Adoption of web-based technologies in pursuit of work productivity and creativity within the public sector in South Africa

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ABSTRACT

This paper reports on the diffusion and adoption of web-based technologies by government departments in KwaZulu-Natal Province in the context of work productivity and creativity. Through a survey, key government departments were sampled through multistage and purposive sampling techniques. Questionnaires that were largely structured were distributed to 260 top, middle and lower management respondents from four government departments in the province, namely, department of Arts and Culture; Home Affairs, Education and Health. The data was analysed using thematic categorisation and tabulation, and the findings were presented descriptively. The study adopted Rogers's theory *(Diffusion of Innovations)* as its theoretical framework. The results show that essential Web-based tools and services are largely available and accessible to the civil servants. The results further depict that most of the civil servants used the Web to communicate among themselves, to disseminate departmental information, and for research purposes. The respondents largely concur that the use of the Web had increased their work productivity and creativity. It is concluded that despite the constraints and challenges encountered in the application and use of the Web in government departments, a wide range of web-based technologies have been adopted to facilitate the sharing and exchange of information in the sector. Whether levels of Web service availability and accessibility are uniform among the civil servants (both management and ordinary staff) requires further investigation.

Key words: web technology, civil servants, World Wide Web, public sector, social informatics

Introduction

The aim of this paper was to assess the diffusion and adoption of web-based technologies by selected government departments in the context of work productivity and creativity in the KwaZulu-Natal Province. With a total area of 94 361 square kilometres, KwaZulu-Natal is roughly the size of Portugal (South African info, 2012). While it is the country's third-smallest province, taking up 7.7% of South Africa's land area, it has the second-largest population, estimated at 10.6-million people in 2010 (South African info, 2012). The terms Internet and Web are often used interchangeably as the Web is widely considered to be part of the Internet. However, there is a difference between the two. Computers around the world communicate via the Internet. The Web makes that communication a fun activity. Therefore the Internet can best be described as a Network of millions of computers that offers information, communication, and wealth of online activities, while the Web may be regarded as a simple way of accessing, sharing or exchanging information over the medium of the Internet by use of Hypertext Transfer

Protocol (HTTP), that is one of the languages spoken over the Internet to transmit data (Mbatha, Ocholla and Le Roux, 2011)

In strengthening this view, Malik (2006: 6) and Deitel and Deitel (2005: 5) describe the Internet as an interconnection of Networks that allows computers around the world to communicate with each other. Basically, the Internet allows computers to be connected and communicate with each other. Conversely, the Web uses software programs that enable computer users to view documents on almost any subject over the Internet with click of a mouse. Undoubtedly, the Internet has become one of the world's leading communication mechanisms (Mbatha and Ocholla, 2011; Mbatha, 2012).
The study on web technology is relevant to modern development, particularly in Africa, where the needs and use of ICTs is either low or less developed and also where embracing information society and knowledge society as a new way of life is a major challenge (Mbatha, Ocholla, and Le Roux, 2011; Mbatha, 2009: 83). The web has been described by numerous researchers as a catalyst for improving work productivity and creativity, especially in public offices (Carol, 1998; Kling, 2000 and Mbatha, 2009: 83). While these are true reflections of enhancing the interaction and impact of the Web in the world, it is doubtful whether web interaction and web impact on work environments such as government departments, being the largest formal occupation in most countries, including the KwaZulu-Natal is considered. Thus, it is doubtful whether the social dimensions of the web-based services in workplaces are sufficiently accounted for.

The characteristics and role of the web are widely discussed in many studies. For instance, Mbatha (2009) and Kling (2000) concur that the web is the technology that facilitates the sharing of information and increase the functionality of communication between different individuals and groups of people throughout the world, the web increases productivity, is a tool for teamwork, a vehicle for organisational communication, and a tool to aid decision making processes. Teamwork is one of the web's main growth areas, often referred to as CSCW: computer-supported co-operative work. The assumption in this domain is that the Web may be used to facilitate collaborations over long distances. Frequently, this involves "virtual teams" which spearhead the development of networked organizations (Mbatha, Ocholla and Le Roux, 2011). In support of the above mentioned views, Kling (2000: 217) argues that the Web enables people and organisations to extend their abilities in accessing data and in communicating, and it enables people and organisations to reduce some of the communicational restrictions of space and time.

