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ANALYZING THE INFLUENCE OF DIFFUSION OF INNOVATION ATTRIBUTES ON LECTURERS' ATTITUDES TOWARD INFORMATION AND COMMUNICATION TECHNOLOGIES

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Abstract: *This study investigated the influence of the five attributes of diffusion of innovation theory—relative advantage, complexity, compatibility, trialability, and observability—on lecturers' use of information and communication technologies. A structured questionnaire was used to collect data from 213 lecturers across the seven faculties and one institute at the National University of Lesotho (NUL). Cronbach's alpha reliability coefficient was used to determine the internal consistency of the instrument; the reliability of the multiple item scales ranged between 0.71 and 0.97. Collected data were first structured into grouped frequency distributions, and stepwise multiple regressions were used to test the five hypotheses formulated. At 0.05 level of significance, the attributes relative advantage, complexity, and observability were found to have a positive influence on attitude of lecturers toward using ICTs, with observability having the highest influence. To enhance widespread use of ICTs, it is recommended that NUL's administration organize relevant training and deploy user-friendly ICTs.*

Keywords: *ICT adoption, National University of Lesotho, diffusion of innovation, ICT use, university lecturers.*

INTRODUCTION

The pervasiveness of information and communication technologies (ICTs) has brought about rapid technological, social, political, and economic transformation, which has eventuated in a network society organized around ICTs (Yusuf, 2005). E-learning is currently becoming one of the most common applications of ICTs, with online teaching offered via Web-based systems to students both on and off campus. Considering the role of education in nation building (van Ginkel, 2001) and the exploding secondary school population in some African countries that is expected to impact future higher education enrollment, the use of ICTs in the

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teaching–learning process becomes imperative. This is true because its adoption by the teachers will enhance effective teaching (Isaacs, 2007). Issues such as good course organization, effective class management, content creation, self-assessment, self-study collaborative learning, task-oriented activities, and effective communication between the actors in the teaching–learning process and research activities will be enhanced by the use of ICT-based technology. These trends strongly indicate that the era of teachers without ICT skills is gone. Classroom teachers with adequate and professional skills in ICT utilization will find their students performing better in learning, because modern technology offers many means of improving teaching and learning in the classroom (Lefebvre, Deaudelin, & Loiselle, 2006). ICT facilities used in the teaching–learning process in schools, according to Bandele (2006), Babajide & Bolaji (2003), and Ofodu (2007), include radio, television, computers, overhead projectors, optical fibers, fax machines, CD-Rom, the Internet, electronic notice boards, slides, digital multimedia, and video/VCD machines.

One major trend of educational reform is geared toward teachers and students acquiring and using information technology as a valuable asset to the learning process. Growing interest in the integration of information and communication technologies (ICTs) into classrooms is based on assumptions that successful integration will offer a wide spectrum of valuable benefits for teaching and learning (Cope & Ward, 2002; Naidu, Cunnington, & Jasen, 2002). However, although the availability of ICT use in schools has increased, all the envisaged gains have not always been achieved (Gobbo & Girardi, 2001). This is because when ICTs enter the sociocultural setting of the school, they may trigger changes in the activities, curriculum, and interpersonal relationships in the learning environment, and are reciprocally affected by the very changes they cause (Salomon, 1993).

Sife, Lwoga, and Sanga (2007), Isaacs (2007), and Farrell, Isaacs, and Trucano (2007) argued that, particularly in many developing countries, ICTs have not permeated higher education learning as needed, due to various socioeconomic, technological, and infrastructure circumstances. They noted that although some institutions of higher learning have achieved much in particular academic areas, they remain challenged by the ICT adoption process. The challenges reflect deficiencies in several areas: a systems approach to learning, awareness of and attitudes toward ICTs, administrative and technical support, staff development, personal ownership of technologies, inadequate funds, and the transforming process in higher education.

Public expectations for ICTs and educational systems have increased with the ubiquity of digital technologies in daily life. Currently, the discourse has been predominantly instrumental, focusing on skills and the use of ICTs in the service of the curriculum and instruction. Despite the fact that computers have been available widely in educational settings in some developing countries, particularly in Africa, for more than two decades, teachers are neither confident nor competent users of ICTs. Studies by Kerrey & Isakson (2000) and Wang and Liu (2005), for instance, indicated that many practicing teachers feel unprepared to use ICTs in their classrooms, with Wang and Liu (2005) underscoring that many student teachers have low self-efficacy and negative attitudes toward ICTs. These findings represent a major concern in that both corporations and institutions of higher learning increasingly are adopting ICTs as tools for learning, collaboration, communication, curriculum development, and staff development. The implications of ICT use in education and training become ever more critical today since new means of improving instructional methods are triggering a change in the delivery of education (Pajo & Wallace, 2001). Undoubtedly, ICTs make access to education more flexible and reduce

