.E = .33, p = .708), reported least use of e-mail in their research collaboration than lecturers I (M=3.600 SD= .8944) (Mean difference = .345, S.E = .33, p = .708), lecturers II (M=3.68, SD=.7608) (Mean difference = .345, S.E = .33, p = .708), senior lecturer (M=3.854, SD=.7925) (Mean difference = .345, S.E = .33, p = .708). This reveals that respondents at the senior lecturer level recorded the highest use of e-mail in their research collaboration compared to others, while in the case of the professors, their low proportion of e-mail use in research collaboration might be due to inadequate

Table 5b — One-way anova showing the influence of job position on e-mail use among research collaborators

Variables	Sum of squares	df	Mean Square	F	Sig.
Between Groups	6.501	3	2.167	4.896	.003
Within Groups	42.489	96	.443		
Total	48.990	99			

Table 5c — Tukey HSD post hoc test showing the level difference among respondents' job position and e-mail use

(I) Position	(J) Position	Mean Difference	Std. Error	Sig.
Lecturer I	Lecturer I	-.34483	.32215	.708
	Senior Lecturer	-.43902	.31514	.507
	Professor	-.92000	.32592	.029
Lecturer II	Lecturer I	.34483	.32215	.708
	Senior Lecturer	-.09420	.16142	.937
	Professor	-.57517	.18156	.011
Senior Lecturer	Lecture I	.43902	.31514	.507
	Lecturer II	.09420	.16142	.937
	Professor	-.48098	.16882	.027
Professor	Lecturer I	.92000	.32592	.029
	Lecturer II	.57517	.18156	.011
	Senior Lecturer	.48098	.16882	.027

information and communication technology literacy or negative attitude towards email use.

Academic position of research collaborators and benefits of email use in research collaboration

The results presented in Table 6a indicate that job position of research collaborators influences the amount of benefits derived from e-mail use in research collaboration, professors (M=7.920, SD=.277), senior lecturers (M=7.439, SD=.84), lecturers II (M=7.43, SD=.486) and lecturers I (M=7.000, SD=1.22), the test is significant at 95% confidence level with percentage error found to be less than .05% level of significance (F(3,99) =2.823, P<.05) (Table 6b) .

The results in Table 6c reveal that there is significant difference between the amount of benefits derived from e-mail use in research collaboration by professors (M=7.920,SD=.2768) (Mean difference=.590, S.E=.219 p=.040) and lecturers II (M=7.344,SD=.4837) (Mean difference=.590, S.E=.219 p=.040) , while the level of

Table 6a — Descriptive statistics showing the mean and standard deviation based on e-mail use

Variables	N	Mean	Std
Lecturer I	5	7.000	1.224
Lecturer II	29	7.344	.4837
Senior lecturer	41	7.439	.8381
Professor	25	7.920	.2768
Total	100	100	.7034

difference between professors, lecturer I and senior lecturers did not reach any level of significance (Mean difference=.680 S.E=.392 p=.312), (Mean difference =.426 S.E=.203 p=.161), because the multiple comparison at 95% confidence level was not significant with percentage error more than .05 level of significance.

The results presented in Table 7 show that collectively, research collaborators' faculty/college, gender and job position contributed significantly to e-mail use in research collaboration, as these variables were collectively responsible for 13.8% change observed in

e-mail use among the research collaborators (R =13.8, F(99) 5.142, P<.01). Job position was found to be the most significant independent contributor (B = .354, P <.05) because it was the most significant at 95% confidence level with a percentage error less than .05, while faculty/college (B = -.074, P>.05) and gender (B = -.060, P > .05) were found to be non-significant at 95% confidence level with percentage errors of more than .05 independent contributory influence on e-mail use in research collaboration. This implies that collectively, faculty/college and gender had no significance in the use of e-mail in research collaboration. Only job position had a high significance to e-mail use in research collaboration.