Mbatha (2009) and Mann (2011) are of the view that the web has brought about a dramatic reduction in the cost and time involved in storing, processing and transmitting information, leading to a fundamental reshaping of the labour market and society as a whole. They add that the resultant shift in the structure of skills, work patterns, companies, goods and services makes very different and new demands on workers and employers: flexibility, trust, commitment and ability to anticipate and harness change. Thus, they opine that Web has a powerful capacity to shrink distance and improve access to information and services. In advancing these views, Kling (2000) is of the view that the web plays a key role in the economic and social developments of each country by improving the efficiency and effectiveness of public administration, business and other activities.

Theoretical framework

Roger's diffusion theory was found useful as the study sought to understand the diffusion and use of modern ICTs by SME service providers. Clarke (1999) notes that Roger's theory has been used as the theoretical basis on a number of information systems projects. Clarke further asserts that the theory has also been widely applied to investigate diffusion of organisational and societal innovations. Thus, the theory's application to information technology and organisational and societal relations makes it the most appropriate framework for this article. The *Diffusion of Innovations Theory* (DoI) is one of the theories that explain the acceptance of technology. In his comprehensive book *Diffusion of Innovation*, Rogers (1995) defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. Roger's definition contains four elements that are present in the diffusion of innovation process, namely: innovation, communication channels, time, and the social system.

In order to understand the definition of DoI one needs to first understand some key terms. The diffusion of an innovation concerns: 'the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers 1995). The DoI is essentially a social process in which subjectively perceived information about a new idea is communicated and rests on the premise that a new idea, practice or object has perceivable channels, time and mode of being adopted by individual or organisations (Rogers, 1983). Clarke (1999: 1) notes that the theory purports to describe the patterns of adoption, explain the mechanisms, and assists in predicting whether and how a new innovation will be successful. Clarke sums it up by pointing out that the theory is concerned with the manner in which a new technological idea, artifact or technique, or a new use of an old one, migrates from creation to use. Rogers (2003) argues that those innovations which are perceived by individuals as having greater relative advantage, compatibility, trial-ability and observability will be adopted more rapidly than those which are perceived as more complex. Rogers (1995) proposed a model of the innovation-decision adoption process that emphasises the role of individual behaviour in the technology adoption process. It is worth mentioning that the model relates to actions and choices during which an individual evaluates a new innovation and decides whether or not to incorporate it into an ongoing practice.

Methodology

A survey targeting key government departments was used to collect data. Because of the diverse and dispersed nature of the public sector in South Africa, the study narrowed its scope to government departments in KwaZulu-Natal. In order to obtain a representative sample, the systematic sampling method was applied. In this technique, five out of eleven suitable district municipalities were selected, where every second district from a list was taken. The sample size for the whole study was two hundred and sixty (260) managers. One hundred and fifty two (152) questionnaires were completed and returned. The five (5) district municipalities selected were uMgungundlovu, uMzinyathi, Zululand, uThungulu, and Sisonke. In these districts, four government departments were targeted—the Departments of Arts and Culture, Home Affairs, Education, and Health. These departments were sampled using purposive and systematic sampling techniques. Three selection strategies were used: i) Identifying highly dispersed and

service-intensive departments; ii) Categorising the personnel in the selected departments into top, medium and lower level management; and iii) Dividing the service areas into rural or urban-based centers. Empirical data of the survey was analyzed using largely descriptive statistics and with the help of statistical package of social sciences.

In terms of ethical considerations, informed consent was obtained from each participant in the study in order to ensure that they understood what they were doing and verify their willingness to participate. The respondents were assured of their rights, including the right of consent, protection from disclosure of information, and respect for their privacy. All the research participants voluntarily participated and were not forced to take part in the study. With regard to protection from harm, the researcher ensured that the participants were not at any risk and would not be exposed to embarrassment, unusual stress, or any demeaning treatment. Anonymity and confidentiality were promised and maintained. The information they provided was not made available to anyone else who was not directly involved in the study and cannot be traced back to the participants. In terms of professional standards, the researcher ensured that the results were gathered in a professional manner without misrepresenting anyone and/or intentionally misleading the respondents about the nature of the study. The researcher ensured that all the findings were presented honestly without fabricating any data to support any particular finding. The researcher also adhered to the institutional guidelines on conducting research.

