The Social Meaning of ICTs: Patterns of Technology Adoption and Usage in Context

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***Abstract*—Understanding contextual variance of the social meaning of ICTs for development is essential; technology is much more likely to substantively contribute to development if we understand how technologies are likely to diffuse and be adopted – and those patterns of diffusion and usage hinge on the social meaning of those technologies and how they inhabit a larger technological ecology. In this article we focus on the Internet as a series of technologies with widely varying meanings for users around the globe. We have found that while people who use the Internet tend to share characteristics across nations, what people do with the Internet, once available, differs in some surprising ways. In this article we compare users in two disparate regions – the United States and two countries of Central Asia -- in order to demonstrate that "The Internet" is not only a series of technologies rather than one technical innovation, but the utility of that series of innovations differs across contexts.**

***Index Terms*— Central Asia; developing nations; Diffusion of Innovation; Internet; Technology Acceptance Model.**

I. Introduction

THE Internet is not a particular technology; it is, rather, a series of technologies with widely varying meanings for users around the globe [1]. How the Internet, or any technology, is used by different societies (and at different historical times) offers a reflection of those varied meanings [1, 2, 3]. In other words, socio-technical aspects of the Internet are complex, varied, and contextual. While we have found that Internet users share some demographic characteristics, and tend to occupy similar areas of society, what these users do with the actual technology once it gets into their hands differs in some surprising ways. In part, this variance reflects different information and technology ecologies across communities, but it also speaks to the socio-technical components of ICTs that have been leveraged -- to varying success -- for development efforts.

In this article we compare Internet users in two disparate regions – the United States (US) and two countries of Central Asia (Kazakhstan and Kyrgyzstan) -- in order to expand on Miller & Slater's (2000) early ethnography of Internet use in Trinidad in which the authors argued that "The Internet" is a series of technologies rather than one technical innovation, and that the utility of that series of innovations differs across contexts. This is particularly important because perceived usefulness (i.e. utility) is crucial to acceptance which leads to adoption [4]. Through statistical analysis we demonstrate that the usefulness of Internet technologies, as evidenced by usage patterns, is clearly perceived differently across contexts, which emphasizes the necessity of a socio-technical analysis of these technologies in developing regions. Acknowledging contextual differences when discussing information, communication and technological (ICT) innovations for development is crucial; technology is much more likely to substantively contribute to development if we understand how that technology (or technologies) is likely to diffuse and be adopted. Through a series of qualitative and quantitative studies we have found that western assumptions about utility are not always applicable.

The Internet is not only a conduit for many innovations but it is also dependent on other technologies and infrastructures to be in place [5]. Other technologies, such as mobile phones or computers also share this capacity for multi-faceted use and are also dependent on other technologies and infrastructures. We acknowledge that many dependencies affect the perception of the utility the Internet, but in this paper we are concerned primarily with constraints that move beyond infrastructure limitations.

Scholarship about the Internet ranges from questions large and small. It considers online interaction [6], it conducts large scale surveys [7, 8] it does close readings of the technology industry and consumer electronics, it studies students [9] and older adults [10] and minorities and women [11], and it looks at the deployment of information and communication technologies in schools, homes, [12] workplaces, rural villages[13], and urban centers. What scholarship about the Internet does not often do – despite (or, rather, perhaps because of) its multidisciplinary research perspectives – is acknowledge contextual differences of the technology it purports to study which can lead to an imprecise understanding of what the Internet actually means in developing nations.

In other words, we often lack clear definitions on exactly what we are talking about when we discuss the Internet. As a result, the scholarship generated from the multiple surveys and interviews and analytical studies leaves a somewhat blurry picture that makes it difficult to extract a clear understanding

Manuscript received July 30, 2010, 2001. This work was supported in part by U.S. National Science Foundation grants #0326101 and #0219350.

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of what the Internet actually is in context and its concurrent effects on social practices and formations. Understanding relative perceptions about Internet usefulness and ease of use would help clarify the picture.

