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Determinants of Mobile Telecommunication Adoption in Kurdistan

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This study analyzes Kurdistan's potential for effectively using mobile telecommunication. It identifies key factors determining the adoption of mobile telecommunication service. A conceptual model is specified, and several hypotheses are tested with a sample of 1,458 Kurdish mobile phone users in 2010. A discrete choice methodology is used to test two models of mobile telecommunication acceptance: choice of service providers and usage pattern. The results indicate that Korek is the favorite service provider in the Kurdistan region of Iraq, and the subscribers mostly use the service for work purposes. The findings have implications for competition in the market and flows of investment resources to targeted market segments with potential expansion.

Keywords: multinomial logit model, mobile telecommunication, technology adoption, service providers, Kurdistan, Iraq

Introduction

The Kurdistan Region is an autonomous region in federal Iraq that was cut off from all basic postal and telephone services after the first Gulf War in 1991. The region became dependent on satellite-based information and communication systems and services. The expansion and diffusion of these services have been rapid and promoted by the Kurdistan Regional Government (Khayyat, 2010; Khayyat & Heshmati, 2012).

Cell phone and Internet connectivity and use have increased dramatically in recent years. In a short time, information and communication technology (ICT) has become one of the main interests of the Kurdistan government and business community. They have made significant inroads in both public and private sectors of Kurdish society by incorporating the new technologies into governance and business activities. Despite significant progress and public investment in the infrastructure, the Kurdistan region is

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a latecomer in the area of ICT because of political issues and economic, social, and cultural causes such as language barriers and lack of training and development programs.

With a population of nearly 5.2 million—36% aged 0 to 14 years, 60% aged 15 to 64, and 4% over age 64—the diffusion rate in the telecom sector is between 75% and 78% (UNDP, 2004). The diffusion rate is lower than that of neighboring countries; for example. Kuwait and Saudi Arabia's mobile penetration rate reached 150% by the end of 2012 (ITU, 2012). The three mobile phone operators with GSM licenses in Iraq and Kurdistan—Zain Iraq, AsiaCell, and Korek—are relatively new, and their rapid growth nationwide needs to be tracked and studied to derive the necessary policy implications for their business. The telecom sector in Iraq and Kurdistan has witnessed an average of 11.6% growth in the subscription rate, as the rate of subscription increased from 5% in 2005 to 75% in 2012. Zain Iraq has the largest share in the market with 53%, followed by AsiaCell with 31% and Korek with 16% (Marcopolis, 2012).

The objective of this research is to study the factors that influence the adoption of mobile telecommunication service in Iraqi Kurdistan. Such measures are important for the telecommunication sector to serve customers' needs and ensure business sustainability and economic growth. The direct contribution is to identify and estimate the factors that affect the adoption of mobile telecommunication service in the region—a developing area with little infrastructure for wired telephone and basic postal services after the first Gulf War in 1991. The results are useful to other regions with similar conditions. In addition to its insights for the management and regulation of the telecommunication sector, this study has significant potential for education and research in the region.

Literature Review

Mobile telecommunication services have changed people's lifestyles by transforming and revolutionizing the way they work and interact. In addition, they have provided opportunities for a powerful communication medium to influence business and social life.

Many studies have examined the adoption of mobile services and systems, and various models have been applied to predict customers' intentions to use technological innovations (Alborz, 2009; AlHinai, Kurnia, & Johnston, 2007; Baker & Bellordre, 2003; Bouwman & van de Wijngaert, 2009; Carlsson, Hyvonen, Repo, & Walden, 2005; Coursaris, Hassanein, Head, & Bontis, 2007; Hong & Tam, 2006; Hsu, Lu, & Hsu, 2007; H. W. Kim, Chan, & Gupta, 2007; I. Lee, Choi, Kim, & Hong, 2007; Lu, Yao, & Yu, 2005; Park, Roman, Lee, & Chung, 2009; Sanford & Oh, 2010; Yang & Jolly, 2009). We rely on these theoretical models to determine the relevant factors that predict the intention to adopt a mobile phone. Among the most significant and applicable theories to study intentions to adopt mobile phone technology is the technology acceptance model (TAM) developed by Davis (1989). Other theories include the theory of reasoned action developed by Fishbein, I., and Belief (1975), and the theory of planned behavior by Ajzen (1991). Several studies rely on these three theories' models in explaining the intention to adopt ICT systems (Venkatesh, Morris, Davis, & Davis, 2003).

The Technology Acceptance Model

The TAM was developed to explain potential users' behavioral intentions in using technological innovation. It is based on the theory of reasoned action (Fishbein & Ajzen, 1975), in which attitudes that are influenced by beliefs form behavioral intentions. The TAM uses this causal sequence of belief–attitude–intention–behavior to understand the determinants of information technology acceptance, which then triggers actual behaviors (W. J. Lee, Kim, & Chung, 2002). The TAM describes the causal relationships between system design features, perceived usefulness, perceived ease of use, attitude toward using, and actual usage behavior. The TAM provides an informative representation of the mechanisms by which design choices influence user acceptance.

Two key constructs are *perceived usefulness* and *perceived ease of use*. Perceived usefulness refers to the prospective user's subjective notions about how much using a specific application system will increase his or her job performance in an organizational context, which relates to extrinsic characteristics such as efficiency and effectiveness. Perceived ease of use refers to the degree to which the prospective user expects the target system to be free of effort, which relates to intrinsic characteristics such as ease of use and flexibility. These two perceptions combine to affect the adoption of new technologies (Adams, Nelson, & Todd, 1992).