the barriers of time and place. Asynchronous Web-based technologies, for example, can advance the effectiveness of learning by bringing learners into contact with learning peers from around the world (Lea, Rogers, & Postmes, 2002). In addition, ICTs and their access to diverse knowledge resources and applications can also enhance the quality of university teaching and research. Many developing countries in the Southern African Development Community region are following the lead of industrialized countries in efforts to restructure their educational practices through utilizing the potential of ICTs. It is expected that ICTs will improve the quality of learning, motivate students, allow them to exercise complex skills needed for professional careers, and make accessible the extended knowledge resources of the Internet, which, taken together, facilitate the development of agency needed for mastering the future (Bose, 2004; Bose & Tsayang, 2005; Ramharai & Goodoory, 2003; Senteni, 2005).

Despite its poor ICT infrastructure and high levels of poverty, Lesotho has begun to take the necessary steps toward promoting higher levels of ICT access and usage in its communities and education institutions. The Government of Lesotho has adopted a national ICT policy that makes some references to the education sector. Since 2007, the NEPAD eSchools Demo Project in Lesotho has been a catalyst in focusing attention on the potential that ICTs hold for enhancing education in the country (Isaacs, 2007). Lesotho has three main institutions of higher learning, although the National University of Lesotho (NUL), established in 1975, is the country's only university.[1] According to Isaacs (2007) and the *World Factbook* (2012), Lesotho has a severely underdeveloped ICT infrastructure. Although Lesotho does not have an explicit independent national policy on ICTs in education, the government adopted a National ICT Policy in 2005 in which are embedded considerable references to and implications for the education sector (Isaacs, 2007). Lesotho also has an education strategy that includes the role of ICTs. The National ICT Policy highlights ICTs as tools to enable the country to achieve its development goals, as articulated in the Lesotho Vision 2020 policy document Ministry of Development Planning, 2003) and the Poverty Reduction Strategy papers (World Bank, 2000). The Vision of the policy also provides a brief stakeholder analysis and the roles that are expected in realizing the policy goals. It identifies 10 catalysts in the implementation of the policy, which include education and human resource development as well as health, agriculture and food security, tourism, gender, and youth (Isaacs, 2007).

The Vision policy's goal is to create a knowledge-based society within Lesotho that is fully integrated into the global economy by 2020. This vision anticipates, by 2015, the successful development and deployment of ICTs that will respond to national needs and priorities, reduce inequalities between the sexes, decrease the digital divide between urban and rural areas and the haves and have-nots, improve governance and deepen democracy, develop the human capacity needed to drive and sustain an information economy, and support economic activities at home and throughout the world. To achieve this mission, the goal is to integrate fully ICTs throughout all sectors of the economy, thereby achieving rapid, sustainable socioeconomic development.

Some of the strategies toward this end, as Isaacs (2007) noted, include investing in ICT education and human resource development by

- requiring the availability of ICT literacy and training programs throughout the education system and within the public at large;
- growing the resource pool of ICT professionals with standardized skill sets and ensuring that appropriate incentives are in place to retain these workers;

- encouraging lifelong learning among the population at large and promoting on-the-job training and retraining within the public and private sectors; and
- promoting electronic distance learning to maximize scarce resources and expand access to educational training and research.

Educational institutions also feature among the key stakeholders identified to play a role in realizing the policy by improving teaching and learning mechanisms that promote ICT literacy and produce local ICT products and services. These institutions should ensure that ICT literacy is part of the core curriculum and they must use ICTs to expand access to education as well as improve the quality of education. The policy proposed investment in ICTs at all levels of formal education, and that policy efforts be directed toward use of ICTs to facilitate lifelong learning and to support efforts of the private sector in its delivery of on-the-job training and retraining programs (Isaacs, 2007).

It is in this connection that NUL has attempted to fulfill its ICT initiatives. In January 1994, a feasibility study was initiated to determine the worth of establishing the Thomas Mafolo Library Information Systems. This was completed in January 1996, leading to the establishment of the Library, followed by the implementation phase in which 41 data points of a local area network and an integrated library management system were installed. The main library is connected to the campus-wide network; all library computers have full Internet connection. The library also subscribes to a large number of databases and full-text electronic publications, and provides online access to students and faculty members. In addition, a Technology Enhanced Learning Initiative of Southern Africa was established in the form of a telecenter at the Institute for Extra Mural Studies based at NUL with the aim of providing access to ICT facilities, but the project is no longer functional as of the time of this study.