II. Background

This paper has two components. The first is a cross-cultural comparison in which we identify demographic factors that most strongly predict the likelihood of someone being an Internet user. In addition, we compare the usage patterns of those Internet user populations in order to demonstrate that although these groups are demographically similar, functionally they are different as "users" of "the Internet" in that "the Internet" they chose to adopt as "users" is basically a different set of online activities. As a framework for these analyses, we began by using the Technology Acceptance Model (TAM) and Rogers' Diffusions of Innovations (DOI) theory for understanding how the Internet takes root in a society and how perceptions about the Internet might help define the utility of Internet for a particular group of people at a particular historical time. The original TAM model identified two attributes of a technology that affected adoption: (1) perceived usefulness (PU) and (2) perceived ease of use (PEOU) [2, 14]. TAM scholars argue that these two attributes are the most important which in turn affect acceptance and adoption. While TAM (and later model extensions such as TAM 2) was primarily developed through studying technology acceptance and adoption in the workplace, the model shares overlap with Roger's more general DOI model which also considers the attributes of an innovation in concert with other variables (including the attributes of users).

Rogers argues that there are four main elements that affect the rate of diffusion and adoption of an innovation: (1) the characteristics of the innovation itself; (2) communication channels; (3) time and (4) social systems [15]. In this paper, we focus specifically on the first element, i.e. the perceived characteristics of the innovation (in this case the Internet) itself. The DOI framework outlines five qualities that define a characteristic of an innovation: (1) relative advantage, i.e. is it better than the idea it proceeds, which is a concept very similar to TAM's PU concept; (2) complexity or ease of use which is parallel concept to TAM's PEOU; (3) compatibility with existing values which in extended TAM models is similar to the inclusion of 'subjective norms' as a variable effecting PU; (4) trial-ability which is the degree to which the innovation can be experimented with before adoption; and (5) observability which is the level at which the results of an innovation adoption can be observed in others. What we are trying to establish in this paper is that socio-technical analyses of the Internet need to accompany diffusion and adoption studies in order to prioritize the social meaning of technologies.

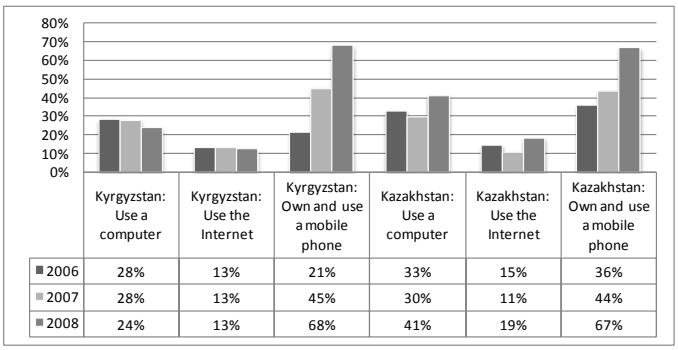
To be clear, we are not concerned with this topic because we desire an acceleration of the diffusion of the Internet (we're agnostic on that point). What we are concerned about is demonstrating how widely perceptions of the Internet's usefulness or meaningfulness to one's life can vary and that this variation fundamentally changes the very definition of the Internet. Further, we argue we cannot talk about any technological innovation without addressing perceived usefulness and ease of use which are embedded in the socio-technical frame. Too often assumptions are made, that since early adopters share certain characteristics, they display similar usage patterns. We show in this paper that the demographics associated with ICT adoption are not determinants of later usage patterns.

We chose the regions we are comparing (US and Central Asia) partly because the regions represent disparate levels of diffusion; by 2007 the Internet was used by approximately 75% of the US population [8] compared to less than 20% of that in Central Asia. Additionally, our team of designers and researchers has been studying technology diffusion and adoption in Central Asia for over ten years as part of the Central Asia + Information Communication and Technology (CAICT) project at the University of Washington. We began focusing on Central Asia in 2000 because the area was in early stages of general ICT adoption and diffusion. Further, Central Asia is a multi-ethnic, multi-lingual area that has several characteristics common to emerging markets and developing regions. However, it is also somewhat unique from other developing regions because literacy rates are estimated at over 98% [16], and as part of the former Soviet Union, the region has extensive infrastructure already in place. Therefore, a steady rate of Internet diffusion seemed plausible and even likely in 2000 when we began our study.

As part of our investigation we have conducted a broad social survey of 1000 responders from four Central Asian countries (Kyrgyzstan, Kazakhstan, Uzbekistan and Tajikistan) over a three year period (2006-2008). As Fig. 1 demonstrates, we have found that growth of mobile phone usage has accelerated while the spread of computer and Internet technologies remains somewhat flat[1]. Indeed, over the course of the past decade, the Internet has certainly not diffused at the pace predicted.

