
Factors affecting diffusion and adoption of information and communication technology among rural users in Khyber Pakhtunkhwa Province, Pakistan

Zahid Latif*, Wang Lei and
Zulfiqar Hussain Pathan

School of Economics and Management,
Beijing University of Posts and Telecommunications,
Hadian District, 10, Xitucheng Road, Beijing, China
Email: zahid25latif@yahoo.com
Email: 18810771076@139.com
Email: zulfi2k3bcs@yahoo.com
*Corresponding author

Sikander Hussain

Business School,
University of International Business and Economics,
Chaoyong District, China
Email: sikander.hussain234@yahoo.com

Kaleem Khan

School of Economics and Management,
Beijing University of Posts and Telecommunications (BUPT),
Hadian District, 10, Xitucheng Road, Beijing, China
Email: mkaleemkhan@yahoo.com

Abstract: The purpose of this study is to investigate and categorise the factors influencing diffusion and adoption of ICT in the rural areas of Pakistan. The research deals principally with common people of the rural areas of Khyber Pakhtunkhwa Province for adoption of ICT in their daily life. The sample size encountered was 330 respondents, who were selected through random sampling technique. Primary data was collected from people belonging to different races of life throughout the province. The results of the study were calculated by using confirmatory factor analysis (CFA) and structural equation modelling (SEM) techniques which show that the overall ICT diffusion and adoption is profoundly influenced by seven factors, including social, political, environmental, regulatory, technological, economic and legal. The study confirms a most significant impact of social and political factors upon ICT diffusion, whereas the remaining factors seem to have a moderate impact.

Keywords: ICT diffusion; confirmatory factor analysis; CFA; gross domestic product; GDP; Khyber Pakhtunkhwa; Pakistan.

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Biographical notes: Zahid Latif is a PhD scholar at the Beijing University of Posts and Telecommunications, China. He has been working in the telecommunication sector of Pakistan since 2003. He earned his Master's in Philosophy in International Relations from Peshawar University. His research interest areas are information and communication technology, one belt, one road, China-Pakistan economic corridor and ICT diffusion in Pakistan.

Wang Lei is a PhD scholar in Beijing University of Posts and Telecommunications, China. He obtained his Master's from Tianjin University and his research interest areas are service innovation management and competitiveness.

Zulfiqar Hussain Pathan has been affiliated to Mehran University of Engineering and Technology, (MUET) Jamshoro, Pakistan. He earned his post-graduation in the field of technology and innovation management and graduation in computer science. His research interests are information system, innovative and technological practices in management in public and private sectors, and entrepreneurship.

Sikander Hussain obtained his Master's in Management Sciences from Muhammad Ali Jinnah University (MAJU), Islamabad. Currently, he is doing his PhD in Management Sciences from the University of International Business and Economics (UIBE), Beijing, China.

Kaleem Khan obtained his Master's in Management Sciences in Finance from COMSATS Lahore, Pakistan. Currently, he is pursuing his PhD from the School of Economics and Management Sciences, Beijing University of Posts and Telecommunications.

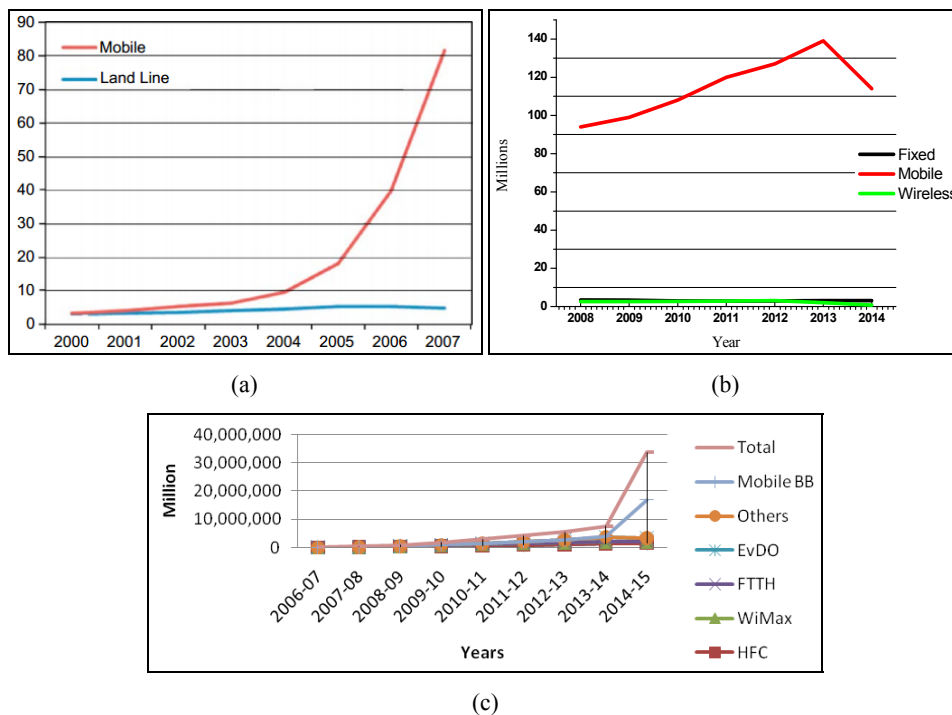
1 Introduction

With the start of new millennium, a new force called information and communication technology (ICT) came into being, which shaped up the future of the world by reducing geographical boundaries and bringing cultures and societies closer to each other (Lee et al., 2014). ICT creates a paradox of wealth and poverty; it links the gaps between individuals on one hand, while isolates them on the other (Mariscal, 2005). We can easily articulate that the last decade of 21st century observed a dramatic transform in the world through ICT by connecting people and communities. It improved living standard of people and provided opportunities to them across the globe (Soeftestad and Sein, 2002). ICT played an important role in bridging the gap between people and communities through many sources. It is now an essential part of everyday life of a person living in any part of the world [Joseph and Nath, (2012), p.383]. There is a common concept among social scientists that ICT can play an important role in socio-economic development, gross domestic product (GDP) growth, productivity and organisational