Results and discussion

The results are reported under the following headings: characteristics of the respondents, purpose for using web-based applications, respondents' level of interaction with web-based services, effective web-based services for work purposes, web-based applications that are increasing in work productivity and creativity, civil servants' web-based training needs, and challenges faced by civil servants in the use of the web for work purposes.

Characteristics of respondents
In terms of job titles, the respondents ranged from assistant managers to district managers, with the majority (33; 22 %) holding the position of assistant manager. Most of the respondents (66; 43 %) had bachelor degrees. A study by Ayoo (2001) established that most professionals above the age of 40 years in developing countries are often conservative and slow in keeping pace with ICT advancements. This study established that a large number of respondents were between the ages of 40 to 49 (47 %), followed by respondents in the 30 - 39 year age group (28 %). Respondents in the age group of over 50 years and those between 20–and 29 ranked third and fourth respectively. It was also vital to assess gender proportionality in the study, as it is a widely held view that males dominate use and access to ICTs. Earlier studies have identified women and girls as disadvantaged in their uptake of ICTs (Botha, Small, and Crutchley, 2001; Ngenge, 2003). Likewise, Cullen (2001) found that disparities in the use of ICTs are much greater in Africa, with the involvement of women being as low as 5 %. Similarly, Majanja and Kiplang'at (2003) have also suggested that gender disparity among professionals in Africa can be attributed partly to the educational system and partly to factors inherent in society at large. This issue is revised by Shaw and Gant (2002), who argued that it has been empirically proven

that women and men differ in their attitudes towards, comfort with, and anxiety with respect to computer technology. The results of the study indicate that there was clear male dominance (89; 59 %) in the sample population. In terms of the level of management, most of the respondents (68; 45 %) were top managers.

Purpose for using web-based services

The respondents were asked to indicate the purpose for which they use web-based services for. The respondents were provided with a list of web-based services and asked to rate each one of them on a scale of 1 to 4 as was applicable to their situations (1=strongly agree; 2=agree; 3=disagree and 4=strongly disagree). In addition, the respondents were asked to indicate any other purpose not listed and thus multiple responses were generated as presented in Table 1 below.

Table 1: Purpose for using web-based services (N=152)

Web-based services	Strongly agree	Agree	Disagree	Strongly disagree	Mean
	1	2	3	4	
To communicate with colleagues	152(100%)	-	-	-	1
To disseminate departmental info.	121(80%)	31(20%)	-	-	1.20
For Information retrieval	113(74%)	14(9%)	25(16%)	-	1.42
For research purposes	35(23%)	102(67%)	15(10%)	-	1.86
For marketing purposes	19(13%)	18(12%)	24(16%)	91(59%)	3.23
For e-banking	11(7%)	42(28%)	89(59%)	10(6%)	2.64
For e-learning	2(1%)	9(6%)	19(13%)	122(80%)	3.71
For e-commerce	-	8(5%)	114(75%)	30(20%)	2.94

The table above depicts that all the respondents (152; 100%) used the web to communicate with fellow colleagues. The table further demonstrate that those who used the web to disseminate their departmental information were also significant (121; 80%). Also, (113; 74%) of the respondents used the web to retrieve information. Likewise, those who used the web for research purposes were also significant, at total rating of 137 (90%) at the combined levels 1 and 2 as they are both positive phenomenon. These findings concur with Kling (2000) who posits that the web is the technology that facilitates the sharing of information and increases the functionality of communication between different individuals and groups of people throughout the world.

According to Paliouras et al. (2004), the web can be regarded as sources of information that can be turned into valuable knowledge for individuals and organizations. Mbatha (2012) asserts that the web can be useful in helping employees perform their jobs better, while Stanton (2002) provides a good example of this while researching a sample of professional engineers, finding that employees that used the web more frequently than their counterparts contributed

higher to the organisation because they had access to information that helped them perform their jobs better. These results concur with numerous researchers such as Entorf and Kramarz (1998); Forestier, Jeremy and Kenny (2002) and Kenny (2002) who pointed out that the escalation of the web has had a considerable impact on the way governments function.

