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Factors affecting adoption of ICT among Omani faculty members in Sultanate of Oman

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Abstract

ICT has gradually become an integrated part of the higher education system in Oman in the past few years. With the nation's effort to build a digital society for Oman, ICT will play an even more important role in Omani higher education. Thus, faculty members in Oman are under pressure of adopting ICT into their instructional processes. Nevertheless, empirical evidence of Omani faculty members' ICT adoption is still limited. Although there have been some studies on Omani faculty members' ICT adoption in the past, the current status of ICT uses and skills by Omani faculty members has basically remained unknown in the dynamic social and educational environment. The purpose of this study was to explore the factors, influencing adoption of information and computing technology (ICT) for Omani faculty members from a framework of Rogers' theory of diffusion of innovation. Participants were Omani faculty members from Sultan Qaboos University (SQU), Oman.

Keywords: Blended learning, Compatibility, Complexity, Diffusion, Observability, Trialability, Adopter, Adoption, Barriers, Ease of use, Innovation, Relative advantage.

Introduction

Despite ICT having the potential to improve educational methods and the quality of teaching and learning, the diffusion of ICT for teaching and learning has not been widespread, nor has it become deeply integrated into the curriculum [14]. Faculty utilization of innovative technologies has remained low [25]. The adoption of ICT at universities is often badly done and based on ignorant optimism [26]. The advantages of ICT have been often under-realized in higher education [25].

There are many reasons for the above problems. Research has found various factors to be serious obstacles to fully integrating technology into the teaching and learning processes in higher education. Furthermore, there are no universal solutions to these problems as ICT adoption is not a merely technical issue. Instead, many factors affect ICT adoption, including the adopters' personal characteristics, attributes of technologies, and various economic, sociological, and organizational variables [24]. For instance, in a cross-cultural study examining the validity of Davis et al.'s 1998 technology acceptance model (TAM), Straub, Keil, and Brenner found that the TAM only held for the participants from the U. S. and Switzerland, but not for the Japanese. Such a finding indicated that the TAM model may not predict technology use across all cultures. Similarly, in another intercultural study, Pelgrum [23] reported that there was a substantial variation between countries of the most significant barriers to ICT perceived by teachers. Thus, research on ICT adoption by educators in a specific culture, in this case by Omani faculty members, is meaningful and valuable.

ICT has gradually become an integrated part of the higher education system in Oman in the past few years [6]. With the nation's effort to build a digital society for Oman [18], ICT will play an even more important role in Omani higher education. Thus, faculty members in Oman are under pressure of adopting ICT into their instructional processes. Nevertheless, empirical evidence of Omani faculty members' ICT adoption is still limited. Although there have been some studies on Omani faculty members' ICT adoption in the past, the current status of ICT uses and skills by Omani faculty members has basically remained unknown in the dynamic social and educational environment. The faculty members' perception of barriers to adopting ICT and perception of ICT attributes have been barely explored. In addition, ICT adoption happens at different rates for different users [19]. Nevertheless, no studies have examined the relationship between adopter category and ICT uses and skills, perception of barriers to ICT adoption, and perception of ICT attributes for Omani faculty members. Moreover, little is known on the significant factors impacting Omani faculty members' ICT adoption, especially with a concurrent consideration of multiple variables. Thus, to help Omani faculty members be proactively well-prepared for the digitalized era, it is necessary to understand their current level of ICT uses and skills, to know their perceptions of barriers to adopting ICT and perception of ICT attributes, and to examine whether the adopter category is related to theses variables. More importantly, it is critical to identify the salient factors influencing Omani faculty members' ICT adoption.

This study was significant in several aspects. First of all, different from existing studies focusing on some specific areas of ICT adoption such as online learning in the Omani cultural context, this study took a board perspective with regard to ICT uses. It considered a wide range of possible ICT applications in today's technological and working environments in Oman. Such a scope was needed to provide an overall picture of ICT adoption by Omani faculty members. Secondly, many studies on ICT adoption conducted in Oman were a theoretical. This study, instead, was driven by Rogers' theory of diffusion of innovation. On one hand, it attempted to use Rogers' theory to explain ICT adoption by Omani faculty members. On the other hand, it provided empirical evidences to verify Rogers' theory. Thirdly, this study concurrently explored multiple factors which may affect the Omani faculty members' ICT adoption in regression models, in addition to presenting descriptive delineations and examining the group differences. Last but not the least, findings from this study may provide directions for the Omani universities to support and enhance their faculty members' adoption of ICT in the teaching-learning process.