We used the data from the CAICT project along with data from the Pew Internet and American Life project in order to address two research questions. First, we asked: are Internet users differentiated by similar demographic variables regardless of location? (RQ1) We determined this by asking if the same demographic variables predict Internet use in all three countries in all four time periods. Our findings support that Internet users are differentiated from non-users by a very small set of reliable demographic factors regardless of country and historical time. In other words, they are a similar group of people relative to their populations.

[1] Our analysis here focuses on data from Kazakhstan and Kyrgyzstan because those countries have diffusion rates that are comparable with the early US data; even by 2008 Internet usage rates in Tajikistan and Uzbekistan were under 10%.



	Kyrgyzstan: Use a computer	Kyrgyzstan: Use the Internet	Kyrgyzstan: Own and use a mobile phone	Kazakhstan: Use a computer	Kazakhstan: Use the Internet	Kazakhstan: Own and use a mobile phone
2006	28%	13%	21%	33%	15%	36%
2007	28%	13%	45%	30%	11%	44%
2008	24%	13%	68%	41%	19%	67%

Fig. 1. Technology diffusion in Kyrgyzstan and Kazakhstan 2006-2008

Our second research question asked (RQ2): how do different user adoption groups perceive and use the Internet? Our findings for this second analysis demonstrate significant variance in how the Internet is used (implied usefulness) and perceived ease of use within a single country, among countries, and across time. In other words, these two analyses together demonstrate that while Internet users share demographic commonalities that set them apart from non-users, Internet users themselves vary greatly in what they actually do with the Internet once they adopt it. We argue that this analysis generalizes to other technologies in which perception and use vary, and that understanding contextual differences can guide meaningful deployment of ICTs in developing regions.

III. Methods

We used a total of four datasets to explore our research questions: (1) PEW Internet survey on Gadgets II and Internet Topology conducted in December 2007 in the US [6]; (2) the Pew Internet survey conducted March-May 2002 in the US [5]; (3) the CAICT survey conducted in Kyrgyzstan in July 2008; and (4) the CAICT survey conducted in Kazakhstan in August 2008. The 2002 Pew dataset was chosen because many of the CAICT survey questions were based on those asked in the 2002 Pew survey pertaining to attitudes about the Internet (questions not repeated in later Pew surveys). The 2007 Pew dataset was chosen to provide a closer historical time of comparison between the regions.

For each dataset we put respondents into user groups based on when they adopted the Internet using Roger's DOI model as a segmentation mechanism. At 100% diffusion, the first 16.5% of users would be considered 'Innovators + Early Adopters', the second 34% of users would be considered the 'Early Majority', the next 34% would be considered 'Late Majority', and the last 16% would be considered 'Laggards'. However, our groups were segmented slightly differently due to: (1) how the length of time respondents had been using the Internet was asked in each survey; and (2) none of the samples represented Internet diffusion greater than 75% (therefore, there were no 'Laggards'.

In the next sections we discuss: (1) survey methods; (2) how we cleaned the data for comparison; (3) the participants in the final datasets; and (4) the analysis methods we used to answer each research question.

A. Survey Methods[2]

One year of survey data from Kyrgyzstan and Kazakhstan (2008) was used. Each survey originally included 1000 participants. The survey sample was based on government census information on age, gender, ethnicity, and geographic location. The survey instrument was designed by the CAICT team and was administered by BRiF Research Group located in Kazakhstan. Rigorous methods were employed to assure a random sample. The BRiF research group selected households by using random walk procedure in neighborhoods. Only one respondent was interviewed in each selected household. Each respondent was chosen using the Kish grid method [17] , a common technique to assure a random selection of household members. The final sample included 50 sampling locations; 12-29 respondents were interviewed in each location.

B. Cleaning datasets for comparison

We were unable to merge the CAICT datasets with Pew Internet datasets because Pew used weighting schemas for their samples. As such, tests of significance between the datasets were not possible; however, we were able to include other statistical analyses. We made a few minor changes to the Pew datasets to facilitate comparison[3].

C. Survey Responders

1) Pew/US December 2007

After minor changes (see footnote) were made to the datasets, of the remaining 2007 Pew/US survey participants (*N* = 1922), there were 1436 (75%) Internet users. Time using the Internet ranged from less than one year to 18 years. See Fig.2 for a diffusion comparison to the other samples.

2) Pew/US March 2002

Of the remaining 2002 Pew survey participants (weighted *N* = 4984), there were 2873 (58%) Internet users. Time using the Internet ranged from less than one year to over three years. This question was not asked in a powerful way in 2002;

[2] For more information on methods employed by the Pew Research Center, see http://www. pewinternet.org.