Discussion

E-mail use and research collaboration

Research collaborators in the University of Ibadan employ e-mail in research collaboration for communication daily. This is in line with a previous study that educators use e-mail routinely as a method of communication with faculty colleagues, researchers and students[23]. Research collaborators in the study also employed the use of e-mail in research activities for file/ document exchange. This equally corroborates with an earlier study that e-mail has the capacity to send any computer-created document or file as an attachment to an e-mail message of a collaborative researcher[24]. Findings from this study also alluded to the capabilities of e-mail use in research collaboration for dissemination of results and data collection on a monthly basis. The study goes further to reveal that research collaborators have a high awareness of e-mail for communicating to clarify and demystify knotty issues in their research collaboration. The result further confirmed the finding of D Souza that much of the growth in e-mail utilization has occurred in educational settings. Also, male research collaborators employed the use of e-mail in inter-

Table 6b — Summary of one-way Anova showing research collaborators job position and benefits of email use

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.431	3	1.810	2.823	.043
Within Groups	61.569	96	.641		
Total	67.000	99			

Table 6c — Tukey HSD post hoc test showing the level difference among research collaborators job position and benefits of e-mail use

(I) Position	(J) Position	Mean Difference	Std. Error	Sig.
Lecturer I	Lecturer II	-.08966	.38779	.996
	Senior Lecturer	-.25366	.37936	.909
	Professor	-.680	.39233	.312
Lecturer II	Lecturer I	-.08966	.38779	.996
	Senior Lecturer	-.16400	.19431	.833
	Professor	-.59034	.21856	.040
Senior Lecturer	Lecturer I	.25366	.37936	.909
	Lecturer II	.16400	.19431	.833
	Professor	-.42634	.20321	.161
Professor	LECTURER I	.68000	.39233	.312
	Lecturer II	.59034	.21856	.040
	Senior Lecturer	.42634	.20321	.161

Table 7 — Regression analysis showing the influence of e-mail use among research collaborators

	R	R^2	B	Sig.	F	Sig.
Constant	.372	.138	-	-	5.142	<.05
Faculty	-	-	-.074	>.05		
Gender	-	-	-.060	>.05		
Position	-	-	.354	<.05		

Key: R = Regression; R^2 = Regression explained; B =Weighed effect; F =ANOVA value

departmental research collaboration and off-shore research collaboration more than their female counterparts[25].

Motivation, productivity and e-mail use in research collaboration

The utmost motivation for the use of e-mail in research collaboration is its widespread use among academics. This demonstrates the acceptability of e-mail use among the research collaborators at the University of Ibadan, owing to the fact that it facilitated easy and rapid response to knotty issues that arise in the course of research collaboration. Since research collaboration entails consistent sharing of ideas and cross-examining of findings on a regular basis, thus affirming e-mail's wide acceptability among the research collaborators at the University of Ibadan. Timeliness of e-mail also ranked high, so also was its cost-effectiveness. This agrees with the previous finding, that the ready availability of e-mail now makes direct communication even easier and likely faster, hence less costly, than telephone call or a visit[26]. The study also demonstrated that e-mail has a positive impact on the productivity of research collaborators. Virtually all the research collaborators affirmed that e-mail has impacted positively on their productivity. Increasing their publication profile was also revealed as an utmost benefit and positive impact. However, increased income surprisingly was not revealed as a factor that contributes any significant impact on the research collaborators. These findings further confirmed the finding that e-mail is quickly becoming the most popular and probably the most productive resource available on the internet for research collaboration[27].

Benefits of e-mail use in research collaboration

The research collaborators submitted that flexibility of e-mail was highly beneficial, and this corroborates Taufer et al's findings, that the application of e-mail in storage, organization, sharing and communication of information within and across group, facilitates and provides a medium through which the intricacies of collaborative research is becoming a thing of the past[28]. All the benefits of e-mail use in research collaboration from this study showed substantial contribution to the use of e-mail in research collaborator activities. E-mail's facilitation of easy linkage with peer and colleagues corroborates finding that collaborators require more and more knowledge, a demand which can only be met by pooling one's knowledge with others[29]. Furthermore, the findings from this study also highlighted beneficial uses of e-mail in research collaboration as its ease of file/ document exchange, privacy and confidentiality of information, and distance friendliness.