Roger's Theory on Diffusion of Innovation

Rogers' theory originated from agricultural innovation in the late 1950s. Over the years, this model of diffusion of innovation has been applied to diverse fields including education. The key concept of the model is diffusion. Rogers defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". This definition implies there are four main elements in the diffusion process: innovation, communication channels, time, and the social system. An innovation is "an idea, practice or object that is perceived as new by the individual". A communication channel is "the mean by which messages get from one individual to another". The third element, time, gets involved in diffusion in three aspects: (a) the innovation-decision process by which an individual passes from first knowledge of an innovation to forming an attitude toward the innovation, (b) the innovativeness of an individual's relative earliness/lateness of adopting the innovation, and (c) the adoption rate in a system measured as the number of members of the system adopting the innovation in a given time. The last element, social system, is "a set of interrelated units that are engaged in joint problem solving to accomplish a goal".The social and communication structure or the patterned arrangement of the units in the system facilitates or impedes the diffusion of innovations in the system. These four elements influence the adoption or rejection of an innovation in a complicated, interdependent way in a system.

Figure 1 shows the rates of successful adoption through time in a given population for an example

of three different innovations. The rates of adoption tend to follow an S-shaped pattern. Diffusion is usually very slow in the beginning with only a few earlier adopters of the system. Then, it enters the "taking-off" or "tipping point" period of rapid spread. Rogers stated that the tipping point typically happens when the adoption rate is between 10-20% of the target population. Finally the adoption rate levels off at the "permanent" level as almost all of the members, including the later adopters, have adopted the innovation. Characteristics of innovations, communication channels, and social systems interact with one another affecting the slopes of adoption, as seen in Figure 2.

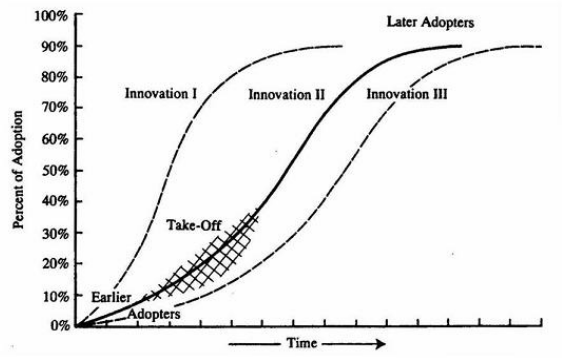

Figure 1: The diffusion process

Rogers' theory contains four major parts: adopter categories, perceived attributes, diffusion process, and rate of adoption. First, members of a population vary greatly in their willingness to adopt a particular innovation. Individual characteristics such as socioeconomic features, personality traits, and communication behavior patterns can be used to divide the population into five categories - innovators, early adopters, early majority, late majority, and laggards. The frequencies of these five types of adopters closely form a normal distribution on the basis of the relative time at which an innovation is adopted, as shown in Figure 2. Innovators are active information seekers about new ideas. One of their salient characteristics is venturesomeness. They play a gate-keeping role in the flow of an innovation into a system. Early adopters are a "more integrated part of the local social system than are innovators". They are usually not too far ahead of the average individual in innovativeness and they often serve as a role model for many other members in the system. The early majority adopt innovations just before the average number of a social system. Their innovation-decision process is relatively longer than that of innovators and the early majority. They usually "follow with deliberating willingness in adopting innovations but seldom lead". The late majority are skeptical to new ideas. They adopt innovations just after the average number of the system, usually due to economic necessity or peer pressure. The social norms must definitely favor an innovation before the members of the late majority are convinced to adopt it. Laggards are the last group in the system to adopt an innovation. They tend to be suspicious of innovation or even resistant to innovation.

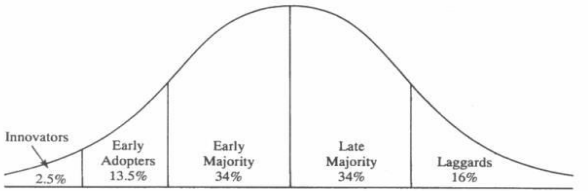

Figure 2: Adopter categorization on the basis of innovativeness

Second, a person's perception of an innovation influences the adoption decision. Five perceived attributes of an innovation have been shown to have strong influence – trialability (i.e., the degree to which potential adopters can experiment with the new behavior), observability (i.e., the degree to which the results of an innovation are visible to others), relative advantage (i.e., the degree to which a new system is perceived as being better than the alternative it supersedes), complexity (i.e., the degree to which an innovation is perceived as difficult to understand and use), and compatibility (i.e., the similarity with previously adopted innovations).

Third, diffusion is a process that occurs over time and can be seen as having five distinct stages - knowledge, persuasion, decision, implementation, and confirmation (as shown in Figure 3). But, before an innovation is formally evaluated by an individual, four prior conditions must be met: (a) the person or unit of analysis needs to have previous experiences relevant to the innovation, (b) there is a perceived need or problem facing the individual to consider the innovation as an option, (c) the new ideas or techniques must have novelty or innovativeness, and (d) the norms of the social system should show some evidence favoring innovation. In the knowledge process, an individual is exposed to the existence of an innovation and gains an understanding of how it works. Three broad categories of personal characteristics--socioeconomic characteristics, personality traits, and communication behaviors-- affect the extent to which the person possesses knowledge about the innovation. The next process, persuasion, occurs when an individual forms an attitude towards the innovation. The personal perception on the five attributes of an innovation plays a vital role in forming the favorable or unfavorable attitude towards innovation. In the next process, decision, the individual has decided to either adopt or reject the innovation and engaged in activities associated with the choice. In the implementation process, the individual puts the new idea or innovation into use, if deciding to adopt the innovation. In the final process, confirmation, an individual seeks reinforcement or revision of the decision being made. If the previous decision of adoption or rejection seems to be correct, the individual keeps the same choice; otherwise, the person reverses the previous decision.