External factors such as individual favorites or constraints resulting from certain situations also are expected to affect users' acceptance of the technology when these factors are within the two key construct of perceived usefulness and perceived ease of use. According to King and He (2006), perceived usefulness might affect actual use irrespective of attitude if the use of the technology offers direct benefit to the user.

Despite several studies confirming the robustness of the acceptance models, many scholars have identified some important limitations associated with using such models. Chuttur (2009) classified the criticism of the acceptance models into three categories: First, the methodology relies on self-reported use data instead of actual use data. This subjective measure is considered by some scholars unreliable for measuring the actual use of a system. Second, the variables and the relationships constructed in the acceptance models are limited in terms of their ability to be replicated. Many scholars have found that perceived usefulness has more influence on system acceptance than perceived ease of use. Therefore, these two sets of variables may not mediate all relevant influences from external environmental factors on the system usage. As a result, some external factors such as level of education and age also may have direct influences on system usage (Burton-Jones & Hubona, 2006). Finally, according to Bagozzi (2008), behavior cannot be considered as a terminal goal. He has argued that the acceptance models are deterministic and not suitable for explaining and predicting system usage. Bagozzi notes the need for a paradigm shift because of critical shortcomings in the paradigm. Bagozzi's proposition was that there might be other factors that alter the dominant paradigm.

Based on these theories, researchers have studied many aspects of mobile phone adoption, such as the effects of factors such as usefulness, ease of use, enjoyment of using a service, content and system quality, and impact of technical issues. Despite possible individual limitations but strong complementarities, the experience gained from the studies and their results can be used to specify suitable models of adoption of mobile telecommunication service in Kurdistan.

Technology Adoption in Developing Countries

Fong (2009) proposed some "relevant" factors for ICT adoption in developing countries such as market structure, institutional capacity, socioeconomic factors, human capabilities, government policies, basic utility infrastructure, stakeholders' interactions in the system, and international cooperation and collaboration.

An empirical examination of the factors affecting consumers' intentions to use mobile commerce in Malaysia proposed an extension to TAM. Five factors were examined: perceived usefulness, perceived ease of use, social influence, perceived cost, and trust (Wei, Marthandan, Chong, Ooi, & Arumugam, 2009).

In research on technological adoption in poor countries, Foster and Rosenzweig (2010) recommend further study focusing on the interaction between behavior, market settings, traditional institutions, and technology payoffs to understand the different experiences over time for different countries in adopting new technologies. Gulbahar and Guven (2008) surveyed 326 primary school teachers in Turkey to examine the use and adoption of ICT. They found that, despite the teachers' willingness to use ICT, accessing the ICT tools was difficult.

Other studies examining the ICT adoption in developing countries have added to the growing stock of knowledge in the field of ICT (Aboelmaged, 2010; Al-Qirim, 2007; Al-Shafi & Weerakkody, 2009; Avgerou, 2009; Bwalya, 2009; Dercon & Christiaensen, 2011; Duncombe & Boateng, 2009; Giné & Yang, 2009; Howard & Mazaheri, 2009; Khayyat & Heshmati, 2012; Kijsanayotin, Pannarunothai, & Speedie, 2009; Park et al., 2009). A strand of literature has changed focus from theories explaining adoption intention to theories of usage of technology after adoption (Bhattacherjee & Premkumar, 2004; S. S. Kim & Malhotra, 2005).

Conceptual Framework and Research Hypothesis

The model presented here includes five main determinants: perceived usefulness, perceived ease of use, perceived enjoyment, price, and demographic characteristics such as age, gender, location, education level, and occupation. Type of service provider and purpose of using a mobile phone are added as dependent variables against which all other variables are analyzed.

Perceived usefulness is defined by Venkatesh and Davis (2000) as "the extent to which a person believes that using the system will enhance his or her work performance" (p. 187). Previous research found that perceived usefulness is the strongest predictor of intention to use and purchase the technology. We expect such an influence will persist under the current circumstance; therefore, our first hypothesis is:

H1: *Perceived usefulness of mobile technology affects an individual's intention to adopt the technology.*

Perceived ease of use is defined as the degree to which interaction with the technology is clear and understandable (Ndubisi, Gupta, & Massoud, 2003). Perceived ease of use, as one of the characteristics of TAM, has been found to be an important factor influencing the intention to purchase a technology (Davis, 1989). Thus, our second hypothesis is:

H2: *Perceived ease of use of the mobile technology affects an individual's intention to adopt the technology.*

Perceived enjoyment is defined by Davis, Bagozzi, and Warshaw (1992) as "the extent to which the activity of using the technology is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (p. 1113). The concept is also used by others who argue that it affects the intension to use the technology (Moon & Kim, 2001; van der Heijden, 2003; Venkatesh & Davis, 2000). Accordingly, we propose the following hypothesis:

H3: *Perceived enjoyment of the mobile technology affects an individual's intention to adopt the technology.*

Rogers (1995) has presumed intrinsic generalizations concerning characteristics of the adopter that influence innovativeness: socioeconomic status, personality values, education level, and communication behavior. The age characteristic, according to Rogers' generalization, do not distinguish the earlier adopters from the later adopters. However, some studies have shown that early adopters are younger, and some have shown that they are older.

We propose the following additional hypotheses regarding the adoption and usage of mobile telecommunication service. Because these variables can be considered control variables, no theoretical justifications for their use are needed.