Limitations of e-mail use in research collaboration

Epileptic power supply was the major constraint against the use of e-mail in research collaboration. This further confirmed the appalling state of the power sector in Nigeria. Also, the respondents confirmed that unreliable/ poor internet infrastructure sometimes inhibit their use of e-mail in research activities. This corroborates[30] finding, that projects take advantage of efficient networks to obtain access to precise skills needed, and researchers gain access to the projects that demand their skills. Cost was however never a hindrance to the use of e-mail. This affirms finding[31], that another factor encouraging greater collaboration has been the substantial fall – in real terms – in the cost of communication, especially with the advent of the e-mail in collaborative research.

Job position and benefits of e-mail use in research collaboration

Findings from this study revealed that senior lecturers demonstrated optimal use of e-mail in their research

collaboration, compared to others. These might be adduced to their judicious use of e-mail with its inherent capabilities, as well as taking advantage of e-mail's ready availability at their faculty/college. It was also demonstrated from this study that research collaborators of job positions lecturer I and lecturer II showed significant use of e-mail in their research activities, as they made use of e-mail which was within their reach to further enhance their capacity to collaborate in research activities, thus corroborating[32] finding, that e-mail use in research collaboration empowers budding research collaborators to have access to information that would have been impossible to obtain using conventional methods. Also, the study revealed that the job position of research collaborators has some significant relationships with the benefits they get in email use. Research collaborators who belong to the professor and lecturer II categories reported significant benefits revealing that those that are lecturer II judiciously employed e-mail in collaborative research collaboration as a means of enhancing their publication activities while those that are of professorial position further built on their network of research collaborators to harness e-mail's capabilities to derive optimum benefits.

Factors that influence e-mail use in research collaboration

Job position was the significant highest contributory factor to the use of e-mail in research activities. This further corroborates the findings of earlier studies that much of the growth in e-mail utilization has occurred in educational settings, where e-mail facilities are now commonplace[33-35] as well as confirming the finding of Lyness & Raimond that e-mail technologies have been used to facilitate group work and group interaction[36]. Although, faculty/college, gender, and job position collectively contribute13.8% of change observed in e-mail use in research collaboration, job position was the most significant contributory factor for e-mail use among research collaborators at the University of Ibadan.

Conclusion

The findings from this study have revealed that e-mail use among research collaborators at the University of Ibadan was on the high, with virtually all the collaborators alluding to its productive capabilities, while its benefits was also highlighted significantly. We can deduce from the study that the use of e-mail by the research collaborators has positively impacted on research activities significantly, thus revealing e-mail's inevitability to research collaboration. In spite of these benefits and relevance to research collaboration, there are constraints being experienced by the research collaborators. In this connection, the following recommendations are made:

1. The authority of the University of Ibadan need to create a better enabling environment, especially by installing efficient and effective internet connectivity. This could be through the provision of high speed server and network capacity.
2. A policy should be put in place by the university and/or the departmental authorities, to regulate and monitor email use.
3. The perennial inadequate power supply should be addressed by the university authority. This could be alleviated by developing alternative power sources, aside the diesel-fuelled generators.