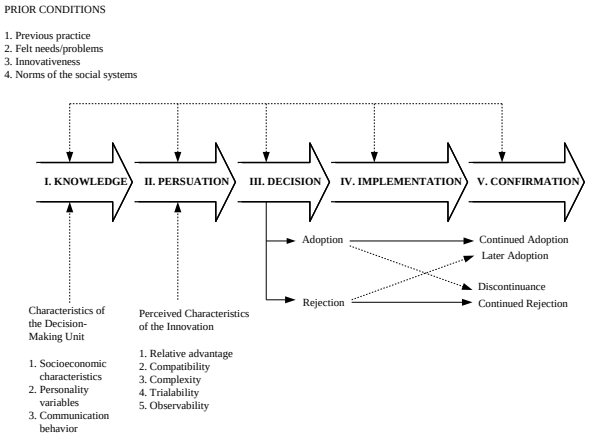

Figure 3: A model of five stages in the innovation-decision process

Finally, the rate of adoption indicates the relative speed with which members of a social system adopt an innovation. Five broad categories of variables affect the adoption rate as shown in Figure 4: perceived attributes of an innovation, type of innovation-decision, communication channels, nature of the social system, and the extent of the changing agent's promotion effort. Rogers stated about 49-87% of the variance in the rate of adoption can be explained by the five categories of variables. The type of innovation-decision affects the rate of adoption in the sense that the greater the number of individuals involved in the decision process, the slower the rate of adoption. Thus, the optional innovation-decision category, which requires only an individual's independent decision, was the fastest one, whereas the collective decision-process which needs consensus from most of the members of a system is slowest. Communication channels in the form of mass media make the rate of adoption faster than the means of interpersonal channels which often happen for later adopters. If a social system is highly structured, interconnected, and organized, the adoption rate of innovation is usually fast. In the last, the more promotion effort on innovation the change agent spends, the faster the rate of adoption, although the relationship between them is not linear.

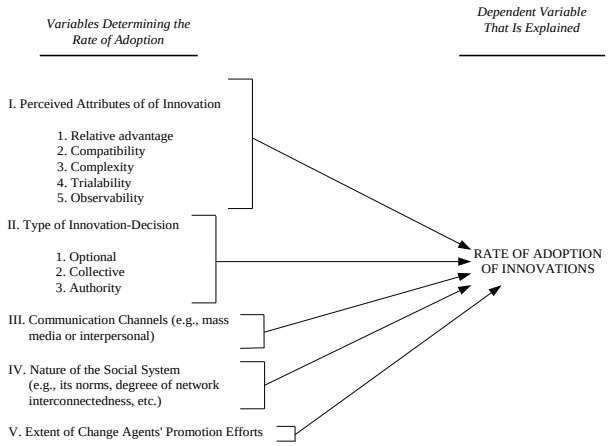

Figure 4: Variables determining the rate of adoption of innovations

E-Learning in Omani Higher Education

E-learning has a comparatively short history in Oman. SQU was the first higher education institution in Oman adopting the e-learning approach in 2001 and continues to be the leader for the e-learning movement. However, online learning has steadily grown at other universities and colleges in Oman in the past several years. For instance, when SQU first started the online learning platform WebCT in 2001 with eight online courses, it was totally technology-driven, operationalized without the foundation of a vision or even an action plan to implement e-learning at the university level. But, as mentioned earlier, by the academic year 2006-2007, the online courses at SQU had climbed to 387 with 268 WebCT and 119 Moodle courses with 20,409 available seats.

Oman launched the eOman initiative in 2006 to prepare its businesses and people to participate fully in the digital society. eOman was founded on His Majesty Sultan Qaboos bin Said's progressive vision to transform the Sultanate into a knowledge-based society and to build a knowledge-based economy. eOman aims at creating an effective government-community-citizen infrastructure that provides better services to people. Leveraging ICT power for economic and social benefits is eOman's greatest goal. Integrating government departments to provide more efficient public services, increasing IT literacy, developing the economy through smart electronic services, creating local knowledge industries, and minimizing the digital divide are some initiatives undertaken by eOman [21].

Along with the e-government initiative, recently, the Ministry of Education in Sultanate of Oman implemented e-learning for the state schools in two contexts: a virtual classroom system and a self-learning system. The use of virtual classrooms is to provide lectures on the Internet in an interactive learning environment consisting of teachers and learners, and coach trainees. The self-learning system is based on the design of electronic content. It allows the learner or trainee the possibility of direct research on educational materials and training courses from the existing manual system from anyplace, at any time [17]. Although there is no nationwide e-education systems in place at present, many efforts to restructure the country's education system to be technology-based such as the "*laptop for each teacher*" project, have taken place. Currently, the Ministry of Education is strategically planning the nation's infrastructure of educational system.