infrastructure improvement, poverty reduction, employment development and democratic maturity in the people of a country (Kozma, 2005). Furthermore, ICT has significant impact on education opportunities, healthcare betterment, cultural creativity, improved transparency of government departments and agencies, and social integration of individuals with different ethnic groups. It has also made the voice of a common man more effective than ever before (Butcher, 2011; Europe, 2011).

According to Lee et al. (2014), the diffusion of ICT appears to be a global phenomenon, rather than local or regional and we can see that people around the globe are connected via information technology. International telecommunications union (ITU) released an annual report titled as ‘ICT facts and figures: the world in 2015’, according to which the world has 3.2 billion internet users, which correspond to 46% of the world total population. Moreover, currently, seven billion mobile subscribers exist, corresponding to almost 97% penetration rate of world total population. The increase in a number of subscriptions is due to the lower rates of ICT applications globally, which makes it convenient for low income people.

Figure 1 (a) and (b) Subscription of telephone (c) Internet services in Pakistan (see online version for colours)



Pakistan has 191.71 million estimated¹ population in 2015, with increasing teledensity from 60% in 2008 to 70% in December 2011, with an addition of 125.8 million subscribers to mobile phone utility (Figure 1). During 2000 to 2008, the internet subscription was about 3.7 million (2.3%), starting from 0.5 million in early 2000 which was only 0.23% of total number. Currently, the density of internet subscription is 23 million (5.4%) (ibid). Figures 1(a) and 1(b) shows the total number of telephone service

subscriptions in Pakistan from 2008 to 2014, whereas the main medium of telephone services are fixed local loop, mobile (cellular) and wireless local loop, while Figure 1(c) shows the internet penetration in Pakistan on the other hand. The media of internet services is mobile broadband, WiMax, Fiber to the home (FTTH) and landline broadband. The key sources in ICT for Pakistan are mobile operators and internet service providers, which have attracted a lot of foreign investment and contributed a considerable portion of GDP during the last two decades.

Due to dynamic policies of Pakistani government, the subscription ratio of mobile services has been increased rapidly as compared to the other telecom operators. However, the overall ICT sector has not achieved such a great success in comparison with the past years. Here raises a question that what can be the possible reasons for these unprecedented changes in ICT sector and how precisely ICT diffusion can take place with the same institutional system? A lot of studies have been conducted to answer the question raised. In case of developing countries, lack of knowledge about characteristics of ICT diffusion and penetration, as well as conventional social and political norms in these countries can directly affect the ICT growth (Gao and Rafiq, 2009). There are some other important factors that have a reasonable influence on ICT diffusion in Pakistan, including environmental, economic, political, social, regulatory, legal and technological factors, also called as fundamental factors (Ali and Khan, 2014). All these factors create a systematic risk to ICT diffusion and penetration in any area of the world.

This research will examine the impact of the factors on diffusion of ICT sector in Pakistan. Pakistan is among the six biggest populated countries in the world having cheap labour and capital, rich natural resources, and most favourable and fertile land for ICT (Wilson, 2008). The following research questions are the main theme of the paper:

- Does ICT contribute positively in the rural areas of Pakistan?
- Does these seven factors affect ICT diffusion?
- Which factor most and least influence the ICT diffusion process in Pakistan?

The paper focuses on ICT industry diffusion in rural areas of Pakistan. It also endeavours to fill up the gaps in literature by providing actual description and a holistic view of the diffusion of ICT in Pakistan over the last decade.

No detailed study was found on the proposed topic that might fully focus on systematic investigation of these factors impact on ICT diffusion in rural Pakistan.

Pakistan ICT Industry provides an interesting case study due to its marvellous growth over the past few years in shape of mobile, fixed telephone and broadband services (see Figure 1). In this paper, we have conducted interviews together with a brief questionnaire, which include all the key agents in ICT industry, namely fixed, wireless and mobile operators, users, regulators, and common people. The findings from these observations were further analysed in methodology section. This study is expected to educate all stakeholders including policy makers, ICT and triple play service provider companies, and independent researchers to undertake further studies.

This paper is organised in the following way: Section 2 defines theoretical framework. On the basis of theoretical framework, we have analysed the case study of

Pakistan in Section 3. While, in the Section 4, methodology of the paper is given, including the results and conclusion of the paper.