[3] We eliminated respondents who used the Internet prior to December 1989. We chose 1989 as a cut-off date for the US because CompuServe was the first to offer Internet connectivity in 1989 and AOL began its service in 1991 [18] Wikipedia, http://en.wikipedia.org/wiki/CompuServe, [Accessed on April 1, 2010. This eliminated 79 additional responders from the sample.

We also eliminated some responders so that we could group Internet users by when they adopted the technology using Roger's DOI model:

- In the Pew/US December, 2007 database, we eliminated 23 responders who did not know when they started using the Internet. We also eliminated additional outliers
- In the Pew/US March-May 2002 dataset, we eliminated all the May responses (weighted N = 2346) because we wanted all responses to be within a single month so that we could more precisely identify the adopter groups.
- We also eliminated the few responders who answered they did not know or refused to answer whether they used the Internet (N = 20 in 2007 and N = 11 in 2002).

Additionally, we recoded the Pew databases for location identification. The Pew datasets separated locations into rural, suburban and urban; we recoded this to a binary (rural or not) to match the CAICT datasets.

respondents were given four broad options for when they began Internet use: (1) three years ago or earlier; (2) two to three years ago; (3) a year ago; (4) less than six months. As such, there was overlap between groups (Innovators + Early adopters and Early majority), see Fig. 2.

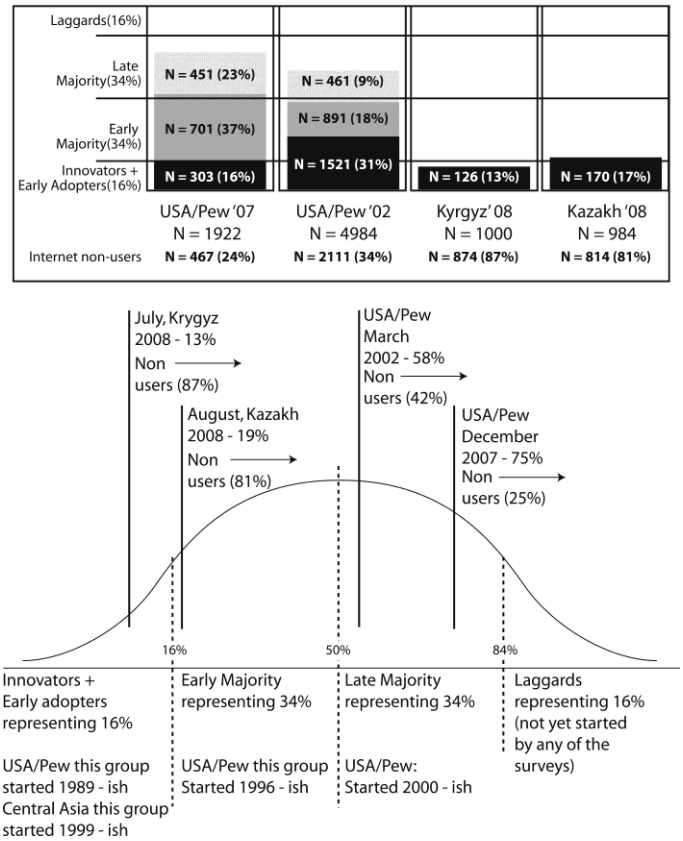


Fig. 2 Participants by Diffusion group in each sample

3) CAICT Kyrgyzstan July 2008

There were 126 Internet users representing 13% of the 2008 Kyrgyz sample; as such all Internet users would be considered Innovators and Early Adopters, see Fig. 2.

4) CAICT Kazakhstan August 2008

There were 186 Internet users in the 2008 Kazakh sample, representing approximately 19% of the sample; however, only 170 responders offered the number of years they had used the Internet. As such, we grouped all the Internet users an Innovator + Early Adopter group, see Fig 2.

D. Methods specific to research questions

For RQ1 (Are Internet users differentiated by similar demographic variables regardless of location and historical time when diffusion is below 75%?), we determined if the same demographic variables predict Internet use in all three countries by conducting a logistic regression for each dataset using a parsimonious model consisting of five variables, (1) age, (2) education, (3) reported income, (4) gender, and (5) location, i.e. rural or not.