Despite the progress in some important areas of ICT access in educational resources, and the fact that faculty members have ready access to some ICTs through the library, a key challenge for NUL remains: getting ICTs into the hands of lecturers and equipping them to use the technologies for teaching, research, and other functions. The responsibility for the ICT-use situation at NUL, specifically the support for teaching, learning, research, and administrative activities, as well as staff training, falls to the Computer Service Unit. Even with the support services provided by this unit and NUL's huge investment in its ICT infrastructure within a tight budget environment, the cost effectiveness of the ICT infrastructure has been neither monitored nor evaluated. The actual number of lecturers who are competent in ICT use and the extent to which they optimize ICTs for teaching and other functions is unknown. In addition, the factors that could influence the attitude of lecturers in ICT adoption remain unidentified, at least empirically, creating a gap that this study hopes to fill in supporting NUL's success in its vision for quality in higher education.

PRIOR RESEARCH ON ICT USE

With the ongoing development of ICTs and diversification in the fields they affect, theoretical studies have been carried out in order to ensure a better understanding concerning their diffusion, adoption, acceptance, and usage (Davis, 1989; Rogers, 2003; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003; Yi, Jackson, Park, & Probst, 2006). In his diffusion of innovation (DoI) theory, Rogers (2003) mentioned

that the rate of adoption is partially influenced by perceived attributes, namely, relative advantage, compatibility, trialability, complexity, and observability as innovation characteristics. Four of these characteristics—relative advantage, compatibility, trialability, and observability, as perceived by members of a social system—are positively related to the rate of adoption. However, the complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption.

The theory is used to explain DoI in numerous fields, such as medicine, agriculture, and information technologies. Rogers (2003, p. 223) stated, "The first research on attributes of innovation and their rate of adoption was conducted with farmers, but studies of teachers and school administrators suggested that similar attributes predict the rate of adoption for educational innovation." Bussey, Dormody, and VanLeeuwen (2000) stated that the strongest predictor of the level of adoption of technology education was the teacher's perception of the attributes of technology education. They also concluded that Rogers' theory of perceived attributes could be a valuable tool for instructional developers working to increase the utilization of their products.

Although a consensus has formed on the idea that certain innovation characteristics have predictive power, there is disagreement about which characteristics are predictive. For instance, Aşkar, Usluel, and Mumcu (2006) stated that complexity is a commonly perceived innovation characteristic for preparation, teaching delivery, and managerial tasks in schools; observability is a perceived attribute in teaching delivery in some specific tasks performed during the class period; and relative advantage and compatibility are important for teaching preparation tasks. Yi et al. (2006) concluded that prior studies provided evidence that relative advantage, complexity, result demonstrability, and image are among the most important factors in predicting users' intentions to use technology. In a study carried out in Brazil on the use of the Internet as an instructional tool, Martins, Steil, and Todesco (2004) found that the two most significant predictors are trialability and observability. Mumcu (2004) highlighted in her research that there is a positive relationship between relative advantage, compatibility, and visibility and the use of ICTs in vocational and technical schools. Surry and Gustafson (1994) concluded that compatibility, complexity, and relative advantage could be important considerations when introducing an innovation into instructional settings.

The diffusion and adoption patterns of an innovation are functions of several interrelated elements involving the innovation, the individual, and the environment. In his innovation decision process, Rogers (1983, 1995, 2003) identified four primary components: (a) the innovation itself, (b) communication channels, (c) social system, and (d) time, which interact to describe how individual adoptions combine to represent diffusion. In this current study, we concentrate on the five key elements that affect both individual adoption and the larger collective diffusion of the innovation as identified by Rogers (1995), namely: relative advantage, compatibility, complexity, trialability, and observability. Each is described as follows:

> The relative advantage of an innovation is an individual's perception that the innovation will be better, when compared to similar ideas, products, or practices. Those innovations that are perceived to be better will be adopted more rapidly.
>
> Compatibility is the perception that a particular innovation is similar and congruent with existing understandings of similar or past ideas, products, or practices. Innovations that fit into an individual's existing understanding or schema will be more easily adopted.

Complexity refers to the perception of how difficult the innovation is to comprehend. It is hypothesized to be negatively related to the rate of adoption of an innovation (Rogers, 1995). In other words, if an innovation is found to be too complex, it is not easily adopted. Therefore, in this study, we took the alternative perspective of this construct, hypothesizing that if an innovation is easy to use, it is more likely to be adopted.

Trialability refers to an individual's access to an innovation for experimentation before adoption and use.

Observability is characterized by how available and visible an innovation is to an individual. The idea behind observability is similar to unspoken peer pressure: If influential others possess an innovation, the observer is more likely to adopt it as well. Observability leads to a social threshold at the point where an innovation becomes so pervasive and/or desirable in a culture that even those who would not normally be a user of an innovation consider adopting the product.