2 Factors affecting the ICT diffusion in literature

The innovation of diffusion concept was given by Griliches (1957) in which he presented profitability as an economic variable that can affect the diffusion process. This theory states that *how, why and at what rate* new ideas and technology spread throughout the cultures. After Griliches, Roger introduced this concept in his book *diffusion of innovations* in 1962, where he stated that diffusion is a process by which an innovation is communicated through certain channels over time among the members of a social system (Roger, 2010; forecasting, 2016). Several scholars have analysed the factors that might have important impact on ICT diffusion in both developed and developing countries. Hargittai (1999) studied and explained the socio-economic factors' impact on the diffusion of ICT in European Union and North American states.

Gruber (2001) conducted a comprehensive study on the diffusion of mobile telecommunications services, highlighting that GDP per capita, analogue to digital conversion and technological innovation in telecom sector had a great impact on the diffusion of mobile telecommunications in the European Union. Further, Gruber (2001) stated that the diffusion speed of mobile phone subscribers increases with increase in the size of fixed telephone network in Central and East Europe. Furthermore, Kiiski and Pohjola (2002) investigated that internet access cost and GDP per capita might influence ICT diffusion in European Union and North-American countries. Balamoune-Lutz (2003) examined government trade policies as one of the main factor that influence the diffusion of ICT.

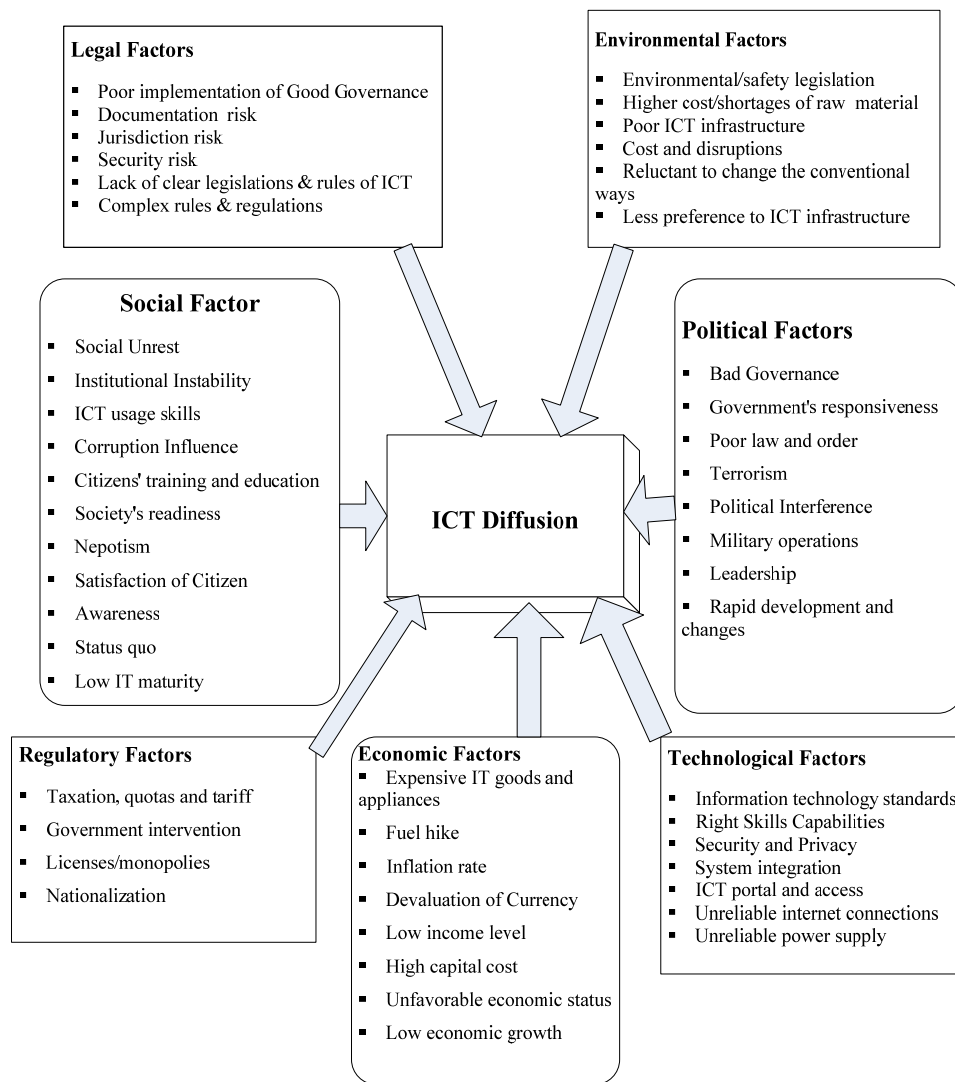
Later on Bass (2004) developed a diffusion model, which combines the exponential and logistic functions; it is widely and commonly used in marketing research. In his findings, he described that the innovations of 3G services in telecom industry will increase the number of subscribers, which result into diffusion of ICT industry. The diffusion of new technologies is a well-developed theory with social, economic, political, and technological foundations (Rogers, 2003). Consequently, diffusion study has extended to political science, communication, marketing, public health, social science and behavioural science.