Research on E-Learning in Omani Higher Education

Research on e-learning in Omani higher education has been in three broad categories: (a) institutional strategic implementation of the e-learning system in the nation or at a particular university; (b) faculty members and e-learning, including the use, attitudes, perception, concerns, and impact of e-learning on their instructional practices, and (c) the impact of e-learning on students. Even before the debut of e-learning as an integrated part of Omani higher education, researchers have advocated its implementation. For instance, Al Rawas [9] contended that Omani higher education must be extended throughout the country using distance learning and e-learning solutions.

Al Balushi [4] stated that e-learning is the 'now big thing' not the 'next big thing', and pointed out the serious need for a strategic plan for e-learning in the Gulf region. Akinyemi and Al Rawas have identified some critical ingredients for e-learning installation and offered some recipes for e-learning implementation in Oman. In addressing Omani educators' doubts about e-learning, Al Musawi and Akinyemi [8] concluded that peoples' concerns for comparability between the e-learning system and the traditional system must be attended to before e-learning can be diffused into Omani higher education on a large scale.

Most of the empirical studies so far have focused on faculty members at Sultan Qaboos University. Hamshari and Bu-Azzah conducted one of the earliest surveys on 182 SQU faculty members' Internet use before the-learning was launched in 2001. They found about 37% of faculty members at SQU used the Internet; the majority of them were in scientific colleges. Their purposes for using the Internet in rank order were: communication through e-mail, teaching, research, and browsing and visiting sites looking for information. The major difficulties faced by those faculty members in using the Internet were the slowness of communication and the heavy use of the Internet.

Abdelraheem and Al Musawi [3][4] conducted another survey on the instructional uses of the Internet in 193 SQU University faculty members and further examined the group differences on gender, college affiliation, teaching experience, and academic rank with ANOVAs. They reported that the two most frequent uses of Internet were in courses, and to download ready-made instructional materials. Whereas there were no differences on Internet use between females and males faculty members, they did find the group difference was in favor of science faculty members, those with 5 to 9 years teaching experiences, and assistant professors.

Abdelraheem [1] examined the context beliefs of 250 Sultan Qaboos University faculty members about teaching with technology. It was found that SQU faculty members held positive beliefs but with varying degrees. The findings of group differences on teaching experience, college affiliation, and academic rank were in favor of those faculty members with longer teaching experience, at science camp, and in the senior positions (i.e., associate professors and professors).

Akinyemi, Osman, and Al Kindi in Al Musawi & Abdelraheem [7] investigated the viability of WebCT as a mode of instructional delivery at SQU in its early implementation stage. They found both faculty and students were favorably disposed to this new technology in spite of some problems. But they made recommendations on infrastructural improvements on hardware, software, and IT training in order for e-learning to gain popularity at SQU.

Al Musawi and Abdelraheem [7] reviewed the WebCT implementation at SQU in its first few years. They found online courses had increased each year. Students were able to access the Internet for knowledge sources and faculty members used the Internet in their instructional processes. They concluded that web-based instruction was as effective as the traditional face-to-face approach on students' achievement. However, they argued more online courses needed to be offered and standards must be set before e-learning could be more widely used at SQU.

Al-Washahi [12] investigated the perceived effectiveness and impact of educational technology faculty development activities in the College of Education (COE) at Sultan Qaboos University using the qualitative approach of interviews, focus groups, and document analysis. The COE faculty members described the college's culture as technology-oriented since faculty members rely on technology in their daily activities and form networks to learn technology. Nevertheless, the study revealed that no structured form of a program or a plan with a clear vision, goals, and strategies for educational technology faculty development existed in the COE. Also, a lack of systematic evaluation and follow-up to encourage and support faculty members in applying technology in instruction was found. The COE faculty primarily gained their confidence through their own experiences of integrating technology into the teaching practices.

Al-Suqri [11] examined the information needs and information-seeking behaviors of social science scholars at Sultan Qaboos University using a mixed-method research method. Findings revealed that SQU social science faculty members make increasing use of electronic resources but retain a preference for print materials and informal sources of information. The three main types of barriers to information seeking faced by those scholars were: (a) limited availability of resources, especially full text resources; (b) poor Internet connection speeds or Internet availability; and (c) a lack of sufficient Arabic language sources. The study also reported that information needs and information-seeking practices vary with age, academic rank, and academic department or college.

Online learning has the potentials for greater access to knowledge and serves as an ideal alternative to deliver instruction. Nevertheless, online learning could have the drawbacks of loosely structured environments, the vast amount of information, intensive mental influx required from learners, and possibly unclear learning goals and tasks for learners if not designed well [10]. Thus, the implementation of the e-learning platform and environment need a balance "between choice and control, and between instruction, construction, and inadvertent distraction to learning" [22]. Therefore, it is not surprising to find studies that have focused on students' perception of their e-learning environment and the attitude towards e-learning in general. For instance, Osman and Ahmed examined the potential and the impact of web-assisted instruction on SQU students' learning and attitudes. They found that students had positive attitudes towards web-assisted instruction and that web-assisted instruction was as effective as face-to-face instruction on student achievement.