However, despite the fact that many researchers agree that some characteristics are typically associated with innovation adoption, and that the five included in this study are among the most commonly cited, some scholars raise concern in regard to how many researchers have approached the study of these characteristics. The nature of research biases, particularly as they apply to individual adoption choices, raise important considerations in our approach to the challenge of ICT adoption by faculty at NUL. The pro-innovation bias, characterized as the assumption that all innovations are good and thus should be adopted by all members of a community (Haider & Kreps, 2004; Jeyaraj, Rottman, & Lacity, 2006; Rogers, 1991, 1995), is a significant concern. In our study, we sought to test the possible influence of each of the five attributes of innovation diffusion defined above on potential users' attitudes, and thus intention to use ICT without the assumption that the individuals would perceive the technologies or their implementation as inherently good and important for uptake and use. Therefore, considering the fact that more than half of NUL's lecturers have not integrated ICTs into their teaching (Isaacs, 2007), we hypothesize as follows:

Hypothesis 1: The relative advantage of using ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 2: The complexity (i.e., ease) of the use of ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 3: The compatibility of ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 4: The trialability of ICTs will not positively affect the attitude of lecturers toward using the technology.

Hypothesis 5: The observability of ICTs will not positively affect the attitude of lecturers toward using the technology.

The remainder of this paper is structured as follows: The next section details the methodological approaches adopted, then the results are presented, which are followed by a discussion of the findings. The study's implications and suggestions for future studies conclude the paper.

METHOD

Research Design, Sampling and Instrumentation

A survey research design was adopted. The study was conducted at NUL, with the study population comprising all full-time lecturers in all academic departments (33 departments within 7 faculties, and a separate education institute), except those either in managerial positions or on sabbatical leave. A complete enumeration of the study population was carried out, whereby all qualified members of the population were included in the study. According to Aina and Ajiferuke (2002), four variables determine the sample size: the size of the population, the variations in the characteristics being measured, the number of ways in which data is to be stratified in the analysis, and the precision required of the data. In the case of this study, we considered the population not too large, hence a total enumeration of the population was carried out, bearing in mind that the larger the sample, as a proportion of the total population, the more reliable the results (Aina & Ajiferuke, 2002; Leech, Barrett, & Morgan, 2005).

A structured questionnaire, divided into two sections, was used for data collection. A 4-point Likert scale was used in designing the questions. Section A of the questionnaire comprised closed-ended questions on the demographic characteristics of the respondents; Section B collected data on the influence of the five constructs of DoI theory on the lecturers' adoption and use of ICTs. No open-ended questions were included in the survey instrument.

Before the questionnaire was distributed, five local experts in ICT research examined it. Their comments to clarify the instrument were integrated to arrive at the final version. Cronbach's alpha coefficient was used to determine the internal consistency and reliability of the multiple item scales (see Table 1), with a value over .70 indicating acceptability, over .80 indicating good, and excellence when over .90. The questionnaire is provided in the Appendix.

Data Collection and Analysis

Data were collected in January and February 2010. The questionnaire was distributed by the researchers to the 250 eligible lecturers in NUL's seven faculties and one research institute. Each survey instrument was hand delivered to the office of the lecturer. All questionnaires were self-reported, in that the lecturers filled them out. Respondents were allowed 3 weeks to complete the survey; the data collection period was staggered over 5 weeks. At the end of each respective 3-week period, the questionnaires were retrieved in person by the researchers. All participants

Table 1. A Test of the Reliability of the Key Constructs of the Survey Instrument.

Construct	Cronbach's Alpha	Items in Construct
Relative advantage	.71	5
Complexity	.97	5
Compatibility	.81	5
Observability	.92	4
Trialability	.74	5

were informed of their right to refuse participation or withdraw from the study at any point, but all agreed to participate in the study. Confidentiality was guaranteed by the use of identification codes instead of names. Of the 250 copies administered, 213 were returned and all were found useful for analysis, resulting in an 85.2% response rate. Table 2 provides details on the survey distribution and return rate by faculty.

Even with the lecturers who were in management or on sabbatical removed from the data collection, nearly all lecturers in all faculties and the research institute were surveyed. The only faculty with a significant number not surveyed was Humanities. Regarding return rates, three faculties had rates at or near 100% (Education, Health Sciences, and Humanities). The lowest rate of return was from the faculty of Law, with just two thirds of the surveys returned.