H4: *An individual's age influences his or her intentions to adopt the technology.*

H5: *An individual's gender influences his or her intentions to adopt the technology.*

H6: *An individual's occupation influences his or her intentions to adopt the technology.*

H7: *An individual's educational level influences his or her intentions to adopt the technology.*

H8: *An individual's location influences his or her intentions to adopt the technology.*

H9: *An individual's income influences his or her intentions to adopt the technology.*

Studies on the telecommunication business show that customers are sensitive to the service price. Price is used to attract new and current customers from competitors through marketing campaigns (Roos & Gustafsson, 2007). The final hypothesis, then, is stated as follows:

H10: *Adoption of mobile telephone service is related to the price of the purchased service.*

In Kurdistan, the service price is set by the service provider according to the market competition. There are no regulations about price setting in the region.

The five main determinants of mobile phone technology adoption used in this study are presented in Figure 1. The figure also provides a graphic representation and summary of this study's conceptual foundation.

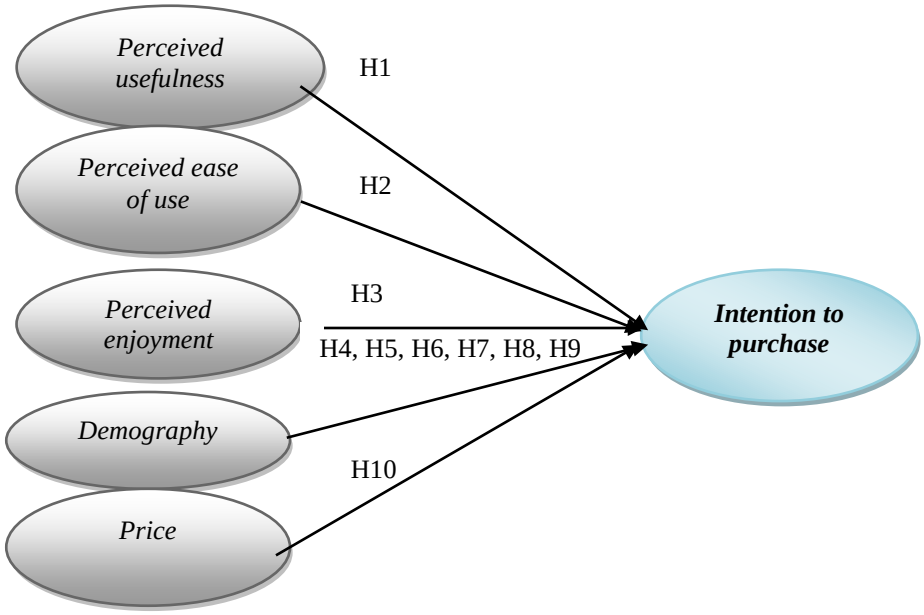

Figure 1. A conceptual model for consumer acceptance of mobile phone technology.

Data, Models Estimation, and Results

Mobile Service Survey

To study the mobile telecommunication service network subscribers in Kurdistan, the considered sample was limited to the general public living in the region. To collect a representative sample of respondents,[2] different methods were applied for data collection. The two main mobile phone operators in the region (Korek and AsiaCell) collected each 400 surveys in 2010 by calling their customers randomly and conducting the questionnaire directly through phone calls. The surveys were conducted upon request from the principal author. In addition, 658 forms were collected by the Ministry of Transportation and Communication and the Ministry of Agriculture and Water Resources targeting government employees. The survey distribution reflected the population structure in the region's governorates.

A total of 1,458 questionnaires were received. The median respondent was between 26 and 40 years of age, hold a diploma or bachelor degree, and be a public-sector employee with an annual disposable income of less than US$8,000. The frequency distribution and descriptive statistics of the main variables are reported in Table 1.

Table 1. Frequency (Main Variables) of the Survey Data (N = 1,458).

Variable	No. of Obs.	%	Variable	No. of Obs.	%
Location			Use purpose		
1	555	38	1	824	56
2	236	16	2	465	31
3	667	45	3	80	5
Gender			4	89	6
1	780	53	Hours used		
2	678	46	1	963	66
Age			2	380	26
1	486	33	3	115	7
2	578	39	Cell phone brand		
3	344	23	1	1,007	69
4	50	3	2	200	13
Education			3	83	5
1	174	11	4	50	3

[2] The sample is representative according to the 2007 statistical yearbook released by KRG Ministry of Planning. See http://www.krso.net/documents/99/FactSheet1_Demography_21072012.pdf

2	163	11	5	55	3
3	355	24	6	63	4
4	685	46	Preferred features		
5	81	5	1	215	14
Occupation			2	205	14
1	70	4	3	173	11
2	160	10	4	499	34
3	800	54	5	366	25
4	428	29	User satisfaction		
Income			1	972	66
1	165	11	2	486	33
2	632	43	Service quality		
3	345	23	1	406	27
4	98	6	2	548	37
5	68	4	3	333	22
6	64	4	4	124	8
7	86	5	5	47	3
Operator					
1	654	44			
2	748	51			
3	56	3			

The questionnaire consisted of two parts: *Part 1* contained questions about consumer characteristics and demography, and *part 2* contained questions about the driving factors of the customer's technology adoption. The questions were designed to discover customers' perceptions about customer service after experiencing it and to inquire about the brand and type of cell phone purchased after the technology adoption. Based on previous research (Liao, Tsou, & Huang, 2007; Moore & Benbasat, 1991; Pagani, 2004), perceived usefulness is measured with questions about the daily amount of time the service is used, the main purpose of use, and the network quality. Perceived ease of use is measured with questions about the customers' preferred cell phone features; the questions were adapted from Agarwal and Prasad (1997).