The level of interaction with web-based services

It is believed that if the level of interaction with web-based services is high, the level of work productivity and creativity would also improve, and civil service success would be achieved. The respondents were asked to indicate their level of interaction with web-based services in their respective departments. The aim was to establish the extent to which the civil servants interact with the web for work purposes. The respondents were provided with a list of possible web-based activities and asked to rate each one of them accordingly on the Likert scale of 1 to 5 as was applicable to their situations (1=very high; 2=high; 3=satisfactory; 4=low; and 5=very low). Table 2 below summarises the responses.

Table 2: The level of interaction with web-based services (N=152)

Web services	V-High	High	Satisfactory	Low	V-Low	Mean
E-mail	133 (87%)	19 (13%)	-	-	-	1.12
Info. searching	102 (67%)	35 (23%)	15 (10%)	-	-	1.42
Online databases	40 (26%)	21 (14%)	77 (51%)	9 (6%)	5(3%)	2.46
E-commerce	-	3 (2%)	12(9%)	16 (10%)	121(79%)	4.67
E-banking	-	-	9 (6%)	10 (7%)	133 (87%)	4.81

Going with the results on the table above, it can be concluded that e-mail is highly used in government departments. This is evident by combining positive phenomenon, i.e. levels 1 and 2 which adds up to 152 (100%). Likewise, 102 (67%) of the respondents interact intensely with the web to search for information. Similarly, the number of respondents who felt that their interaction with online databases was very high were 40 (26%). Interestingly, e-commerce and e-banking are used relatively less by the majority of respondents 121 (79%) and 133 (87%) respectively. These results confirm what Rogers theory postulates that those innovations which are perceived by individuals as having greater relative advantage, compatibility, trial-ability and observability will be adopted more rapidly than those which are perceived as more complex. Therefore, it can be concluded that the main reason for civil servants to use e-mail more than any other web applications is because it has greater relative advantage and is not complex.

It is important to note that e-commerce, e-banking, and online databases are some of the web-based services that civil servants could use to improve work productivity and creative in their respective departments. However, the study established that these applications are used considerably less. While one understands the nature of government departments, it should be noted that these web-based services are some of the best innovations civil servants may adopt in order to improve work productivity and creativity in the sector. As Roger's theory lucidly put it, some of the innovations lie dormant for decades not because they are useless, but because of the users' perceptions towards that particular innovation.

Effective web-based services for work purposes

Table 3 below indicates responses to the question 'which web-based services do you consider effective in your work?' The respondents were provided with a list of web-based services and asked to rate each one of them on a scale of 1 to 5 as was applicable to their situations (1=very effective; 2=effective; 3=not sure; 4=less effective and 5=not effective). Table 3 below summarises the responses.

Table 3: Effective web-based services for work purposes (N=152)

Web services	Very effective	Effective	Not sure	Less effective	Not effective	Mean
E-mails	152 (100%)	-	-	-	-	1
E-banking	8 (5%)	11 (7%)	133 (88%)	-	-	2.82
E-commerce	9 (6%)	20 (13%)	115 (76%)	8 (5%)	-	2.80
Online databases	117 (77%)	13 (9%)	7(5%)	10(7%)	5(3%)	1.50

Interestingly, from the above table, it can be seen that all the respondents (152; 100%) indicated that e-mail was very effective in their work. Also a significant number of the respondents indicated that there were not sure whether e-commerce (115; 76%) and e-banking (133; 88%) were effective or ineffective in executing their work. These results may be attributed to the fact that the majority of respondents (121; 79%) indicated on Table 2 that their interaction with e-commerce was very low. Also another point worth mentioning is that the majority of respondents (133; 87%) revealed on Table 2 that their interaction with e-banking was very low.