The demographic profile of the respondents showed that a majority of them are males (55.8%). This was surprising since the 2009 adult literacy level of females (95%) is higher than for males (UNESCO, 2012). The report noted further that although Lesotho's education system has achieved progress in raising literacy levels, major issues in terms of drop-out, student flow, quality, and equity (UNESCO, 2012) remain to be addressed. Throughout all levels of education, statistics show that a higher number of girls than boys are enrolled in school, a scenario that is different from most of the other sub-Saharan countries. However, the total enrollment for girls is still very low and the enrollment of girls decreases significantly as the grades increase, indicating a very high incidence of dropout and a larger number of out-of-school girls. In 2009, 25% of girls at primary level and 64% at secondary level were not attending school. Thus, despite the higher level of enrollment of girls in secondary education and the women's high literacy rate, drop-out rates for girls remain very high. This can be attributed to social, economic, and cultural factors, such as poverty, distance from school, the impact of HIV and AIDS, and teenage pregnancies.

Table 2. Population, Sample Size, and Responses Across Faculties.

Faculties	**Total Population of Lecturers**	**Number of surveys distributed**	**Institutional Percentage (%)**	**Response Rate across Faculties**	
				n	Return Rate (%)
Agriculture	35	32	13	24	75
Education	15	15	6	15	100
Health Sciences	23	22	9	22	100
Humanities	56	50	20	49	98
Faculty of Science and Technology	53	51	20	40	78
Faculty of Social Sciences	55	55	22	45	82
Faculty of Law	19	19	8	13	68
Institute of Education	6	6	2	5	83
TOTAL	**262**	**250**	**100%**	**213**	**85%**

In addition, a 2010 Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) report (Saito, 2010) noted that girls' learning achievement in mathematics was slightly better than that of boys in 2000, but seven years later it decreased and was lower than that of boys. Abagi (2003) had earlier showed that girls' course selection and performance in secondary education were influenced by the persistence of traditional gender roles and cultural norms. For example, the perception that boys are good at mathematics, science, and technology while girls are good at languages and home economics is widespread among teachers, parents and, consequently, male and female students. In addition, teachers and principals are often not gender-sensitive in their attitude, behavior, and teaching practices, which negatively influences the opportunities of girls' access to, retention in, and completion of secondary education, which leads to fewer numbers of girls at tertiary levels. This situation thus implies that although literacy level among girls is higher than boys, access to education is not empowering girls and that gender disparities persist, not only in education but in all spheres of life: Decision-making and leadership roles continue to be reserved for men, regardless of the educational outcomes of boys.

Regarding the age distribution of the respondents, those aged 35–44 constituted the largest group at 31.5%, in comparison with those aged below 25 (3.3%), 25–34 (20.7%), 45–54 (23.9%) and 55–64 (19.2%). Only three respondents (1.4%) were older than 64 years, which might be due to the fact that the retirement age is 65 years in Lesotho. The academic rank of the respondents showed that 58.2% indicated they were lecturers, followed by senior lecturers (23%), assistant lecturers (14.6%), associate professors (3.3%), and professors (0.9%).[2]

Descriptive and inferential statistics were adopted for data analysis. Collected data were first structured into grouped frequency distributions, and stepwise multiple regression was used for data analysis to test the five hypotheses. Stepwise multiple regression provides a means for identifying predictors of a particular dependent variable on the basis of statistical criteria. Essentially, the statistical procedure indicates which independent variable is the best predictor, the second best predictor, and so on. Stepwise is the most sophisticated of regression statistical methods, and was determined most suitable because of our emphasis on finding the best predictors at each stage of the analysis. Each independent variable was entered in sequence and its value assessed. The variables contributing to the model were retained and retested to see if they continued to contribute to the success of the model. Variables that no longer contributed significantly to the model were removed. The analysis method ensured that the model ended up with the smallest possible set of predictor variables. For our study, stepwise regression was found to be the most appropriate analytical tool as it helped identify the most parsimonious set of predictors (i.e., the DoI constructs) for potential users' attitudes toward ICT adoption in their work.

RESULTS

Test of Hypotheses

The scores used for the constructs in this study were standardized using Excel software before being imported into SPSS for regression analysis. In order to test the hypotheses, stepwise multiple regressions were carried out. The following tables are the results of that process, using

the constructs relative advantage, complexity, compatibility, observability, and trialability as the independent variables and attitude as the dependent variable. Table 3 presents the regression result showing that complexity, observability, and relative advantage were the significant constructs. Further results presented in Table 4 show the prediction level of each of the three significant constructs.

The ANOVA result in Table 5 gives the general significance of the model. Because the value of *p* is less than 0.05 for the three variables, the model is significant. Thus, the combination of complexity, observability, and relative advantage significantly predict the dependent variable (attitude).

Table 3. Stepwise Multiple Regression Results on the Constructs.

Attitude (10.592)	**Relative Advantage (0.303)**	**Observability (0.309)**	**Complexity (0.317)**
Standard error (1.262)	.116	.103	.087
Significance (.000)	.009	.003	.000

Table 4. Model Summary Showing Prediction Level of the Constructs.