Many scholars stated that market competition is the main motivating factor for higher diffusion of ICT industry (Rouvinen, 2006). Al-Debei and Al-Lozi (2012) presented various similarities and differences in terms of challenges faced to develop and developing countries and its impacts on ICT diffusion. In this paper, the authors analysed ICT challenges for developed and developing countries and similarities and differences were also justified. The latest study about the factors affect the ICT diffusion was carried out by Nada et al. (2014), in their study they investigated the barriers that affect the ICT diffusion and development in Sudan. They further described that, these obstacles are interrelated to each other and collectively have a negative impact on the ICT diffusion in Sudan. They contributed finally in their paper, how to overcome these barriers in order to develop the ICT in Sudan. The most recent studies were carried out by Al-Abdulkarim

et al. (2014) presents a comprehensive study of the social rejection of ICT-intensive smart metering. In this study, a hybrid model of two well-known technology theories is presented the theories are unified theory of acceptance and usage of technology (UTUAT), and innovation diffusion theory (IDT). The study concludes that social factors (SFs) have a significant impact on ICT, and it also predicts the acceptance of ICT-intensive socio-technical infrastructure system in Netherlands.

From the previous literature, we can categorise these factors in seven groups (Figure 2). The brief literature review is shown in Table 1.

Figure 2 Social, political, environmental, regulatory, technological, economic, and legal (SPERTEL) factors and ICT diffusion (see online version for colours)



Source: Sketched by author

Table 1 Literature review on determinant factors

<i>Group</i>	<i>Topic</i>	<i>Authors</i>
Political factors	Bad governance	Al-Debei and Al-Lozi (2012), Rehman et al. (2012), Qaisar and Khan (2010) and Goodman et al. (1994)
	Government's responsiveness	Li (2012), Rehman et al. (2012), Kim et al. (2009), Weerakkody and Dhillon (2009) and Galloway and Mochrie (2005)
	Poor law and order	Qaisar and Khan (2010)
	Political interference	Zarei et al. (2008) and Ghobrial (2006)
	Leadership	Tambotoh et al. (2015), Kim et al. (2009) and Elnaghi and Alshawi (2007)
	Rapid development and changes	Pour et al. (2009)
Social factors	Institutional instability	Nada et al. (2014) and Qaisar and Khan (2010)
	ICT usage skills	Nduati et al. (2015), Nada et al. (2014), Moghaddam and Khatoon-Abadi (2013), Azam et al. (2010) and Shahawai and Idrus (2010)
	Corruption influence	Khan et al. (2012)
	Citizens' training and education	Maharana and Misra (2007) and Al-Shehry et al. (2006)
	Society's readiness	Rehman et al. (2012) and Azam et al. (2010)
	Satisfaction of citizen	Moghaddam and Khatoon-Abadi (2013)
	Awareness	Tambotoh et al. (2015), Moghaddam and Khatoon-Abadi (2013), Ovais Ahmad et al. (2013), Shahawai and Idrus (2010), Rubaii-Barrett and Wise (2008) and Al-Omari (2006)
	Low IT maturity	Nduati et al. (2015), Al-Debei Al-Lozi (2012), El-Haddadeh et al. (2012), Aijaz and Butt (2009) and Bélanger and Carter (2008)
Environmental factors	Culture	Nada et al. (2014) and Maitlan (1999)
	Environmental/safety legislation	Consoli (2012), Boyer-Wright and Kottemann (2008), Ulrich and Chacko (2005), Rashid and Al-Qirim (2001) and Fuller and Jenkins (1995)
	Higher cost/shortages of raw material	Nduati et al. (2015), Vosough et al. (2015) and Mridha et al. (2013)
	ICT infrastructure	Al-Abdulkarim et al. (2014), AlShehri et al. (2012), Al-Debei and Al-Lozi (2012), Kamal et al. (2009) and Nyrhinen (2006)
	Cost and disruptions	Li (2012) and Harindranath et al. (2008)
	Reluctant to change the conventional ways	Al-Debei and Al-Lozi (2012), Al-Ghamdi et al. (2011), Aijaz and Butt (2009), Zhou et al. (2007) and Walker (2004)
	Less preference to ICT infrastructure	Alshehri et al. (2012), Rehman et al. (2012), Al-Ghamdi et al. (2011), Al-Awadhi and Morris (2009) and Dwivedi and Irani (2009)

Source: Own

Table 1 Literature review on determinant factors (continued)

<i>Group</i>	<i>Topic</i>	<i>Authors</i>
Technological factors	Information technology standards	Nada et al. (2014), Li (2012), Kamal et al. (2009) and Zhou et al. (2007)
	Right skills capabilities	Nada et al. (2014), Ahmed et al. (2012), Harby et al. (2012) and Walker (2004)
	Security and privacy	Agarwal and Hall (2013) and Harindranath et al. (2008)
	System integration	Shin (2007) and Nyrhinen (2006)
	ICT portal and access	Al-Debei and Al-Lozi (2012), Kayani et al. (2011), Al-Shafi (2009), Geovanny and Suarez (2008), Madon et al. (2007), Shin (2007) and Ghobrial (2006)
	Unreliable internet connections	Ahmed et al. (2012), Al-Ghamdi et al. (2011), Venkatesh et al. (2011) and Aijaz and Butt (2009)
	Unreliable power supply	Mridha et al. (2013), Aijaz and Butt (2009) and Friedlander (2002)
Economic factors	Expensive IT goods and appliances	Friedlander (2002) and Rashid (2001)
	Low income level	Aijaz and Butt (2009)
	Low economic growth	Nada et al. (2014), Lee et al. (2014) and Cronin et al. (1991)
Regulatory factors	Government intervention	Weerakkody and Dhillon (2009), Ghobrial (2006) and Goodman et al. (1994)
Legal factors	Jurisdiction risk	Aijaz and Butt (2009), Rubaii-Barrett and Wise (2008) and Madon et al. (2007)
	Security risk	Al-Abdulkarim et al. (2014) and Harby et al. (2012)
	Lack of clear legislations and rules of ICT	Al-Ghamdi et al. (2011), Gupta et al. (2008), Ghobrial (2006), Bonham et al. (2003) and Heeks (2001)
	Complex rules and regulations	Madon et al. (2007)

Source: Own

The following hypotheses are constructed from the above literature.