The questionnaire was designed in English and Kurdish versions. The English version was created first, because this was easier and more convenient to adapt from the original format initiated by Parasuraman, Zeithaml, and Berry (1985). The English questionnaire was then translated into the Kurdish language. Table 2 presents definitions of the variables and their scales.

Table 2. Descriptions of the Main Variables and Their Classifications.

Main variable	Subvariable	Description	Type of variable	Construct
Location	Erbil	Consumer residing in the capital of the Erbil region	Dummy (1 for yes, 0 otherwise)	Demography
	Dhok	Consumer residing in the city of Duhok		
	Suli	Consumer residing in the city of Sulaymaniyah		
Gender	Male	Male consumer		
	Female	Female consumer		
Age	Age	Age of consumer	Continuous	
Education	Prims	Level of education up to primary school	Dummy (1 for yes, 0 otherwise)	
	Mids	Level of education up to middle school		
	Hs	Level of education up to high school		
	College	Level of education: bachelor or diploma		
	Postgrad	Level of education: high diploma, master, doctorate		
	College	Level of education: bachelor or diploma		
Occupation	None	Occupation: none/retired		
	Private	Occupation: self-employed		
	Public	Occupation: public employee		
	Student	Occupation: student		
Income	Income	Monthly income	Continuous	
Operator		1: Users of AsiaCell 2: Users of Korek 3: Users of other services	Discrete variable (1, 2, 3)	Service resources
Name of service operator used	Korek	Consumers use Korek service	Dummy (1 for yes, 0 otherwise)	
	Asia	Consumers use AsiaCell service		
	Othersp	Consumers use the other services (Ariafon/Mobitel)		
Price		AsiaCell: 1.16 Korek 1.245 Others on average: 1.92	Continuous	Cost
Cost	Cost	Time use × price		
Purpose of use	Work	Primary purpose of using the service: Work-related	Dummy (1 for yes, 0 otherwise)	Efficiency
	Social	Social interaction		
	Entmnt	Entertainment		
	Otheprps	A combination of purposes		

Hours used	Houruse1	Amount of time service is used (receiving/making a call): less than 30 minutes per day	Dummy (1 for yes, 0 otherwise)	Utility
	Houruse2	Amount of time service is used (receiving/making a call): 30–60 minutes per day		
	Houruse3	Amount of time service is used (receiving/making a call): More than 60 minutes per day		
Cell phone brand	Nokia	Name of cell phone brand: Nokia		
	Korean	LG or Samsung		
	Othebnd	Sony/Motorola/other		
Preferred features	Color	Color		
	Media	Multimedia		
	Battery	Battery life		
	Tech	High-tech options		
	Easyuse	Ease of use		
User satisfaction		Is the user satisfied with the current service		
Service quality		User's rating of service quality 1 = very high 2 = high 3 = medium 4 = low 5 = very low	Discrete variable (1, 2, 3, 4, 5)	

The questions were categorized according to the five main constructs: demography, service resources, cost, efficiency, and utility (see Table 2). In addition to demographic constructs, the study includes the constructs of perceived usefulness and efficacy, which include utilization rate factors. It also includes a construct of efficiency expressed in terms of the customer's main purpose of using the mobile service. A correlation matrix of the variables is presented in Table 3. No significant correlation exists between the demographic variables, which allows the use of the fourth and fifth determinants as control variables.

The distribution of the mobile subscribers is shown in Table 4. The number of users for Korek, AsiaCell, and others (Ariafon and Mobitel) are 748 (51.3%), 654 (44.86%), and 56 (3.84%), respectively. We pooled the number of users for the two latter operators into one due to their relatively small number and market share. The market share of the service providers as represented by our sample is close to their actual market shares.

The Multinomial Logit Models

The Logit model is used to model a relationship between a discrete dependent variable Y and one or more independent variables X. The dependent variable, Y, is a discrete variable (if it contains only two choices, then the model is called a binomial logit; although it is called multinomial logit if the dependent variable Y is multicategorical variable) that represents a choice, or category, from a set of mutually exclusive choices or categories. For example, a researcher models the choice of mobile phone purchase (from a set of mobile phone brands), the choice mode (such as Nokia, iPhone, Samsung, LG, etc.), the features of the mobile phone (color, size, display screen, etc.), or the service provider choice (SP1, SP2, SP3, etc.). The independent variables are presumed to affect the choice or category or the choice maker, and represent a priori beliefs about the causal or associative elements important in the choice or classification process. In the case of ordinal scale variables, an ordered logit or probit model can be applied to take advantage of the additional information provided by the ordinal over the nominal scale (Greene, 2008).

To explain the concept of logistic regression, we follow the definition of Train (2009) . A decision maker, labeled *i*, faces a choice among *J* alternatives (*j = 1, 2,…, J*). The decision maker would obtain a certain level of utility from each alternative. This utility is denoted as *Uj,*. The decision maker chooses the alternative that provides the greatest utility. Our behavioral model takes the following form: A decision maker chooses alternative *j* if and only if $U_{ij} > U_{ik} \ \forall \ j \neq k$. The probability that decision maker *i* chooses alternative *j* is equal to: *Pij* = Prob(*Uij* > *Uik* ∀ *j* ≠ k). If *j > 2,* then the model is a multinomial choice probability model. The basic function of the logistic analysis is:

$$(1) \quad P_{ij} = E(Y_j \mid 1 / x_{jm}) = \frac{1}{1 + \exp(-(\beta_0 + \beta_m X_{jmi}))},$$

where P_{ij} is the probability that individual *i* chooses alternative *j*, X_{im} is a vector of observed variables relative to alternative *j*, and β_0 and β_m are vectors of coefficients to be estimated.