For RQ2, (How do different Internet user groups, based on when the technology was adopted, perceive and use the Internet), we made two comparisons: (1) among user groups determined by the DOI framework within the US/Pew sample, and (2) among user groups in the US, Kyrgyzstan and Kazakhstan across all four datasets.

To facilitate comparisons within a dataset we conducted univariate tests on three constructs, controlling for type I error by using a Bonferroni adjusted alpha for each construct[4]. The three constructs were:

- Behavior which we are interpreting as contributing to perceived usefulness (PU)[5].
- Connection speed and location of Internet use which we are interpreting as contributing to perceived ease of use (PEOU)[6].
- Attitudes which we are interpreting as sometimes contributing to PU, and sometime to PEOU[7].

IV. Findings and Discussion

Consistent with many of the DOI arguments, we found that Internet users in both Central Asia and the US shared several characteristics, which we confirmed by statistical analysis. Overall, variables related to age, education, income, gender, and location were the determiners of Internet use. Despite the significant economic and cultural differences between Central Asia and the US, these variables proved instrumental across contexts. In the paragraphs below we discuss these similarities.

A. RQ1: Internet users share demographic similarities when compared to non-users (when use is diffused at less than 75%) regardless of time or geographic location.

To demonstrate that regardless of the populations (location and historical time), we could reliably predict Internet users from non-users with a parsimonious model consisting of five variables, (1) age, (2) education, (3) reported income, (4) gender, and (5) location, i.e. rural or not, we conducted four logistic regressions using SPSS (version 17). Correlations among model variables are shown in Table 1 for each dataset[8].

1) Logistic regression models

In all four datasets, a test of the full model with the set of predictors against the null model with no predictors was significant:

- Pew US 2007, $\chi^2(5, N=1587) = 544.92$, $p<.001$, Pseudo $R^2 = .443$.
- Pew US 2002, $\chi^2(5, N=1896) = 1484.85$, $p<.001$, Pseudo $R^2 = .427$.

[4] Recall, that because the Pew datasets were weighted, they could not be merged for statistical tests between the datasets. Instead, we provide descriptive statistics and graphs to help interpret results.

[5] For this construct there were ten different questions, the resulting alpha was .05/10 for each univariate test.

[6] For this construct there were ten different questions, the resulting alpha was .05/10 for each univariate test.

[7] For this construct we analyzed five questions, the resulting alpha was .05/5 for each univariate test.

[8] Classification tables and regression tables with Wald statistics and regression coefficients were deleted for space consideration. Contact the first author tables if interested in acquiring copies of the tables and statistics.

- Kyrgyzstan 2008, $\chi^2(5, N=833) = 216.04$, $p<.001$, Pseudo $R^2 = .497$.
- Kazakhstan 2008, $\chi^2(5, N=912) = 222.24$, $p<.001$, Pseudo $R^2 = .353$.

These findings indicate that the set of predictors reliably distinguishes between those who use the Internet and those who do not in all four samples, accounting for between 35-50% of the variance in the samples using Nagelkerke's formula (Pseudo R^2).

TABLE 1 CORRELATIONS AMONG THE MODEL VARIABLES

	M	*Spread*	*n*	1.	2.	3.	4.	5.	6.
Pew/USA December 2007									
1. Internet use	1.0	[75%]	1922	--					
2. Age	49.0	(18.03)	1922	-0.43 *	--				
3. Education (range 1-8)	4.6	(1.62)	1916	0.38 *	-0.08 *	--			
4. Income (range 1-8)	4.9	(2.23)	1590	0.34 *	-0.08 *	0.44 *	--		
5. Gender	0.0	[48%]	1922	0.04	-0.06	0.00	0.11 *	--	
6. Rural	0.0	[21%]	1921	-0.11 *	0.06 *	-0.12 *	-0.90 *	-0.04	--
Pew/USA March 2002									
1. Internet use	1.0	[58%]	4984	--					
2. Age	44.4	(17.22)	4857	-0.35 *	--				
3. Education (range 1-8)	4.2	(1.65)	4942	0.44 *	-0.05 *	--			
4. Income (range 1-8)	4.6	(2.14)	4000	0.42 *	-0.07 *	0.45 *	--		
5. Gender	0.0	[49%]	4984	0.05 *	-0.15 *	0.00	0.10 *	--	
6. Rural	0.0	[25%]	4984	-0.09 *	0.04 *	-0.16 *	-0.14 *	0.03	--
Kyrgyzstan July 2008									
1. Internet use	0.0	[13%]	1000	--					
2. Age	39.9	(17.02)	1000	-0.24 *	--				
3. Education (range 1-10)	5.2	(2.17)	1000	0.28 *	0.06	--			
4. Income (range 1-6)	2.1	(1.08)	833	0.35 *	-0.21 *	0.33 *	--		
5. Gender	0.0	[45%]	1000	0.06	-0.02	0.00	0.07	--	
6. Rural	1.0	[60%]	1000	-0.38 *	-0.02	-0.35 *	-0.31 *	0.01	--
Kazakhstan August 2008									
1. Internet use	0.0	[19%]	1000	--					
2. Age	39.7	(15.95)	1000	-0.28 *	--				
3. Education (range 1-10)	5.2	(2.07)	1000	0.26 *	-0.03	--			
4. Income (range 1-6)	4.0	(0.90)	912	0.29 *	0.22 *	0.28 *	--		
5. Gender	0.0	[45%]	1000	0.06	-0.02	-0.01	0.04	--	
6. Rural	0.0	[44%]	1000	-0.21 *	0.04	-0.20 *	-0.26 *	0.02	--