Osman investigated students' reaction to implemented WebCT at Sultan Qaboos University in a sample of 31 undergraduates. Results showed that students are generally positive to the WebCT learning environment at the university and they are confident with major features of the new learning tool. But the participants indicated that the slow network performance and limited number of computers on campus are two major factors affecting their effective use of WebCT. It is interesting to note that the majority of the students liked the blended learning as practiced in the university rather than the pure online learning without weekly lectures.

Elango, Gudep, and Selvam [13] examined the issues related to the six quality dimensions of e-learning in a sample of 112 UAE and Omani students. They found that students perceived their e-learning system as having both strengths (e.g., course contents, knowledge level of instructors) and weaknesses (e.g., graphics and animations). Findings also indicated that the e-learners had diverse opinions with regard to administrative issues, instruction materials, instructors' support, viper sessions (the software program which helps interactive learning through the Internet), grading, and assessment. The authors recommended that university administrators take a holistic approach to address the needs and problems faced by the e-learners to ensure a better future for e-learning education in the Mid-East.

In summary, Oman's utilization of educational and information technology in higher education has proceeded rapidly in the past decade [7]. The number of online courses available and the number of users involved have dramatically increased, most notably at SQU. Studies conducted in Oman have shown that Omani faculty and students are favorably disposed to e-learning. Nevertheless, educational technology in the Omani higher education context is still characterized by the underutilization of advanced technology; and unsatisfactory staff skills to achieve an appropriate level [5]. Faculty members are, in many instances, short of the required preparation time to apply the new educational innovations [2]. In addition, faculty members vary in the level of ICT uses in their teaching practices. The factors underlying the differences of ICT uses in Omani faculty members are still unclear. Thus, a need for multivariate investigation on the topic is apparent.

Findings

With the widespread use of computing technology in Oman in the past decade, informational and computing technology (ICT) has become an integrated component for Omani faculty members in

their teaching practices. However, empirical data on the level of ICT uses and skills and the factors influencing the ICT uses for Omani professors are still limited. The primary purposes of the present study were to describe the current levels of ICT uses and skills and to explore the salient factors affecting the ICT uses for Omani faculty members. In formulating the study, Rogers' model of DoI served as the theoretical foundation. Rogers stated that members of a given population vary greatly in their willingness to adopt a particular innovation and that they can be divided into five categories: innovators, early adopters, early majority, late majority, and laggards. Furthermore, the numbers of these five types of adopters closely form a normal distribution on the basis of the relative time taken to adopt the innovation. Many personal, social, and technological characteristics affect the adoption rate. This study only focused on some of the individual variables, perceived attributes of technology, and perceived barriers to adopting ICT. The five hypotheses guided the present study were: *(a) earlier adopters use ICT more than the later adopters; (b) earlier adopters are more technically skillful than the later adopters; (c) earlier adopters perceive fewer barriers than the later adopters; (d) earlier adopters are more positive towards to the ICT attributes than the later adopters; and (e) the level of ICT uses can be significantly predicted by the users' ICT skills, perception of barriers to ICT adoption, perception of ICT attributes, and some demographic and job-related variables.* Three hundred Omani faculty members from SQU participated in the study.

Findings from this study first indicated that the Omani faculty members at SQU as a whole used ICT at the level of slightly more than "sometimes" but less than "often". The top three areas of ICT uses were browsing the contents of websites, using Internet search engines, and word processing. On the other hand, the faculty members rarely used simulation and games, video/audio conferences, web design software, interactive communication, or Web 2.0 tools. These findings were consistent with previous research that reported word processing, emails, and web content browsing as the most popular uses and multimedia and communication tools as the least frequent ICT uses in faculty members in other countries.

Contradictory to some studies that reported faculty members in the developing countries lack many technological competencies, this study found that the overall level of ICT skills for SQU faculty members was close to the "intermediate". Not surprisingly, the ICT skills repertoire for the SQU faculty members followed a similar pattern to their ICT uses. The participants also had the most advanced skills on the three most often used ICT application areas and had the least skills for the five least often used technological functions. Isleem identified the same pattern in his sample of 1,170 technology education teachers in Ohio public schools in the United States. In addition, the correlation between the levels of ICT uses and ICT skills in this study was .81, similar to the canonical correlation coefficient 0.84 between the level of computer use and expertise found in Isleem's research.