In this study we have specified two models using logistic regression methodology. The two models are constructed as functions of the different data characteristics and are estimated independently.

Table 3. Correlation Matrix, 1,458 Observations.

	Locat	Gender	Age	Educat	Occup	Income	Spname	Satisfy	Handtyp	Preftur	Houruse	Usprpos	Qosrate
Locat													
Gender	0.009												
Age	0.186	−0.176											
Educat	−0.068	0.042	0.166										
Occup	−0.019	0.021	-0.368	0.226									
Income	−0.015	−0.031	0.109	0.176	−0.027								
Spname	−0.577	0.042	-0.194	0.021	−0.048	0.054							
Satisfy	0.087	−0.158	0.043	0.146	0.020	0.012	−0.100						
Handtyp	−0.032	−0.024	-0.021	−0.033	−0.008	0.018	0.137	0.013					
Preftur	−0.039	0.015	0.113	0.027	−0.128	0.044	0.026	0.075	−0.149				
Houruse	0.017	−0.006	0.015	0.092	−0.059	0.500	0.112	0.002	0.126	−0.027			
Usprpos	−0.039	0.132	0.206	0.016	0.108	−0.118	0.043	−0.025	0.138	−0.144	0.022		
Qosrate	0.021	−0.089	0.005	0.013	0.020	−0.104	−0.075	0.302	0.004	0.022	−0.044	0.148	

Table 4. Distribution of Mobile Telephone Service Subscribers.

Service provider	Frequency	Percentage
Asia Cell	654	44.86
Korek	748	51.30
Aria/MobiTel	56	3.84
Total number of observations	1,458	100.00

To examine how well the two models fit the data, the log likelihood ratio test (LR test) is used to compare one model without restriction (the full model) with the other model with restriction (the null model). The utility maximization that is subject to restriction will not imply a larger maximum when it is compared with utility maximization that is subject to no restriction (Gujarati, 2004).

The LR test is defined as follows: $\lambda = 2(LR_u - LR_r)$, when LR_u is the log likelihood for the model with no restriction, and LR_r is the log likelihood for the model with restriction. The test statistic λ follows a χ^2 distribution with degree of freedom equal to the number of restrictions imposed by the null hypothesis. The difference between LR_u and LR_r indicates whether the restrictions are correct.

The Choice of Service Operator

Because we are interested in a sample of individuals and mobile service operators, we used the multinomial logit model to study the choices of the subscribers for the mobile telecommunication service operators in Kurdistan. This can be considered a special case of a general model of utility maximization (Greene, 2008). This model will allow us to make inferences and identify the factors influencing users' behavior in choosing the type of services available within the region's mobile telecommunication service network.

It is assumed in the model that the independent variables consist of a set of individual user characteristics such as gender, age, income, education, and employment. These are the same for all the choices regardless of service provider chosen. The observational setting is the individual's choice among a set of alternatives, where it is assumed that an individual's characteristics determine his or her choice. The service provider (Sp) has three values—0 = AsiaCell, 1 = Korek, and 2 = Other provider—and is specified as follows:

$$SP_i = \alpha_0 + \beta_{Age} Age_i + \beta_{Cost} Cost_i + \beta_{Income} Income_i + \beta_{Gender} Gender_i \sum_{j=1} \beta_j Locat_{ji} + \sum_{j=1} \beta_j Eduat_{ji} + \sum_{j=1} \beta_j Occup_{ji} + \sum_{j=1} \beta_j Usprpos_{ji} + \varepsilon_i \quad (2)$$

where Age, Income, Gender, Locat, Educat, and Occup represent the age, income, gender, location, education level, and occupation of the consumer; and Cost and Usprpos represent the cost of using the service and the main purpose of using the service, respectively. The number of categories in each group of variables may differ. Because there are multiple categories for SP, we choose a base category (AsiaCell = 0) as the reference group.

The reference group for explanatory variables is comprised of subscribers with the following characteristics: women residing in Erbil, with a primary school education, are unemployed or have no permanent job, and use the phone for work-related purposes.[3] To test the fit of the model, we calculated the predictive values for the three alternatives: (608 + 529 + 8)/1,458 = 78.5%, which implies that 78.5% of the choices are correctly predicted by the model (see Table 5). The results show that AsiaCell has the highest number predicted, the model estimated correctly 79% of the actual outcome. The model predicted 78% of the actual outcome for Korek service provider.

Table 5. Number of Actual and Predicted Outcomes from Model 1, the Choice of Service Provider.

	Predicted alternative service provider			Total
Actual alternative service provider	AsiaCell: 0	Korek: 1	Other: 2	
AsiaCell: 0	608 (79%)	140	0	748
Korek: 1	123	529 (78%)	2	654
Other: 2	38	10	8 (80%)	56
Total	769	679	10	1,458

[3] We have chosen different reference groups in the models, but this had no effect on the results.

The likelihood ratio (LR) in this model is 814.75 (see Table 6). With 32 degrees of freedom, it indicates that the effects in model specification are statistically highly significant at the 10% level of significance. The null hypothesis (the model with only intercept) is rejected, and the independent variables are jointly significant.