Notes. In the M column, means are reported here for continuous variables: age, education and income. While both education and income are ranked variables, we treated them as continuous for the sake of the regression. Modes are reported for dichotomous variables: Internet use, gender and rural versus urban/suburban location. Rural represents rural versus urban, where rural was coded 1 and urban was coded 0. Gender was coded 0 female, 1 male. In the Spread column, parenthetical values are Standard Deviations (SD), and bracket values [%] are percentages of respondents coded 1 in the sample.
* p < .05, however, with samples sizes this large statistical significance a low threshold.

1) Shared reliable variables

In all four datasets, age, education and income were significant predictors of Internet use. Additionally, being male was significantly positively associated with Internet use in the US/2002 and living in a non-rural location was significantly positively associated with Internet use in Central Asia. By duplicating our logistic regression procedure with a parsimonious five variable model in all four of our sample populations, we demonstrated that Internet users share common differentiating demographic variables when compared to their non-user cohorts regardless of country or historical time at least when diffusion is below 75%. To expand and investigate this point further, we analyzed the three consistent reliable predictors individually by each sample population's diffusion grouping by quartile. This helped us to identify with which US adopter groups the Central Asian Internet users shared the most commonality.

a) Age

Internet users were from the second quartile of age, while non-users were in the third quartile of age across all the sample populations, see Fig. 3.

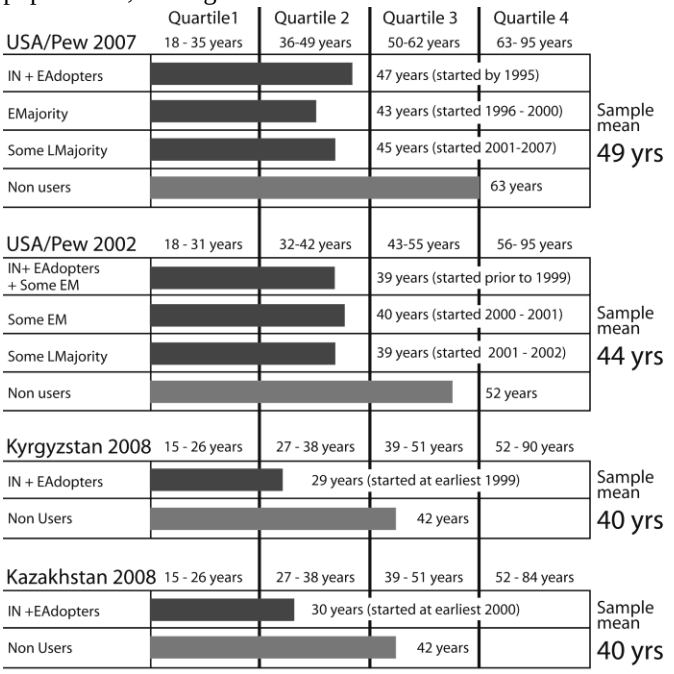


Fig. 3. Age by diffusion in each sample.

a) Education

We found that the Innovator + Early Adopter groups were more educated than their Early Majority and Late Majority counterparts in the Pew/US datasets; these differences were significant[9], $F_{(2,\ 1430)} = 73.74$, $p < .001$[10] in the 2007 dataset and $F_{(2,\ 2854)} = 114.55$, $p < .001$ in the 2002 dataset, see Fig 4. Internet users in Central Asia had the most in common with Innovators and Early adopters when comparing the quartile level of their education. Internet users in Central Asia were in the third quartile of education which most closely aligned to the Innovators + Early Adopters in the 2007 Pew/US dataset.

b) Income

Among the US/Pew Internet users, differences in income show a similar pattern to education[11], in that earlier adoption was associated with higher incomes. Again, differences among

[9] Non-users were not part of the univariate tests for significance. They are shown in the graphs for reference only.