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.221[a]	.049	.044	1.3620
2	.321[b]	.103	.094	1.3259
3	.363[c]	.131	.119	1.30778

Note: a. Predictors: (Constant), complexity; b. Predictors: (Constant), complexity, observability; c. Predictors: (Constant), complexity, observability, relative_advantage

Table 5. Analysis of Variance (ANOVA) Results.

	Model	***SS***	***Df***	***MS***	***F***	**Sig**
1	Regression	20.112	1	20.112	10.842	.001 [a]
	Residual	391.418	211	1.855		
	Total	411.531	212			
2	Regression	42.334	2	21.167	12.040	.000 [b]
	Residual	369.197	210	1.758		
	Total	411.531	212			
3	Regression	54.083	3	18.028	10.541	.000 [c]
	Residual	357.447	209	1.710		
	Total	411.531	212			

Note: a. Predictors: (Constant), complexity; b. Predictors: (Constant), complexity, observability; c. Predictors: (Constant), complexity, observability, relative_advantage: d. Dependent Variable: attitude.

Table 6 reveals the standardized Beta coefficients, which give the contributions of each variable to the model. The *t* and *p* values show the impact of the independent variables on the dependent variable. From Table 4, it is clear that complexity, observability, and relative advantage were revealed to be significant constructs.

Based on the analyses, the following inferences were drawn in relation to the hypotheses. From Table 6, the Beta values for relative advantage (β = -.303, p = .009 <0.05); complexity (β = .298, p = .001 <0.05) and observability (β = -.364, p =. 000 <0.05) show that these attributes positively affect attitude of the lecturers toward using technology. Thus we reject the three null hypotheses based on the fact that they had a positive effect on attitude. In the case of Hypotheses 3 and 4, as stated in Table 4, the attributes compatibility and trialability do not contribute to attitude, hence we accept the two hypotheses, meaning that these attributes had no positive effect on attitude.

Table 6. Beta Coefficients Showing Contributions of Variables to the Model.

	Model	Unstandardized coefficients		Standardized coefficients	*t*	Sig
		β	SE	**B**		
1	(Constant)	5.882	.636		9.252	.000
	Complexity	.298	.091	.221	3.293	.001
2	(Constant)	8.285	.917		9.040	.000
	Complexity	.314	.088	.233	3.558	.000
	Observability	-.364	.103	-.233	-3.555	.000
3	(Constant)	10.592	1.262		8.395	.000
	Complexity	.317	.087	.235	3.647	.000
	Observability	-.309	.103	-.197	-2,992	.003
	Relative Advantage	-.303	.116	-.173	-2621	.009

Note: Dependent variable: attitude

DISCUSSION

For decades, Rogers' DoI has been the main starting point for much research into the ICT innovation and adoption domains, and still provides a widely used framework for forecasting purposes, service and infrastructure requirements, business modeling, and policy measurements (De Marez, Evens, & Stragier, 2011). Profound transformations in the ICT environment, however, have led to questions about the validity of the assumptions of diffusion theory in today's complex technology ecosystems. Although the theory has been frequently updated, criticisms for its lack of attention to use contexts gave rise to new user research paradigms, such as the domestication approach. While some consider the adoption and domestication approach

simply competitive frameworks for the same research area, they should be seen rather as complementary sides of the same innovation coin (Boczkowski, 2004). Therefore, in distinguishing between adoption diffusion and use diffusion (Shih & Venkatesh, 2004), a first delineation would be the theory's value in today's ICT environment. Whereas Rogers' diffusion theory should be used for gaining insights into an innovation's potential in terms of penetration pattern, adoption determinants, and segment profiles, domestication research should lead to a better understanding of the actual usage and the context wherein the technology is adopted.

This study investigated the underlying relationship between ICT adoption determinants and the attitude of lecturers in a higher education setting. The five ICT adoption determinants in the DoI theory were hypothesized to not positively affect the attitude of lecturers toward use of ICTs, but when tested, three of them (relative advantage, complexity [ease of use], and observability) were found to have a positive effect on the attitude of the lecturers. This is consistent with the findings of Choi, Choi, Kim, and Yu (2002), who discovered that relative advantage, observability, image, and enjoyment were significant in influencing attitude toward information technologies' adoption. On the relative contribution of each of the constructs to the attitude of the lecturers, observability had the highest contribution, which concurs with the finding of Olatokun and Igbinedion (2008) that observability had the highest impact on attitude, while trialability had the least, among ATM users in Jos, Nigeria. In contrast, however, their study confirmed that all the constructs had a significant positive effect on the attitude toward ATM use. In this study, the fact that observability contributed the highest influence could be because the lecturers were able to observe others using ICTs before using the technologies themselves. Other studies (e.g., Tan & Teo, 2000; Taylor & Todd, 1995) have demonstrated the contribution of observability to the DoI model. Also, Schillewaert and Ahearne (2001) observed the same when they reported that the acceptance of ICTs by peers and colleagues spurs adoption because it signals the benefits of the system to others and creates a form of social pressure within the organization for others to comply.