Proposition 1 ICT diffusion is influenced by SFs.

Proposition 2 ICT diffusion is influenced by PFs.

Proposition 3 ICT diffusion is influenced by environmental factors (ENFs).

Proposition 4 ICT diffusion is influenced by technological factors.

Proposition 5 ICT diffusion is influenced by economic factors.

Proposition 6 ICT diffusion is influenced by regulatory factors.

Proposition 7 ICT diffusion is influenced by legal factors.

3 Methodology and methods

3.1 Sample

People from different part of life of Pakistan are in focus to measures the influence of these factors on ICT diffusion in rural areas of Pakistan. Policy makers, IT analysts, telecommunication experts, legal advisors, Pakistan Telecommunications Company Limited (PTCL), National Telecommunications Corporations (NTC), Pakistan Telecommunication Authority (PTA), Frequency Allocation Board (FAB), and Pakistan Electronic Media Regulatory Authority (PEMRA) officials and officers, rural areas common people, shopkeepers, private firm employees and poor formers became the respondent of the survey, contributing in compilation of a survey from diverse backgrounds with different attitudes and responses. The survey was conducted through structured questionnaires, which were translated in local language to the respondents where needed. Total number of questionnaires was 440, while 330 out of them were acknowledged; the ratio of response was 75%, which is quite satisfactory. The respondents were contacted through personal visits in their offices, homes, shops, and in fields.

3.2 Sampling characteristics

Table 2 indicates the sample characteristics wherefrom the data has been collected.

Table 2 Socio-economic characteristics of respondent in Pakistan

<i>Socio-economic characteristics</i>	<i>Categories</i>	<i>Frequency (n = 330)</i>	<i>Valid percentage</i>	<i>Mean</i>
Sex	Male	246	74.5	13
	Female	84	25.5	
Educational status	Below matric	46	13.9	25
	Matric	56	17.0	
	FA/FSc	56	17.0	
	Bachelor	71	21.5	
	Master	77	23.3	
	PhD	24	7.3	
Occupation	Un-employed	44	13.3	18
	Government service	119	36.1	
	Private service	83	25.2	
	Business	58	17.6	
	Farmer	26	7.9	

Source: Field survey (2015–2016)

Table 2 shows the ratio of gender sampling. This sample consisted of total 330 respondents from different areas of Pakistan including rural areas of Khyber Pakhtunkhwa, out of which 74% were male and 25% were female. The ratio of male is higher than the female, because it is relatively difficult to access females for an interview

or any other social activity. Table shows that a large number of respondents possess Bachelors and Masters degrees (71 and 77) respectively. While the ratio of A level and below A level is also high, as a large number of respondents were from rural areas.

3.3 *Sampling instrument*

The seven factors are independent variables, while ICT diffusion is dependent variable for the study. Although, the instruments to the factors have been already adopted by several scholars, instead the factors were mostly analysed for the individual equity investor decision making. Sugiharto et al. (2007) investigated the fundamental factors influence on the individual investor decision making process and show a positive relationship between these factors and decision making process. Ali and Khan (2014) conducted a research study, which enquires the affect of fundamental factors on the investor behaviour in Pakistan. The study investigates that the social and political factors (PFs) have significant impact, while the rest of the factors shown moderate influence on decision making behaviour of investors in Pakistan. The instrument contained five items and measured on five-point Likert scale (1 = strongly agree, 5 = strongly disagree). The instruments contain eight items environmental, economic, political, social, regulatory, legal and technological factors and diffusion of ICT.

3.4 *Research method*

Close ended questionnaire method was adopted for data collection and analysed by SPSS. In this study the correlation analysis was carried out to show the relationship between the variables. Confirmatory factor analysis (CFM) method was used to check the validity of data, while structural equation modelling (SEM) for testing hypotheses.

4 **Outcomes and discussion**

4.1 *Outcomes*

This research study provides the influence of these factors on ICT diffusion and adoption in rural areas of Pakistan.

Table 3 Reliability analysis

<i>Variables</i>	<i>Items</i>	<i>Cronbach's alpha</i>
Diffusion of ICT	02	0.803
Social factor	11	0.911
Political factor	08	0.673
Economic factor	08	0.697
Regulatory factor	04	0.626
Technological factor	07	0.692
ENF	06	0.670
Legal factor	06	0.745

Source: Prepared on SPSS by author

4.2 Reliability test

The value of Cronbach's alpha value for (diffusion of ICT) is 0.803. For social and PF the value of alpha is 0.911 and 0.673. While the environmental, economic, regulatory, legal and technological factors have 0.670, 0.697, 0.626, 0.745 and 0.692 respectively.