According to the figures shown in table 6, we can interpret the results as follows: Residents of Sulaymaniyah and Duhok cities prefer to use Korek over AsiaCell (where the coefficients of SULI and DHOK, 3.168 and 1.048, respectively, are significant at the 10% level). The same effect is seen when we compare residents of Duhok who prefer AsiaCell over other service providers (but the coefficient of DHOK, 0.611, is significant at the 1% level). This supports our hypothesis (H8) that the individual's location influences his or her adoption of a mobile telephone service.

Table 6. Parameter Estimates for Service Provider Model (*N *= 1,458).

Dependent Variable: Sp			
Variables		Y=1	Y=2
Main	Sub	Korek	OtherSP
Constant	Constant	-5.984***	-4.769***
Gender	Female	Reference	
	Male	0.211	-0.006
Location	Erbil	Reference	
	Suli	3.168***	-0.911*
	Dhok	1.048***	0.611*
Age	Age	0.033***	0.015
Income	Income	-0.0003***	-0.0001
Education	Prims	Reference	
	Mids	-0.311	-0.318
	Hs	-0.508*	-2.061***
	College	-0.236	-1.213***
	Postgrad	-0.641*	-0.717
Occupation	None	Reference	
	Private	1.809***	1.281**
	Student	1.939***	0.050
	Public	2.411***	0.406
Purpose of Use	Work	Reference	
	Social	0.302*	0.529
	Entmnt	0.262	1.258**
	Otheprps	0.215	0.947*
Cost	Cost	0.0417***	0.062***
Likelihood Ratio: LR		814.75 (32 df)	

Note. Standard errors are robust.

* $p < .10$, two-sided test. ** $p < .05$, two-sided test. *** $p < .01$, two-sided test.

Older generations are more likely to use Korek than AsiaCell (a 10% level of significance with coefficient 0.033). This result supports the hypothesis (H4) that age influences the adoption of mobile phone service. H9 is also supported; consumers with lower income prefer AsiaCell over Korek, and the results are logical because AsiaCell service is cheaper than Korek service. Occupation has an overall positive impact on the adoption of service. Students and those who work in the public and private sectors are more likely to favor Korek over AsiaCell. H6 is also supported.

The multinomial logit for men relative to women, for Korek relative to AsiaCell, and other service providers relative to AsiaCell are conditional on the other variables in the model. These are held constant at 0.211 units higher for using Korek relative to AsiaCell and 0.006 units lower for using the other service providers relative to AsiaCell, respectively. However, the prediction is not reliable, because the coefficient is not statistically significant. Hence, we are unable to test gender-related H5 with this model.

People who like to use their mobile phone mainly for entertainment purposes prefer to have service providers other than Korek and AsiaCell, at a 5% level of significance with a coefficient of 1.258. This finding supports our claim, and hence H1, H2, and H3 can be justified. On the other hand, we notice an overall negative influence of education level—in particular, customers with different education levels make different choices. For example, customers with high school or a higher level of education are more likely than customers with some primary education to use AsiaCell than other service providers. H7 is justified based on these results.

By examining the impact of cost on the adoption of service, the coefficient of cost is negative and it is statistically highly significant in both groups compared to the reference group. This supports H10.

The Usage Pattern of Mobile Phone

To be accepted, a technology must satisfy fundamental usability requirements and be perceived as useful by its intended user community (Davis, Bagozzi, & Warshaw, 1989). This model analyzes the factors affecting the purpose of using the mobile telecommunication service (USPURPOS) among mobile phone subscribers in Kurdistan. This model supports our study in determining the factors relevant to mobile telephone adoption. We applied the multinomial logit model again, specified as follows:

$$USPURPOS_i = \alpha_0 + \beta_{Age}\, Age_i + \beta_{Cost}\, Cost_i + \beta_{Income}\, Income_i + \beta_{Gender}\, Gender_i + \sum_{j=1} \beta_j\, SPNAME_{ji} + \sum_{j=1} \beta_j\, BRAND_{ji} + \sum_{j=1} \beta_j\, FEATURE_{ji} + \sum_{j=1} \beta_j\, HOURUSE_{ji} + \varepsilon \quad (3)$$

where Spname, Feature, and Houruse represent service provider name, the preferred features available in the cell phone, and the length of time the customer uses the service on a daily basis. Uspurpos has four choices (0 = work related, 1 = social, 2 = entertainment, and 3 = other purpose). The reference group for the dependent variable is the work-related group. The reference groups for the explanatory variables are as follows: women, AsiaCell for SP, Nokia for BRAND, ease of use for Feature, and houruse1 for Houruse.

We examine how the specified model fits to explain the variations in the data survey, and Table 7 shows the number and percentages of actual and predicted observations of the dependent variable Usprpos.

Table 7. Frequencies of Actual and Predicted Outcomes-Model 2, Use Purpose

	Predicted alternatives				Total
Actual alternative	Work: 0	Social: 1	Entertainment: 2	Others: 3	
Work: 0	709 (63.0%)	110	5	0	824
Social: 1	314	139 (44.5%)	11	1	465
Entertainment: 2	37	34	9 (36.0%)	0	80
Others: 3	61	28	0	0 (0.0%)	89
Total	1,121	311	25	1	1,458

Mobile service subscribers in Kurdistan are mostly using the service for their work. The model estimated 63% of the actual outcome; the second possible use is for social life, where the model estimated 44.5% of the actual outcome correctly. To test the fit of the model, we calculated the overall predictive values for the four alternatives: (709 + 139 + 9)/1,458 = 58.8%. We find that 58.8% is correctly predicted by the model estimating the purpose of using the mobile service.