[10] While we conducted univariate tests of significance for between group comparisons among the US Internet users, this was not our primary concern. Instead, we are trying to establish that the Central Asian users are very much like the Innovator + Early Adopter group in the Pew/US samples in regards to their demographics in their respective populations. Since we could not merge the data sets we were only able do the cross dataset comparison descriptively by comparing the population quartiles.

Additionally, these are large datasets; as such they are very powerful and significant tests are likely.

[11] Recall, that education and income were only somewhat correlated (r = .44 in 2007, r = .45 in 2002, explaining approximately 20% of the variance between the variables). See Table I for correlations.

Internet users in the Pew/US were significant, $F_{(2, 1430)} = 33.24$, $p < .001$ in 2007 and $F_{(2, 2432)} = 44.58$, $p < .001$ in 2002. The Central Asia Internet users were in the highest quartile of income, see Fig. 5. Again, the Central Asian Internet users were most like the Innovator + Early Adopter groups in the Pew/US samples in regards to income compared to their respective populations.

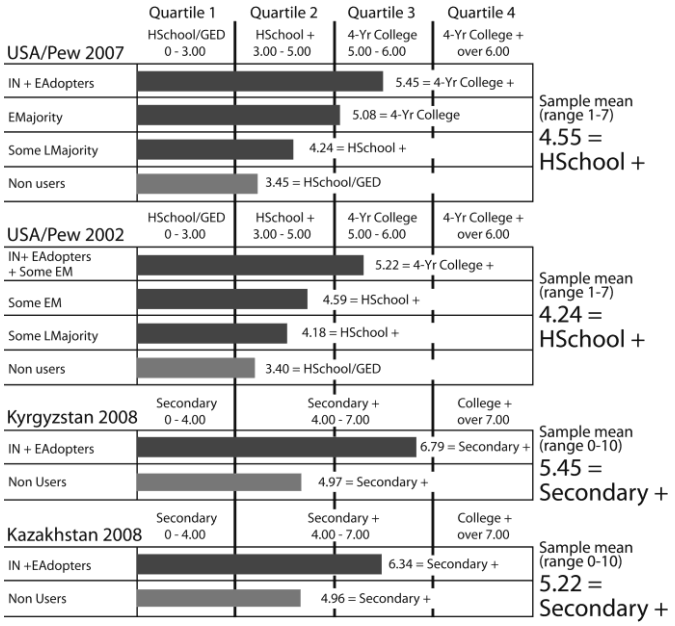


Fig. 4. Education by diffusion in each sample

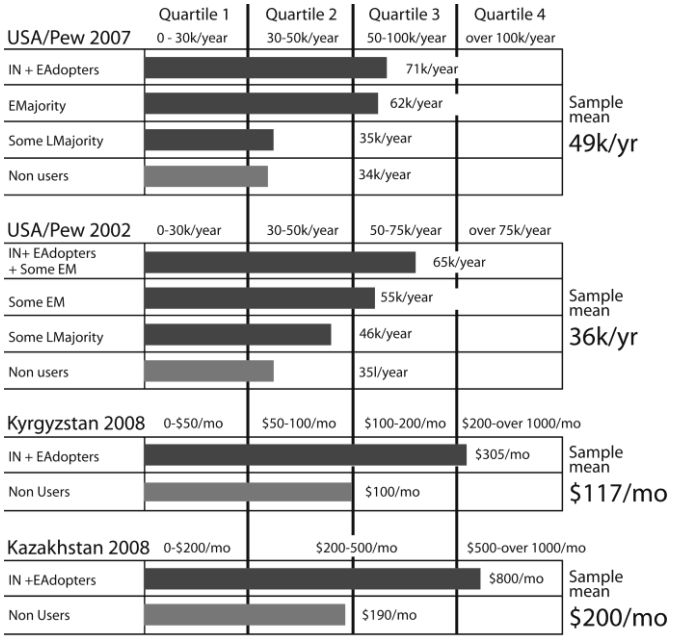


Fig. 5. Diffusion by income

1) Summary: RQ1

Across all four data sets the logistic regressions established that (1) Internet users were significantly differentiated from non-users by very few demographic variables that accounted for between 35 - 50% of the variance across each of the four sample populations using Nagelkerke's formula (Pseudo R^2); (2) age, income and education were the most important and consistently reliable predictors; and (3) a younger age, more education and a higher income were positively associated with a higher predicted probability of Internet use. Follow-up investigations analyzing age, education and income by diffusion group established that Internet users in Kyrgyzstan and Kazakhstan in 2008 were most similar to Innovators + Early Adopters in both Pew/US samples when compared to a non-user cohort. As far as length of time using the Internet, the Central Asian users (earliest use approximately eight years) were most like the Early Majority in the Pew/US 2002 data set and the Late Majority in the Pew/US 2007 dataset.

We conducted this detailed comparative analysis in order to provide a solid basis for the comparisons in types of usage that come in the next part of the discussion. With the understanding from the four sample populations and the statistically validated similarity of the populations across time and location, we analyzed Internet behaviors and attitudes in more depth to help understand perceptions about the Internet relative to each sample. Recall that our goal in this analysis is to demonstrate that even once adopted, and adopted by similar demographic groups, the usage patterns of the Internet reveal that the technology holds a different social meaning across contexts.