The adopter category, a statistical criterion for placing people into time-referenced categories based on how quickly they adopt change, has long been recognized in exploring faculty members' ICT adoption. In line with Rogers' model, this study found the numbers of the faculty members in the five adopter categories were close to a normal distribution. Approximately 86% of the faculty members classified themselves in the innovator, early adopter, and early majority categories. Investigating faculty members' adoption of Web-enhanced instructional technology (WEIT) in 11 Institutes of Technology in the central region of Taiwan, Lee also reported most faculty members self-identified in the upper three categories (Innovator, Early Adopter, and Early Majority). However, in the present study, due to the relatively small overall sample size, the laggard group was too small to be an independent group for the purpose of examination on group differences. Thus, it was combined with the late majority group.

The group differences on ICT uses and skills in one-way ANOVAs showed significant differences among the four groups at the 0.001 level. In addition, the practical significances were medium. Adopter category could account for 13% and 12% of the variances on ICT uses and skills, respectively. Although the post-hoc tests did not necessarily reveal significant differences in all of

the pairwise groups, the early adopter groups always had significantly higher ICT uses and skills than the late adopter groups. Hypotheses 1 and 2 were considered to be supported. Thus, the self-reported adopter category seemed to be a valuable variable in differentiating Omani faculty members on their ICT uses and skills.

These findings were consistent with many other studies. For example, Lu, using a qualitative approach, investigated the factors influencing the diffusion of wireless Internet technology among faculty members at a large American Midwestern state university, and reported early adopters and non-adopters (the mainstream) were different in knowledge of and skill with technology, teaching practices, teaching philosophy, technology needs, communication channels, and characteristics. Jacobsen, using a mixed-method approach, found some differences between early adopters and mainstream faculty for self-rated computer expertise and total adoption of technology for teaching and learning in 76 faculty members from across the disciplines at two large North American universities.

Research question 3 was to examine the group differences between early and late adopters on perception of barriers to adopting ICT for instructional processes. For this purpose, a self-constructed 44-item survey based on relevant theories and empirical findings was developed. Exploratory factor analysis reduced it to an 11-item survey in three factors: lack of values, lack of support, and lack of skills and confidence. These three factors could explain up to 62% of the variances on the scale. Overall, Omani faculty members did not perceive much of a barrier to adopting ICT in their teaching practices. The findings from the exploratory factor analysis in this study were different from many other studies in terms of the number of barriers and the particular significant barriers. For instance, Haber and Mills reported time and compensation were the greatest barriers in Florida's full-time community college faculty members. Odabasi stated the most important barrier to be the lack of easily accessible resources for Turkish faculty members. Gardner identified the greatest barriers to computer-based technology integration as the financial costs associated with computer hardware and software and the availability of computers for use for Oregon secondary agricultural education teachers.

Nevertheless, in the present study, the four groups were statistically different on lack of values, lack of confidence and skills, and the entire scale. The post-hoc test found early adopters perceived significantly lower barriers of ICT than the late adopters. Hypothesis 3 was supported.

Rogers stated that five perceived attributes of an innovation have strong influences on the adopting process: trialability, observability, relative advantage, complexity, and compatibility. Moore and Benbasat reported that Rogers' attributes can be further expanded. Image was found as an independent attribute apart from Rogers' relative advantage. Observability was further broken into three separate attributes: voluntariness, demonstrability, and visibility. However, confirmatory factor analysis (CFA) did not support Moore and Benbasat's eight-factor structure of ICT attributes. The CFAs, using either the 38-item short form or the 50-item long form in Moore and Benbasat, yielded the convergent and admissible solutions problem (i.e. Heywood case). Thus, exploratory factor analysis (EFA) on the 50-item long form was performed to find the new structure of the 50-item scale in the Omani culture. Remarkably, the EFA reduced the original survey from 50 items to 12 items. Results of the EFA indicated three factors on the 12-item survey: compatibility between ICT and job duties or personal style, ease of use, and relative advantage on job efficiency. These three factors collectively could account for 68% of the variance of the perception scale. Furthermore, the three-factor structure survey demonstrated both reliability and construct validity.

Examination of the three factors seemed to indicate that Omani faculty members only concentrate on these ICT attributes related to their jobs, their personal ability, and their style. Other constructs such as trialability, image, voluntariness, demonstrability, and visibility, valid in the Western culture, did not hold in the Omani culture. However, the finding was consistent with Tornatzky and Klein's and Surry and Gustafson's conclusions that compatibility, relative advantage, and

complexity are the most important innovation attributes related to innovation adoption. Kumar and Rose also reported that perceived usefulness, perceived ease of use, job relevance, and computer compatibility showed significant positive relationship with actual computer use for secondary school Mathematics, Science and English language teachers in Malaysia.

The descriptive means on the three factors and the scale were in descending order from the innovator group to the least innovative late majority/laggard group. However, the four group means on the three factors and on the entire scale were all close to 4.0 or above 4.0. This finding indicated that Omani faculty members in all of the four groups agreed on the ICT values. Further examination by one-way ANOVAs showed significant group differences on all of the three factors and the entire scale, with small practical significances. The subsequent post-hoc tests and the independent sample t-test found that the innovator and early adopter groups had generally higher means on the perceived ICT attributes than the early majority and late majority/laggard groups. Hence, Hypothesis 4 was supported as well.