Table 8. Parameter Estimates for Usage Pattern Model (N = 1,458).

Dependent Variable: Usprpos				
Variables		Y=1	Y=2	Y=3
Main	Sub	Social	Entertainment	Combined
Constant	Constant	2.834	-10.307**	2.897
Gender	Female	Reference		
	Male	-.918***	-0.3081	-0.500**
Age	Age	-0.028***	-0.109***	-0.041***
Income	Income	-0.96D-04	-0.006***	-0.006***
Cost	Cost	-0.076	0.390**	-0.140
Preferred Features	Ease of Use	Reference		
	Tech	-0.523***	0.575	0.282
	Media	0.370*	2.288***	0.696*
	Battery	0.239	1.515**	0.585
	Color	0.557***	2.187***	0.032
Hoursuse	Houruse1	Reference		
	Houruse2	1.672	-7.716**	3.152
	Houruse3	2.782	-12.537*	6.248
Brand Name	Nokia	Reference		
	Korean	0.077	0.691**	-0.1826
	Othebnd	0.681***	1.575***	0.793**
SP NAME	Asiacell	Reference		
	Korek	-0.634*	1.963**	-0.857
	Othersp	-0.279	2.653**	-0.394
Likelihood Ratio LR		327.41 (42 df)		

Note. Standard errors are robust.

* $p < .10$, two-sided test. ** $p < .05$, two-sided test. *** $p < .01$, two-sided test.

The likelihood ratio in this model is 327.41 with 42 degrees of freedom (see Table 8). This indicates that the effects in the model specification are statistically highly significant. With a 1% level of significance, we can reject the null hypothesis that the coefficients of the independent variables are all simultaneously zero. The results shown in Table 8 can be interpreted as follows.

The negative and statistically significant values of male, age, and income imply that women, younger cohorts, and lower-income customers are more likely to use mobile service for performing their

work. A possible explanation for this finding is that younger people and women generally earn less income and hence they mostly use the service for necessary tasks. In Kurdistan, most employers subsidize employees' calling expenses. As expected from the economic theory, the cost coefficient is negative and statistically significant, indicating that use of the service for entertainment decreases as the service price increases.

The more time per day the service is used, the more likely it is used for non-entertainment purposes, a claim supported by examining the coefficients of houruse2 and houruse3. Moreover, Korek service users are more likely to use the service for work than for social purposes (coefficient –0.634). This might be due to the high price of using the service in comparison with AsiaCell. In general, customers who use the service for social-related activities prefer AsiaCell over the other service providers, but for entertainment purposes, AsiaCell is less favored. This supports H3, stating a positive relationship between entertainment and adoption of the service.

Table 9. Summary of Hypotheses Tested.

Hypotheses	Proved and justified in models
H1, H2	Model 1
H3	Model 1, Model 2
H4	Model 2
H5	Model 2
H6	Model 1
H7	Model 1
H8	Model 1
H9	Model 1, Model 2
H10	Model 2

H4, H9, and H10 are justified in this model as well as in the previous model, which indicates the power of the two models in determining the adoption factors of the mobile service telecommunication in Kurdistan. Subscribers who use Korean cell phone brands (Samsung and LG) and other brands are more likely than Nokia subscribers to use the phone for entertainment. This implies that Korean brands have more entertainment features than Nokia. Table 9 presents a summary of the proved and justified hypothesis by the two models constructed in this article.

Marginal Effects

The estimated coefficients from multinomial logit models do not have a direct interpretation. Parameter estimates will give us only the expected change in logit, not the probability of choosing a certain service provider in the first model and the probability of using the service for a specific purpose in the second model. The purpose of this study is to examine the direct effect of variables on the probability of choosing a service provider and to examine the direct effect of variables on the probability of using the service for a specific purpose, leading us to the marginal effects. The marginal effects are reported in Table 10.

Table 10. Marginal Effects Obtained From Estimating Technology Adoption Models (N = 1,458).

Model 1: Spnam					Model 2: Usprpos	
Variables		**Y = 1**	**Y = 2**	**Y = 1**	**Y = 2**	**Y = 3**
Main	Sub	Korek	Othersp	Social	Entertainment	Combined
Constant	Constant	−1.420***	−0.043**	0.644*	−0.238**	0.111
Gender	Female	Reference		Reference		
	Male	0.052	−0.002	−0.191***	0.001	−0.009
Location	Erbil	Reference				
	Suli	0.781***	−0.045***			
	Dhok	0.250***	0.003			
Age	Age	0.008***	0	−.005***	−0.002***	−0.002***
Income	Income	−0.00***	0	0	−0.000***	−0.000***
Education	Prims	Reference				
	Mids	−0.073	−0.004			
	Hs	−0.107	−0.037***			
	College	−0.047	−0.022**			
	Postgrad	−0.151	−0.009			
Occupation	None	Reference				
	Private	0.431***	0.010			
	Student	0.473***	−0.016			
	Public	0.585***	−0.013			
Purpose Of Use	Work	Reference				
	Social	0.070*	0.008			
	Entmnt	0.053	0.023*			
	Otheprps	0.045	0.017			
COST	Cost	0.010***	0.001***	−0.017	0.009**	−0.006
Preferred Features	Ease Of Use			Reference		
	Tech			-0.124***	0.015	0.023
	Media			0.053	0.044***	0.026
	Battery			0.031	0.029**	0.024
	Color			0.106**	0.041***	−0.010