The contribution of the complexity construct was positively significant to the model and hence supported in this study. The complexity of a technology affects how well it diffuses in a social system because if the technology is easy to use, more people are likely to adopt its use (Rogers, 1995). The significant contribution of complexity to the diffusion model was supported by previous studies, such as those by Kolodinsky, Hogarth, and Hilgert (2004), Chen, Gillenson, and Sherrell (2002), Lau (2002), and Taylor and Todd (1995). This contribution of complexity makes it imperative for NUL authorities to deploy easier-to-use ICTs to enhance adoption by lecturers. There was no significant correlation between trialability and the attitude of lecturers toward ICT usage, implying that no previous attempts are needed to try out ICT before using it. This meant that potential adopters of ICTs feel they do not need trial demonstrations as an introduction to using them. This is in line with the findings of other studies, such as those of Chang and Cheung (2001) and Davis, Bagozzi, and Warshaw (1989). The compatibility construct was also found as having no significant contribution to the attitude of lecturers in using ICTs. This contrasts with previous studies that have found compatibility to be a significant factor in attitude toward ICT use (Chen et al., 2002; Tan & Teo, 2000). The positive and significant contribution of relative advantage that was found in this study is consistent with previous research involving information system acceptance (Horton, Buck, Waterson, & Clegg, 2001; Morris & Dillon, 1997). This finding is not surprising because one would always expect that the benefits of ICTs will have a strong influence on amount of usage. This also is in line

with Agbonlahor (2006), who found that relative advantage significantly influenced the number of IT applications used by respondents. Thus, relative advantage has been found to be a significant motivator both for the number of computer applications used by respondents and the frequency with which they used computers.

Findings from this study thus provide further evidence of the appropriateness of DoI to measure attitudes toward ICT usage in higher education in a developing country. The findings complement and contribute to the body of literature that seeks to validate existing DoI models in academic communities and a developing country like Lesotho. Most previous studies on African universities and DoI have been conducted in west- and central-African settings. Only a few prior works exist on ICT adoption and use in universities in the South Africa Development Community region (Adam & Woods, 1999; Anandarajan, Igbaria, & Anakwe, 2002; Farrell et al., 2007; Oyelaran-Oyeyinka & Adeya, 2004; Isaacs, 2007). The results of this study provide to administrators at NUL further empirical evidence regarding which attributes influence lecturers at that institution toward adopting ICTs, with implications for policy and planning on manpower development.

Of course concerns such as the pro-innovative bias are apparent in ICT diffusion research studies (Rogers, 1991). By looking at the factors that influence attitude but also those that had no influence on lecturers' use of ICTs at NUL, this study has generated valuable insights that are not possible within a pro-innovative bias perspective. In regard to theory, therefore, this study extends the knowledge about existing diffusion theories in information systems studies. On the practical side, this study was timely because it responds to the continuing interest in and addresses the dearth of literature about ICT diffusion research in developing countries, especially in Africa. Finally, it contributes to a new knowledge and data on the ICT diffusion literature in Lesotho.

To conclude, we confirm that diffusion theory is still a valuable framework for research on ICT diffusion as long as the scope of the research is adoption diffusion and that the reorientations concerning the shape of diffusion patterns, segment profiles, and adoption determinants are taken into account. However, it is important to point out that ICT adoption determinants may no longer be powerful enough to be used for predictive purposes and a metamodel is highly desirable for future research to increase the predictive power of the model. Thus, a combination of models could be used for analyzing adoption scenarios in university settings. Broad theories and frameworks are evident and pertinent for analysis. No one theory is sufficient for devising a generic framework for analyzing the adoption of an innovation.

A clear and sensible path for NUL would be to identify and target early adopters of various ICTs and ensure that potential enthusiasts are alerted to the innovations at an early stage. Furthermore, as indicated above, deployment of user-friendly ICTs that are accompanied by a training plan for staff, students, and administrators is essential. The diffusion of ICTs at NUL could also be studied from the perspective of non-users to determine the factors responsible for persistence in not using an innovation. A SWOT (strengths, weaknesses, opportunities and threats) analysis of ICTs available and/or used at NUL will be equally pertinent to determining the scope of integration of ICTs as an enabling tool at the institution to help realize its goals and mandates, as well as to improve the efficiency within teaching and learning processes. Furthermore, such more detailed research could help inform related internal audiences about policy and decision-making procedures and practices in regard to ICTs. Such efforts will ensure

that future initiatives in ICT deployment at NUL are focused on maximizing limited institutional resources, and attaining high ICT-related outcomes from the resource investments.