The last research question was to predict, using a variety of selected variables, the Omani faculty members' ICT uses. These variables were in four blocks: (a) ICT skills; (b) self-rated adopter type, perception of barriers, and perception of ICT attributes; (c) demographic variables including gender, age, academic rank, English language proficiency, computers at home, owning a laptop, and owning a mobile phone computer; and (d) selected job-related variables including number of traditional classes currently taught, number of blended classes currently taught, credit hours teaching, total teaching experience in higher education in years, total years with computers, daily hours spent on a computer, number of students teaching, and number of graduate students supervising. The regression analysis was performed in two ways. The first approach included all of the 19 predictors simultaneously into the prediction model to reveal the overall prediction effect and to find out the relative importance of the competing predictors. The second method used the hierarchical regression model to explore the relative contribution for each of the four block variables.

The results from the simultaneous regression showed that the 19 predictors together significantly predicted ICT uses at the 0.001 level with a large predictive power. The predictors collectively could account for 72% of the variance on ICT uses. In addition, the minor difference between the adjusted R2 and the multiple R2 (i.e., 0.70 and 0.72) indicated a lack of overfitting of the model statistics. Among the 19 predictors, the most important one was the level of ICT skills. It could explain over 90% of the variance on ICT uses in the presence of the other 18 predictors. The other two salient predictors were perception of ICT attributes and number of traditional classes being taught. Faculty members with higher ICT skills, perceiving higher values of ICT attributes, or teaching fewer traditional classes tended to use ICT more in their instructional processes. The other predictors were either with insignificant regression coefficients or small structural coefficients or both. Thus, they were deemed as unimportant predictors.

The hierarchical regression started with the level of ICT skills. This single variable could explain 65% of the variance on ICT uses, indicating this single predictor model had a remarkable prediction power. With the variables of adopter category, perception of barriers, and perception of ICT attributes in the second block added, the prediction model with the four variables was still significant. But the second block variables contributed only an additional 1% to the prediction. Perception of ICT attributes appeared to be the next salient predictor after the level of ICT skills. The seven demographic variables in the third block collectively only contributed another 1% to the overall prediction. In addition, none of the demographic variables appeared to be important predictors. Finally, the eight job-related background variables in Block 4 contributed another 5% to the prediction, bringing the prediction power to 0.72, the same as in the simultaneous regression model in the first approach. Number of traditional classes taught and total years of experience with computer use appeared to be important predictors in this block. Faculty members teaching fewer traditional classes or having more experience with computers tended to use ICT more. In short,

these findings indicated that the level of ICT uses for Omani faculty members could be significantly predicted by the level of ICT skills, adopter category, perceptions of barriers and ICT attributes, and the selected demographic and job-related variables. Among the 19 predictors, three were found to be salient. The most critical one was the level of ICT skills. The other two important predictors were perception of ICT attributes and number of traditional classes teaching. Experience with computer in years was also statistically significant. But the small structural coefficient was small. This variable could only account for 4.8% of the total variances on the level of ICT uses, much less than those for the other three salient predictors. This variable could be considered as marginally significant. Overall, results from the multiple regression analysis supported Hypothesis 5.

The finding of ICT skills as the most significant predictor was consistent with many other studies The finding of perception of ICT attributes as the second best predictor of ICT uses was also consistent with those in Almusalam, Albejadi, Blankenship, Isleem, Jacobsen, and Park. The insignificant impact of demographic variables on ICT uses has also been reported in Dusick and Yildirim and Isleem. It should be noted that perception of barriers and adopter category were significantly related to ICT uses when they were considered individually. However, their significance disappeared when they were examined jointly with other predictor variables. This finding was congruent with Cardwell-Hampton but different from those reported some demographic variables as significant predictors .

In summary, all of the five hypotheses in the present study were supported. The Omani faculty members at SQU varied on their levels of ICT uses and skills, their perception of barriers to adopting ICT in the instructional processes, and their perception of ICT attributes. The self-rated adopter category could statistically explain these differences with small or medium practical significance. The prediction models on ICT uses had remarkable predictive powers. More specifically, the major findings of this study were: (a) the Omani faculty members at SQU overall used ICT at the "sometimes" level and had ICT skills at the "intermediate" level; (b) the most frequently used and skillful ICT functional features were website browsing, Internet search engine use, and word processing, whereas the least utilized and skillful ICT areas were simulation and games, video/audio conferences, and web design software; (c) the numbers of faculty members in the five adopter categories were close to a normal distribution; (d) significant group differences of ICT uses and skills, perception of barriers, and perception of ICT attributes on the adopter category--the Early adopters used ICT more, had a higher level of ICT skills, perceived fewer barriers in the adopting process, and recognized higher values of ICT attributes than the later adopters; and (e) the ICT uses could be significantly predicted by the selected 19 predictor variables, to a large magnitude. The level of ICT skills was the most salient predictor. Perception of ICT attributes and number of traditional classes teaching also appeared to be important. The other variables demonstrated weak relationships with ICT uses.