4.3 Factors loading and reliability testing

Peansupap and Walker (2005) applied the factor loading technique for the exploratory study to sum up the variables into factors. They also explained some requirements to test data for summing up the variable in a proper way. According to Bagozzi and Yi (1988), the Kaiser-Meyer-Olkin (KMO) value should be greater than 0.60, while in the current study, the said value is 0.857 and regarded as significant ($P = 0.0001$). Therefore, the factor analysis technique is preferable for this dataset. The values of all factors given in Table 4 are standard except SF 9 and economic factors 20 and 23, however, overall factors are significant.

Table 4 Factor loading analysis of the respondents

Construct		Factor loading	Cronbach alpha	Mean value
Social factor				2.0
1	Civil unrest	0.741	0.91	1.5758
2	Institutional instability (weak institutions)	0.81		1.7333
3	ICT usage skills	0.80		1.7545
4	Corruption influence	0.73		1.5182
5	Citizens' training and education	0.76		2.0000
6	Society readiness	0.68		2.2030
7	Nepotism	0.70		2.3000
8	Satisfaction of citizens	0.59		1.9455
9	Awareness	0.58		1.9606
10	Status quo	0.64		2.3727
11	Low IT maturity	0.73		2.2030
Political factors				2.1
12	Bad governance	0.78	0.67	2.0394
13	Government response	0.74		2.2364
14	Poor law and order	0.69		1.5697
15	Terrorism	0.76		1.4242*
16	Political interference	0.59		1.7848
17	Military operations in tribal areas	0.70		2.2273
18	Leadership	0.68		2.8485
19	Rapid development and change in ICT globally	0.67		2.6788

Note: *The most influential and having negative impact on ICT diffusion.

Table 4 Factor loading analysis of the respondents (continued)

<i>Construct</i>	<i>Factor loading</i>	<i>Cronbach alpha</i>	<i>Mean value</i>
Economic factors			2.7
20 Expensive IT goods and appliances	0.55	0.69	2.8121
21 Fuel hike	0.68		2.6576
22 Inflation rate	0.78		2.9606
23 Devaluation of currency	0.53		2.4848
24 Low income level	0.66		2.6818
25 High capital cost	0.72		2.8091
26 Unfavourable economic status	0.71		2.6667
27 Low economic growth	0.71		2.7515
Regulatory factors			2.7
28 Taxation, quota and tariff	0.69	0.62	2.6424
29 Government intervention	0.67		2.4242
30 License/monopolies	0.71		2.6424
31 Nationalisation	0.66		3.0818
Technological factors			2.2
32 Information technology standards	0.61	0.69	2.7576
33 Right skill capabilities	0.72		2.1091
34 Security and privacy	0.75		1.9758
35 System integration	0.65		2.9030
36 ICT portal and access	0.71		2.1242
37 Unreliable internet connection	0.61		2.1273
38 Unreliable power supply	0.69		1.4545*
ENFs			2.4
39 Safety legislation	0.66	0.67	2.5424
40 High cost/shortage of raw material	0.71		2.6394
41 Poor ICT infrastructure	0.66		2.0212
42 Cost and disruption	0.81		2.7515
43 Reluctant to change the conventional ways	0.76		2.3939
44 Less preference to ICT infrastructure	0.75		2.2576
Legal factors			2.6
45 Poor implementation of ICT goods	0.75	0.74	2.6091
46 Documentation risk	0.79		2.6970
47 Jurisdiction risk	0.65		3.0848
48 Security risk	0.66		1.8606
49 Lack of clear legislation about ICT	0.70		2.5000
50 Complex rules and regulations	0.74		2.7333

Note: *The most influential and having negative impact on ICT diffusion.

Table 5 Correlation analysis

	Mean	SD	1	2	3	4	5	6	7	8
Diffusion of ICT			1							
Social			0.686**	1						
Political			0.608**	0.585**	1					
Economical			0.591**	0.523*	0.470**	1				
Regulatory			0.612*	0.489*	0.439**	0.421**	1			
Technical			0.657**	0.569**	0.465**	0.402**	0.467**	1		
Environmental			0.737**	0.562**	0.563**	0.576**	0.454**	0.598**	1	
Legal			0.454*	0.686**	0.608**	0.591**	0.612*	0.557*	0.737**	1

Notes: *Correlation significant at 0.05 level (two-tailed). **Correlation significant at 0.001 level (two-tailed).

Table 4 specifies the mean values for each of the individual factors. Almost all the variables (factors) have equal impact on the ICT diffusion. For the economic factors (EF) and regulatory factors (RF), the overall mean is 2.7 out of 5 (quite high). Both these groups indicate a comparatively high group mean value (2.7). The results indicate that the respondents in these cases are not very much aware of the influence of these factors due to little knowledge and interests. While SF and PF can be considered valuable with an overall mean of approximately 2. It indicates that the respondents to these factors took great interest in the matter and respond quite positively. It also indicates their knowledge about these issues/factors/agents, because these factors are related to everyday life in Pakistan, and people from every race of life take keen interest to discuss them.