ENDNOTES

1. NUL was established by the National Assembly through Act No. 1 3 of 1975 (National University of Lesotho, 2010) on the Lesotho (Roma) campus site of the former University of Botswana, Lesotho, and Swaziland on October 20, 1975. Today, it is a growing institution striving to meet the needs of the nation, through production of competent graduates who could assist in the development of Lesotho. The sole national university in the country has a student population of over 9,000 within seven faculties (Agriculture, Education, Health Sciences, Humanities, Law, Science and Technology, and Social Sciences) and an Institute of Education.

2. At the time of this study, the number of full professors was lower at NUL than is common at other universities.

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Appendix

QUESTIONNAIRE DISTRIBUTED TO LECTURES AT THE NATIONAL UNIVERSITY OF LESOTHO.

Dear Respondent,

This questionnaire is designed to collect data on a study titled, "Analyzing the Influence of Diffusion of Innovation (DOI) Attributes on Lecturers' Attitude toward Information and Communication Technology." Kindly fill out your responses as frankly as possible. The data you provide will be treated in confidence. Thank you for your anticipated cooperation.

Section A. Demographic characteristics of Respondents (Tick as appropriate)

1.Gender [ ] Male [ ] Female

2.Age Group [ ] Under 25 [ ] 25-34 [ ] 35-44 [ ] 45-54 [ ] 55-64 [ ] 65

3.Academic Rank Assistant Lecturer [ ] Lecturer [ ] Senior Lecturer [ ] Associate professor [ ] Professor [ ]

4.Department _____

Section B. The influence of the five constructs of Diffusion of Innovation theory on your adoption and use of ICTs. This section aims at finding out your opinions about the statements listed below.

5. Please read the following statements and circle the number that best describes your use of ICTs, where Strongly Disagree (SD) = 1: Disagree (D) = 2: Agree (A) = 3 and Strongly Agree (SA) = 4).

Relative advantage and ICT use	**SD**	**D**	**A**	**SA**
ICTs improve my efficiency when I use them.	1	2	3	4
Mistakes with ICT transactions are easier to correct than manual ones.	1	2	3	4
There are enough advantages of ICTs for me to consider using them.	1	2	3	4
Mistakes are more likely to occur with ICT usage than with manual operations.	1	2	3	4
ICTs help me to better manage my time.	1	2	3	4
Compatibility and ICT use				
I do not need ICT in my work.	1	2	3	4
ICT makes lecturers redundant.	1	2	3	4
It bothers me to use ICTs when I could do my work manually.	1	2	3	4
I worry about the privacy of my information when using ICTs.	1	2	3	4
I worry that ICTs are not secure enough to protect my personal information.	1	2	3	4
Trialability and ICT use				
It was easy to use ICTs more frequently after trying them out.	1	2	3	4
A trial convinced me that using ICTs was better than using manual systems.	1	2	3	4
I do not need a trial to be convinced which ICTs are the best for me.	1	2	3	4
It did not take me much time to try ICTs before I finally accepted their use.	1	2	3	4
It is better to experiment with ICTs before adopting them.	1	2	3	4

Observability and ICT use				
I was influenced by what I observed as the benefits of using ICTs.	1	2	3	4
I observed others using ICTs and saw the advantages of doing so.	1	2	3	4
Observing ICT users before using ICTs is unnecessary.	1	2	3	4
I have seen how others use ICTs before using them.	1	2	3	4
Complexity and ICT use				
ICTs are complicated to learn.	1	2	3	4
ICTs are difficult to understand and use.	1	2	3	4
ICTs are convenient to use.	1	2	3	4
ICTs are confusing.	1	2	3	4
It is easy to use ICTs even if one has not used them before.	1	2	3	4

6. Kindly indicate how your experiences/attitude with the use of ICTs have affected your intention to continue to use the technology, where Strongly Disagree (SD) = 1: Disagree (D) = 2: Agree (A) = 3 and Strongly Agree (SA) = 4).

The benefits of ICTs will make me continue to use them in the future.	1	2	3	4
I intend to continue to use ICTs because they help manage my time better.	1	2	3	4
Because ICTs are appropriate to my profession I will use them in future	1	2	3	4
ICT usage is appropriate for my working style and I will continue using it	1	2	3	4
The ease of use of ICTs will make me continue to use them	1	2	3	4
The difficulty in learning to use ICTs will make me not use them in future	1	2	3	4
Seeing my colleagues use ICT will make me continue to use it	1	2	3	4
What I have observed about the use of ICTs in my department will make me keep using them.	1	2	3	4
Trying out the opportunities of using ICTs in my profession will make me continue using them in future.	1	2	3	4