References

1. Ehikhamenor F A, The Information Society and Nigerian Print Media, *African Journal of Library Archives & Information Science*, 13 (2) (2003) 187-199.
2. Kalakota R and Whinston A, *Frontiers of electronic commerce*, 1st edn (Addison-Wiley; Reading), 1996.
3. Pauleen D, and Yonng P, Facilitating Virtual tram relationship via internet and conventional communication channels, *Internet research: Electronic networking applications and policies*, 11(3) (2001) 190-202.
4. Kettinger J and Grovers A, The use of computer-mediated communication in an inter-organizational context, *Decision sciences*, 28 (3) (1997) 513-555.
5. Barnes O and Greller K, Computer-mediated communication in the organization, *Communication Education*, 43 (2) (1994) 129-142.
6. Taufer M, Teller P J, Kerstens A and Romero R, Collaborative research tools for students, staff and faculty, Retrieved 10th November, 2007 from: http://www.cs.utep.edu/mtaufer/publications/conferences/sun06/SunConference2006.pdf
7. *Official New Zealand Year Book* (Statistics New Zealand; Wellington), 1998, p.226-7.
8. Lewis G K, Microsoft MAIL: facilitating communication in team projects, *Computers and Composition II*, (1994) 59-70.
9. Foertsch J, The impact of electronic networks on scholarly communication: avenues for research, *Discourse Processes*, 19 (2) (1995) 301-328.
10. Todd N A, Using Email in an undergraduate nursing course to increase critical thinking skills, *Computers in Nursing*, 16 (2) (1998) 115-118.
11. D'Souza P V, The use of electronic mail as an instructional aid: an exploratory study, *Journal of Computer-Based Instruction*, 18 (2) (1991) 106-110.

12. Peckham I, If it ain't broke, why fix it?: Disruptive and constructive computer mediated response group practices, *Computers and Composition*, 13 (2) (1996) 327-339.
13. Mastrian K G, and McGonigle D, Older student perceptions of technology based learning assignments, *On-Line Journal of Nursing Informatics,* Retrieved on 15th August, 2007 from: http://cac.psu.edu/~dxm12/OJNI.html
14. Ward J M, A profile approach to evaluating information systems investments and setting priorities, *Journal of information Technology*, 18(2) (1990) 122-131.
15. Lyness A L, and Raimond J A, Electronic communication to promote consensus-building skills: an innovative strategy, *Journal of Nursing Education*, 31(7) (1992) 331-334.
16. Solomon S J, Corresponding effects: artless writing in the age of e-mail, *Modern Age* (Summer), (1998) p. 319-323.
17. Crawford S J, Hurd J M, Weller A C, From print to electronic: The transformation of scientific communication, *ASIS Monograph Series*, (Medford, New Jersey), 1996, p 15-23.
18. Fakolujo F O, Data retrieval and Use of ICT in Research Collaboration, *Social Studies of Science*, 9 (2) (2006) 418-487.
19. Bamiro A O, Oluleye O O, and Tiamiyu M A, Use of computer and the internet for Research purposes, In: *Methodology of Applied and Basic Research*, 2nd edn (The Postgraduate School, University of Ibadan, Ibadan) 2006, p219.
20. Bernstein A, How can cooperative work tools support dynamic group process? Bridging the specificity frontier, *Proceedings of the CSCW 2000 Conference on Computer Supported Cooperative Work,* (ACM; New York) 2002.
21. Schmidt K, and Simone C, Mind the gap! Towards a unified view of CSCW. *Fourth International Conference on the Design of Cooperative Systems.* (INRIA; France) 2002.
22. Schmidt K, The problem with "awareness". Introductory remarks on "awareness in CSCW", *Computer Supported Work*, 11 (2002) 285-298.
23. Op cit D Souza
24. Op cit Bamiro *et al*
25. Op cit D Souza
26. Op cit Crawford *et al*
27. Op cit Official New Zealand Year Book
28. Op cit Taufer et al
29. Goffman W and Warren K S, *Scientific Information Systems and the Principle of Selectivity*, (Praege; New York), 1980, p127
30. Op cit Fakolujo.
31. Hall S S, Collaboration Dance' in Invisible Frontier: The Race to Synthesize a Human Gene, (Sidgwick and Jackson; London), 1988, p223-225.
32. Katz J S, and Martins B R, *What is Research Collaboration?* Science Policy and Research Evaluation Group, Science Policy Research Unit, (University of Sussex, Falmer, Brighton, UK) 1995.
33. Op cit Lewis
34. Op cit Foertsch
35. Op cit Todd
36. Op cit Lyness & Raimond