These results confirm that some inventions like the e-mail 'take the world by storm' while others (e.g. e-commerce and e-banking) seem to fail. Others (like e-learning), lie dormant for decades, but when their 'time comes,' their use spreads rapidly, even explosively. Conversely, most new innovations (depending on their purpose, need and acceptance) often achieve slow penetration at first, but then grow quickly as their adoption and rate of use increases. Others may grow fast in the beginning but slow down as their use is exceeded by newer, simpler and cheaper technology. A good example here is the use of broadband Internet access. Its adoption and utilisation is directly related to its availability, speed and affordability, both to government departments and the general public. As already indicated in the theory, innovations are more readily adopted when they provide a relative advantage compared to older ideas, and even more so if they are compatible with the existing value system of the adopter. Numerous researchers such as Kling (2000) and West (2005) have pointed out that the escalation of ICTs has had a considerable impact on the way governments function. In his study, West (2005) supported by Mbatha, Ocholla and Le Roux (2011) further observes that the use of ICTs in government (or e-government) is on the rise with 19 percent of all government organisations worldwide offering online services and South Africa is no exception.

An earlier study conducted by Kling (2000) on the use of ICTs in organizational and societal contexts established that there is a correlation between the use of the web and the

increase in work productivity and creativity. Kling (2000) further argues that the web enables people and organisations to extend their abilities in accessing data and in communicating, and in enabling people and organisations to overcome some of the communicational restrictions of space and time. The web has brought about a dramatic reduction in the cost and time involved in storing, processing and transmitting information, leading to a fundamental reshaping of the public sector and society as a whole, and is generating changes in markets, private and public sectors, and economies in the more and less developed world (Castells, 2000; Kling, 2000; OECD, 2003).

Training needs on web-based services

In order to be able to use any technology effectively, a person must be well equipped with the skills necessary to use that technology. Therefore one of the objectives of this study was to identify the type of web-based service training that would equip civil servants with the skills necessary to effectively use web-based applications for service delivery and also to improve work productivity and creativity in their respective work departments. The respondents were provided with web training needs and asked to rate each one of them on the scale of 1 (strongly agree) through 4 (strongly disagree) as was applicable to their situations. Table 4 below summarises the responses.

Table 4: Training needs on web-based services (n=152)

Training needs	Strongly agree	Agree	Disagree	Strongly disagree	Mean
	1	2	3	4	
E-commerce	115(76%)	24 (16%)	13 (8%)	-	1.32
E-government	114 (75%)	38(25%)	-	-	1.25
Info. retrieval	113(74%)	14(9%)	25(17%)	-	1.42
Online databases	101(66%)	30(20%)	21 (14%)	-	1.47
E-banking	99(65%)	42(28%)	11(7%)	-	1.42
E-learning	57(38%)	44(29%)	31(20%)	20 (13%)	2.09
E-mail	-	25(16%)	127(84%)	-	2.83

The results above indicate that majority of the respondents (115; 76%) needed training on e-commerce, followed by e-government (111; 75%), information retrieval (113; 74%), online databases (101; 66%), internet banking (99; 65%), and e-learning (57; 38%) respectively. The issue of web skills has always been a serious one in many countries, and South Africa is no exception. This is evident in the number of civil servants who indicated different areas of training that they required in order to help them interact with web-based service more often and more effectively. The results of the survey indicate that training on e-mails was not necessary, as was revealed by a significant number of the respondents (127; 84%). As all the respondents were managers, one would be tempted to say they had to lead by example and be the first to adopt 'newer' technologies in the sector. One would expect to see all the civil servants properly trained to use the web more effectively. Civil servants also need computer training to ensure that they

keep up with the information society. This view is shared by Petty (2007), who observes that due to the government's continuous striving towards the e-government culture, civil servants have to be involved in the ICDL (International Computer Driving Licence) programs that will help them acquire the IT skills required to assist the public.