Hours Used	Houruse1		Reference		
	Houruse2		0.365	−0.176**	0.142
	Houruse3		0.588	−0.288**	0.287
Brand	Nokia		Reference		
	Korean		0.015	0.014**	−0.011
	Othebnd		0.125***	0.027***	0.026
Service Operator Used	Asiacell		Reference		
	Korek		-0.138*	0.046**	-0.035
	Othersp		-0.072	0.057**	−0.018

Note. Standard errors are robust.* $p < .01$, two-sided test. ** $p < .05$, two-sided test. *** $p < .10$, two-sided test

The marginal effects are interpreted as follows. The coefficient of the residents of Suli (Sulaymaniyah City) and Dhok (Duhok City) in Model 1 for Korek are 0.781 and 0.250, which implies that residents of Sulaymaniyah and Duhok are more likely to choose Korek. The mountainous topography of Sulaymaniyah and Duhok means that a service provider with strong call signals will have a better chance of adoption, and Korek, indeed does have better call signals than other service providers.

The probability of older generations to choose Korek over AsiaCell is relatively higher by 0.008. However, a result can be statistically significant but still may be too small to be practically useful. The negative signs of the coefficients in the education categories imply that educated people in the region are likely to prefer AsiaCell service over other services.

The probability of using Korek rather than AsiaCell among students and those who work in the private and public sectors relative to those who have no permanent job is higher by 0.473, 0.431, and 0.585, respectively. Korek's high-quality network makes the service desirable. In addition, because of the poor infrastructure of landline telephones and the continuous development program of the region, public employees are provided with credits by the government to use mobile telecommunication in performing their jobs.

The probability of using Korek rather than AsiaCell for social purposes is higher by 0.070. Korek is trying to retain customers by offering more entertainment features. The probability of using the other service providers rather than AsiaCell for entertainment is higher by 0.023. The other service providers are trying to attract more customers by offering different entertainment features.

The second model in this study analyzes the factors that are relevant to the purpose of using mobile telecommunication. The negative coefficient among men indicates that the marginal effect of this variable to the probability of using the service mainly for social purposes is negative. In other words, women are more likely to use the service for social networking.

The negative coefficients of age imply that the probability of using the service for social and entertainment purposes are lower among younger subscribers. This is likely due to the high cost of

telecommunication services in the region and the typically low income of younger people. Younger people use the service mainly for work-related purposes.

Positive coefficients of media, battery, and color for entertainment use are relative to work purposes. This indicates that subscribers who prefer to have a cell phone with better media quality, long battery life, and more color options are more likely to use the service for entertainment than for work-related tasks. Moreover, the positive coefficient of Korean brands and other brands relative to Nokia for entertainment use is an indication that Korean cell phones contain more entertainment features than Nokia brands.

Summary, Conclusion, and Policy Implications

This study contributes to the literature in several ways. First, it finds evidence of leapfrogging and diffusion of ICT systems and services in a landlocked region under rapid development. Second, it sheds light on the heterogeneity in the ICT sector development, planned and managed regionally by a late-late comer vs. centrally. Third, it shows the power of new ICT technology and how it crowds out the old technologies. Fourth, it shows the evolution of new Kurdish regional and national corporations and their entry into the competitive Middle Eastern ICT market as main players.

The two multinomial logit models provided evidence of the overall significance of the explanatory variables. The models were found to have a high explanatory power, and individual parameters were strongly significant with the expected signs. This indicates that the model as a whole explains quite well customers' intentions to use mobile services, and the analyses and tests show evidence of reliability of the factors measuring information technology adoption. Despite a lack of previous empirical studies in Kurdistan, we have developed a well-established scale for measuring the intentions to adopt information technology that can be used by business managers, policy makers, and regulators.

These findings prove the relevance of the proposed and successfully tested hypotheses. The study represents a critical step toward developing a technology acceptance theory in Kurdistan's mobile telecommunication sector. The study also presents important theoretical and practical contributions useful to market analyzers and decision makers. It provides a useful conceptualization of the formation of technology acceptance through examining its determinants.

The communications infrastructure in Kurdistan has been neglected for years as a result of sanctions and internal strife. In the short term, the enablement of ICT in the region is as much of a development issue as it is a policy issue. Initial policy development should form the basis of a policy environment that will facilitate rapid growth and exploitation of the telecommunication industry. To catch up in the long run, the regional government must create a suitable regulatory environment, act to create international connectivity with neighboring states, and form partnerships with businesses to ensure an optimized network and with the education sector to develop necessary ICT skills among workers.

Mobile phones are already used extensively within the region. However, the quality of the services is not monitored by the government, and a proper regulatory policy needs to be developed. Regulation of the market in the region will encourage firms to build and maintain a competitive advantage, achieve higher customer satisfaction, and improve service quality. This study is a first attempt to assess—

and suggests an initiative to regularly reassess—service quality to meet customer expectations and provide satisfaction.

The estimated models show that Korek is the preferred service among the available services. To attract more customers, AsiaCell should address the weak points of its service such as network quality and available features. However, according to our results, the younger generation prefers to use Korek over AsiaCell and other providers; therefore, Korek should pay more attention to this age cohort, extending service offers and identifying the factors affecting the nonuse of the service by older age cohorts.

Future research should be forward looking and focused on the examination of similar models with a specific service such as SMS, MMS, Internet service, customized service, and customer service. Additional research is also needed to define better measures of calling cost and cell phone prices.

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