Contributions and Limitations

The present study can be seen to contribute to the existing body of knowledge in several ways. Firstly, it described the current status of ICT uses and skills for Omani faculty members at SQU. Secondly, it examined the distribution pattern of the five adopter categories; the finding supported Rogers' categorization. Thirdly, it explored the group differences of ICT uses and skills, perception of barriers, and perception of ICT attributes for these faculty members on adopter category. The results confirmed Rogers' claim of adopter category as an important factor for differentiating people in adapting to innovation. Fourthly, this study found that ICT uses for Omani faculty members can be predicted with a large prediction power, and that the level of ICT skills was the most critical factor affecting these faculty members' ICT adoption. Fifthly, it developed the Perception of Barriers to Adopting to Information and Computing Technology Scale, based on the Western literature. The exploratory factor analysis remarkably reduced the survey items from 44 to 11; the remaining 11items solidly loaded on three factors with acceptable reliability and construct validity. Lastly, this study validated the psychometric properties of the Perception of Adopting an Information Technology Innovation Scale by Moore and Benbasat. Confirmatory factor analysis did

not support the validity of this American culture-laden measurement instrument in the Omani culture. The subsequent exploratory factor analysis eliminated 38 out of the total 50 items. The remaining 12 items soundly loaded on three factors with satisfactory reliability and validity. The Omani faculty members appeared to focus on the ICT attributes related to their personal ability and styles, and their job duties. These findings from the confirmatory and exploratory factor analysis not only provided empirical evidences on the cross-cultural validity of the two instruments but also offered some foundation for future development of indigenous measurement instruments on these variables applicable to the Omani culture.

Despite both theoretical and practical contributions made by this research, the findings of this study, nevertheless, should be considered in light of the following study limitations. First, as this study used a convenience sample, the generalizability of this study was limited and the findings should thus be interpreted with caution. Second, as there were no ethnographically valid surveys for the Omani or Arabic cultural context suitable for the purpose of the present study, the survey used in the present study mainly originated from constructs identified in the Western culture. They have not been validated in the Omani culture before. Thus, the cultural validity of these surveys remains an issue although its content validity has been confirmed by a panel of experts. Third, this study was driven by Rogers' theory on DoI. Explanations of the findings under other theoretical models may still be possible. Fourth, as a faculty member's ICT adoption may be affected by a variety of personal, institutional, technological, or cultural factors in reality, the present study focused only on a few selected factors related to Rogers' theory and some demographic and job-related variables. Other important factors influencing faculty members' ICT adoption may still exist and have not been investigated by this study. Fifth, although Rogers' theory served as the theoretical foundation in this study, Rogers' model was not a prediction model. Thus, the present study was exploratory in nature. Sixth, this study was a correlational investigation, rather than a well-controlled experimental study. Hence, causal conclusions about ICT uses and influencing factors cannot be made from the results of this study. Last but not the least, this quantitative study suffers from all of the weaknesses of a quantitative inquiry. Qualitative or mixed method approaches may reveal more detailed and dynamic views of ICT adoption and the associated influencing factors for Omani faculty members.

Recommendations for the SQU

The findings from the study also had several implications for practices. First, the overall level of ICT uses was slightly above "sometimes" but much below "often" .This finding indicated the Omani faculty members do not routinely use ICT in their instructional processes at SQU. Thus, there is much room to promote ICT uses at the university.

Second, the study found that the top five most frequently used and skilled application areas of ICT for Omani faculty members were those of website browsing, Internet search engine use, word processing, presentations in PowerPoint, and email communications in the instructional processes. Whereas these ICT features are valuable and necessary, the SQU administrators and the Center for Educational Technology may need to help the faculty members to utilize other ICT functions as well.

One of the most important findings of the present study was the salient factors influencing ICT uses for Omani faculty members. Among the 19 variables investigated, only a few significantly impacted ICT uses. The level of ICT skills was the most influential. Hence, the university needs to help its faculty members improve ICT skills. The number of traditional classes currently being taught by the faculty member was found to have a negative impact on ICT uses; which has several implications. SQU first needs to continue to increase the number of blended classes being offered. Then, the academic planning committee or the program advisor in each department needs to balance the number of traditional and blended classes for each faculty member.

Conclusion

Informational and computing technology in Omani higher education institutions has grown rapidly in the past decade, but is still in its childhood. It will continue to grow to its adolescence and to shape the way faculty members work and deliver teaching to students. Although today's faculty members are much more ICT proficient than those in the past due to the permeation of ICT into the society and the university, their ICT skills have primarily grown from the personal interests. However, the ICT skills are not being automatically transformed into the instructional processes. Furthermore, individual differences on ICT uses and skills for the university faculty members were identified in the study. Hence, it is important to investigate the critical factors affecting the faculty member's ICT uses. Through the findings, research-based suggestions can be provided to the university administrators, the ICT support department, and the faculty themselves on how to deliberately increase effective ICT uses in the Omani higher education system.

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