Challenges on web-based services

The study sought to identify the main barriers that prevent the civil servants from using web-based services more effectively. The most popular obstacles cited by the civil servants include: the need for adequate and well structured planning; the need to make funds available for the purchase of all the necessary ICT facilities and resources; and lack of the necessary skills' set. The issue of planning revealed here is crucial as embarking on any new innovation requires adequate planning**.** Tella (2007) is of the opinion that adequate and proper planning usually results in success. Tella (2007) further argues that institutions that fail to plan before embarking on a particular programme usually end up in a deadlock. In other words, 'fail to plan is to plan to fail' (Tella, 2007). A significant number of the respondents indicated that a lack web skills was hampering their interaction with ICTs. In their study, Mbatha, Ocholla and Le Roux (2011) argue that without the right human capacity, the ICTs would lack someone to operate them, use them, or make minor repairs. It should be noted that civil servants, more especially those operating in management positions, are required to have a fairly broad and extensive knowledge of ICTs. Mbatha, Ocholla and Le Roux (2011) further assert that as leaders, managers should be effective users of the technologies. In support of the above views, Ghana Resource Centre (2008) emphasizes that training sessions for civil servants should be conducted so that they can use the acquired ICT knowledge and skills in their daily work and activities. Petty (2007) concurs with these views that due to governments' continuous move towards the e-government culture, civil servants have to be involved in programs that will help them serve the public effectively with the ICT-related services they require.

Many studies have examined barriers to the adoption and diffusion of e-government. Ebrahim and Irani (2005) provided a review of the barriers to e-government adoption in literature using five dimensions: IT infrastructure, security and privacy, IT skills, and organizational and operational costs. Similarly, Lam (2005) also identified these barriers and organised them in four categories, namely strategy, technology, policy and organisation. Likewise, Vassilakis, Lepouras, Fraser, Haston and Georgiadis' (2005) study of stakeholders in G2E and G2C e-Government categories documented five categories of barriers to e-government adoption and use, in order of perceived importance, as follows: legislative, user-related, administrative, technological and social barriers. Gilbert, Balestrini, and Littleboy (2004) reported e-government adoption barriers to be end users' attitudes towards online trust relationship establishment, the security of financial data and quality of the information provided, skills, and time and money as adoption benefit factors in predicting the potential use of e-government.

Conclusion

The aim of this study was to examine the diffusion and adoption of web-based technologies by civil servants in selected government departments in KwaZulu-Natal Province in the context of work productivity and creativity. The web is strategically important factor for social and economic changes. In addition, it is a tool to provide people with more convenient access to information and services. A wide range of web-based services have been adopted in government departments to facilitate the sharing and exchange of information. Interpreted in light of the "Diffusion of Innovation Theory" (Rogers 1995: 5), the results suggest that web-based services that were perceived to have relative advantage and that were more compatible with their existing values, past experiences and needs, were adopted faster. For example, e-mails had a faster rate of diffusion among the respondents. Despite efforts to expand and modernize web-based services within government departments, their growth has been hampered by a number of constraints and challenges. Among them are inadequate skills development, and the lack of a comprehensive national and departmental ICT policy.

This paper has demonstrated the importance of web-based services in government departments and also various interventions needed to effectively propel civil servants to partake in the emerging information economy. For this to be realized, a number of measures are needed that include among others the enactment of an enabling policy and legislative framework to cater for skills development, and policy framework. Needless to say, the web plays a crucial role in speeding up the flow of information and knowledge in government departments as well as transforming the way in which government and citizens directly interact effectively and efficiently. The web has proved to be key catalysts in increasing work productivity and creativity in the public sector. The web has also brought about a dramatic reduction in the cost and time involved in storing, processing and transmitting information, leading to a fundamentally reshaping of government departments and society as a whole. While a number of constraints could be addressed at departmental level, others may need to be addressed at national level. There is an urgent need to address these problems in order to enhance the diffusion of ICTs in the public sector. This requires the intervention and interaction of all stakeholders in the public sector and also in the ICT sector. The impact of the web is already felt, particularly in the dramatic reduction in the cost and time involved in storing, processing and transmitting information, leading to a fundamental reshaping of the labour market and society as a whole. ICTs are generating changes and advancing in every area of economic, social, and political activity in markets, private and public sectors, and economies in the more- and less-developed world.

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Dr. Blessing Mbatha is a Section Head of Public Relations Diploma and Senior Lecturer at the University of South Africa in the Department of Communication Science. His research and teaching interests -- where he has published and supervised several postgraduate students - include: new media studies; Information and Communication Technology, e-government, e-commerce, e-learning, public relations, organisational communication, information needs and seeking, computer mediated communication, HIV and AIDS, and information and knowledge management.

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