In the current analysis, the mean for all technology factors was recorded as 2.2. While the most influential factor among all these factors is reliable power supply, because in Pakistan the energy shortage affects life adversely, as well as all the service sectors, including ICT, are severely influenced by this. The most restraining factor is system integration, as most of the people have less concern with it and have poor knowledge of it. The ENF is the medium factor having mean of 2.4, which is the middle value of all factors. The most affective factor among others is ICT infrastructure. The cost and disruption factor has a lower mean value xyz.

4.4 Correlation and analysis

The descriptive analysis has been carried out in order to examine the fundamental nature of responses. The results are given in Table 5.

The table shows the correlation between Diffusion of ICT and the factors. The analysis describes that dependent variable (ICT diffusion) has a positive relationship with ENF ($r = 0.737^{**}$, $p < 0.01$), economical factor ($r = 0.591$, $p < 0.01$), PF ($r = 0.608^{**}$, $p < 0.01$), SF ($r = 0.686^{**}$, $p < 0.01$), RF ($r = 0.612^{*}$, $p < 0.05$), legal factor ($r = 0.454^{**}$, $p < 0.05$) and technological factor ($r = 0.657^{**}$, $p < 0.01$). All the above results show that the factors have a significant positive tendency towards diffusion of ICT in the rural areas of Pakistan.

4.5 Regression results

The regression results contain R-square interpretation and its implications on this study. R-square is a statistical measure of how closely the data match with the regression line, also known as the co-efficient of determination. It is the percentage of response variable variation, which can be explained by a linear model as $R\text{-square} = \frac{\text{explained variation}}{\text{total variation}}$. Its value is always between 0 and 100%. Generally, the higher the R-square value, the better the model matches the data.

In this study, based on the data considered the R-square for SF is 0.471, which means that 47% change will occur, if the SFs improve in the rural areas of Khyber Pakhtunkhwa, Pakistan. The R-square value indicates that the data chosen has a close relationship with the model and the model is well fitted. While for the PFs, the value of R-square is considered as 0.370, which means that the improvement of such factors will lead towards increase in the rate of diffusion of ICT up to 37%. Also, R-square is greater than one, which determines that the model is well fitted with the data. The R-square for ENF value is 0.543, which defines that around 54% change will occur in the ICT spreading. It further articulates that the R-square value is positive and greater than zero

and the model well fits the data. Regulatory and technology factors R-square values are 0.375 and 0.310 respectively, which elaborate that the model has significant positive relationship and is well fitted with the data. Similarly, the economic and legal factors have 0.349 and 0.289 square values respectively, which show that around 35% change will occur in ICT diffusion (see Table 6 for values). The values of R-square for these variables as well are greater than zero, so both these also well fit the model. Consequently, the data analysed for all variables suggest that these are well fitted with the regression model. The results also show that there is a significant relationship between all the variables and that the independent variables are significantly related to the dependent variable (ICT diffusion).

Table 6 Regression results

<i>Paths</i>	<i>Entire sample estimate</i>	<i>SE</i>	<i>R-square</i>	<i>F-value</i>	<i>Test result</i>
Social > DF	0.686	0.503	0.471	73.806	Supported
Political > DF	0.608	0.548	0.370	14.609	Supported
Economical > DF	0.591	0.557	0.349	54.763	Supported
Regulatory > DF	0.612	0.546	0.375	23.674	Supported
Technological > DF	0.657	0.574	0.310	36.458	Supported
Environmental > DF	0.737	0.467	0.543	6.501	Supported
Legal>DF	0.454	0.367	0.289	21.203	Supported

Source: Calculated from primary data using Visual PLS

4.6 Discussions

The value of the regression R-square shows that 47% variation in ICT diffusion is due to SF. The value of beta coefficient indicates that SF causes 68% variation in ICT diffusion. The overall strength of the model at F value 73 ($p < 0.01$) shows that the model is significant and it ensures the correctness of our model. Hence, the results support the hypothesis that *ICT diffusion is influenced by SFs directly*. The second row shows 15% variation in ICT diffusion, which is due to PFs having F value 14 ($p < 0.01$), hence indicating that the model is significant and correct. The value of beta coefficient further shows that PFs cause 60% variation in ICT diffusion. Hence, the results support hypothesis that *ICT diffusion is influenced by PFs directly*. The third and fourth rows of Table 5 show 55% and 54% variations in ICT diffusion ratio. The beta values cause 61% and 65% variations in ICT diffusion by economic and RFs having the value of F 54 ($P < 0.01$) and 23 ($P < 0.05$) respectively. It also shows the accuracy and precision of the model. Hence, the hypothesis three and four are confirmed as to be true.

The technological factor R-square value shows 31% variation in ICT diffusion, ENF R-square value indicates 54% variation, and legal factor R-square shows 28% variation in the diffusion. The value of beta for all three factors 65%, 73% and 45% respectively shows the percentage variations caused by the given factors in ICT diffusion. The F value for the above three factors are 36, 6 and 21 ($P < 0.01$, $P < 0.01$ and $P < 0.05$), which indicate that the model is accurate and significant. Hence, the hypotheses 5,6 and 7 become true. In this study, a significant positive relationship between ICT diffusion, and social, political and ENFs among the rural users of Khyber Pakhtunkhwa, Pakistan was

found. This study elaborated that if these factors are improved in the subject area, there would be positive increase in the users of information technology, resulting in development of ICT. The regression results support previous studies such as Noda and Collins (1995) and McKinsey (2001). The computer illiteracy, low ICT usage skill and low IT maturity affect the ICT diffusion, and improving these factors will ensure ICT development in developing countries. These are supported by studies such as Kenny (2003), Molla and Licker (2005), Rao (2003) and Kshetri (2007). As a matter of fact, the rate of literacy is low in Pakistan and most of the people are living in rural areas, so they take ICT applications as a luxury and are reluctant to adopt the technology. The PFs such as law and order situation, bad governance, weak political and economic institutions, and terrorism remained at their worst during the last two decades. Improving these factors will definitely increase the ICT diffusion in rural areas of Pakistan; such findings are given by Aijaz and Butt (2009) also. The findings for ENFs are supported by previous research studies, e.g., Brown et al. (1976) and Mercer (2006). They argued that the ENFs including improvement of infrastructure can play a key role towards the development of ICT in terms of faster ICT diffusion in the country. Generally, the demand for ICT application is much higher in urban areas as compared to rural areas. As a result, government focuses mostly on the urban areas, which leads towards poor infrastructure in the latter.

The results also depict a positive significant relationship between ICT diffusion and economic, technological, regulatory and legal factors among the rural users of KP, Pakistan. Low economic growth, inflation, high capital cost and low income level can surely affect the ICT sector, as described in the previous studies, e.g., Mercer (2006), Kshetri (2007), Zhou et al. (2007) and Nada et al. (2014). The results analysed for technological factors are supported by the studies carried out by Rashid and Al-Qarim (2001) and Molla and Licker (2005). Ovais Ahmad et al. (2013) further elaborated that the technological infrastructure, security and privacy, and ICT access are the factors that can influence the ICT diffusion in Pakistan. The study confirms that reforms in RFs including quotas, licenses might faster ICT diffusion in rural areas of Pakistan, provided the other factors remain constant, as suggested by Gibbs et al. (2003), Tigre and Detrick (2004), Efendioglu and Yip (2004) and Li (2012). In most of the developing countries including Pakistan, the problematic rules and regulations, complex documentation, and lack of clear legislations about ICT and its applications lead towards the decrease of its development. Similar research has been carried out by Tigre and Detrick (2004). Improving legal factors help improving diffusion of ICT sector in any country, as supported by findings of Aijaz and Butt (2009).

Table 4 shows that the respondents in this sample have a better response towards ICT and its applications, which support their higher level of interest in ICT. The results also endorse the supportive policies of the government in encouraging these factors and bringing about awareness regarding ICT that its usage will surely enhance and promote the digital culture in the society. The data also indicate that the policy makers and high government officials have a positive impact on ICT development through its monitoring, training, skill development and other supportive activities. The awareness about the ICT and its applications can be carried out through knowledge-based sharing and taking

personal and professional observations during our surveys of different ICT organisations. Although there was various initiatives been taken by government in different phases to develop the ICT sector in country, but lack of confidence between organisations and customers, and other problems like political instability, weak economic institutions, terrorism, corruption and critical crisis of energy shortage in country have badly influenced the diffusion of ICT. The most influential factors observed from data were the Social and PFs, both these recorded a huge influence in the progress of development of ICT.

5 Conclusions and recommendations

Government of Pakistan has taken many initiatives to improve the ICT infrastructure in the country and its consequent diffusion in the rural areas of Pakistan. Laying down of fibre optic between China and Pakistan along with China-Pakistan Economic Corridor (CPEC) is a future step to be taken by Pakistani Government to promote ICT services in Pakistan. This study helps in understanding the current circumstances of ICT, factors influencing the environment of ICT and optimisation of communication technology to pre-eminent state in the rural areas of Pakistan.

This study determines the impact of certain influencing factors on ICT diffusion in rural areas of Pakistan. The respondents were surveyed through a structured questionnaire, particularly in rural areas of Khyber Pakhtunkhwa, Pakistan. Findings of the study illustrate that user adoption of ICT services in rural areas of Khyber Pakhtunkhwa province of Pakistan is directly affected by social, political, environmental, regulatory, technological, economic and legal factors. Among the seven factors, the social and PFs have a most prominent impact on ICT diffusion, while technological and ENFs have a moderate impact. The factor loading analysis results (given in Table 4) show that institutional instability, lack of knowledge, bad governance, terrorism, and complex rules and regulations are the dominant sub factors among all. The current analysis reveals that by controlling these factors, an enormous and swift ICT diffusion can be achieved in the rural areas of Khyber Pakhtunkhwa, Pakistan. The study also suggests that the widespread adoption of ICT demands solid technological planning at national level.

The results obtained through this study can be generalised across the stretch of the country as the indicators are of positive assistance in ICT diffusion in Pakistani rural areas. It is recommended that government should adopt rational policies and propagate effective awareness through print and electronic media campaigns, in which the significance of ICT and its applications be clearly described. All this will encourage the local and international investors to launch new ICT projects inside the country. If the ICT institutions run under the surveillances of the International Telecommunication Union (ITU) regulations, huge investment in ICT sector can be engrossed, which will result in high GDP growth of the country. This study also provides essential guidelines for the policy makers and elite management, and an imperative research direction for the scholars for further work on the subject matter.

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Notes

- 1 Ministry of planning, Development and Reforms (population projection for the year 2007 to 2030). Does ICT contribute positively in the rural areas of Pakistan?