B. RQ2: While Internet users are from similar demographic groups compared to the non-user population, there is a great variety in how the Internet is perceived and/or used, sometimes in surprising ways.

In the next phase of this investigation, we analyzed (1) Internet behaviors which we interpret as reflecting perceived usefulness (PU); (2) connection speed and location of Internet use which we interpret as contributing to perceived ease of use (PEOU); and (3) attitudes which we interpret sometimes as contributing to PU, and sometime to PEOU. Our goal with this investigation is to demonstrate that just because users across contexts fall into the same category (i.e. Early Adopters/Innovators) doesn't mean they actually fall into identical categories of usage[12]. In the next pages, we demonstrate that the online activities of Central Asian users (as Innovators + Early Adopters) can be similar to the online activities of all the DOI groups of users in the US, depending on the activity.

1) Internet behaviors

We categorized Internet behaviors as (a) recent use, (b) use for email, (c) information seeking, (d) consumer-related, and (e) entertainment related. We used a Bonferroni adjustment to control for Type I error family-wise for the construct[13].

a) Recent use (PU)

All four surveys asked respondents "Did you use the Internet yesterday?" Respondents in both years of the Pew/US were much more likely to say yes compared to Central Asian

[12] Users in Central Asia, according to the previous analysis, never surpass the category of "Early Adopter."

[13] We conducted nine separate univariate tests in the behavior construct; as such, our adjusted alpha was .05/9 = .006.

users, see Fig. 6. The Central Asian users behaved most like the Late Majority group in the Pew/US 2002 dataset. The differences among Internet user groups in the US datasets were significant: (a) in the US 2002 sample, χ^2 (2, N = 1434) = 81.98, p < .001; and (b) in the 2007 dataset, χ^2 (2, N = 2868) = 125.16, p < .001.

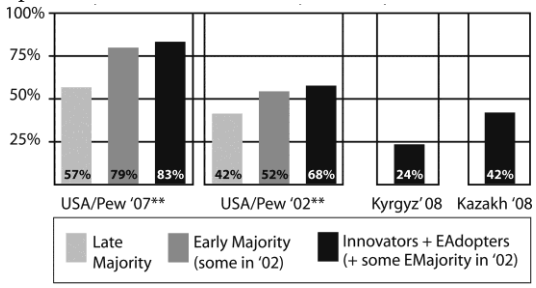


Fig.. 6. Did you use the Internet yesterday? ** = p < .006 (adjusted alpha)

b) Email (PU)

All four surveys asked respondents if they used email; email use was common in all the survey samples. Respondents in both years of the Pew/US were slightly more likely to claim to use email when compared to Central Asian users, see Fig. 7. The Central Asian users behaved most like the Late Majority group in both the Pew/US 2002 datasets. The differences among Internet user groups in the US datasets were significant, χ^2 (2, N = 1436) = 98.65, p < .001 in the 2007 dataset and χ^2 (2, N = 2872) = 70.18, p < .001.

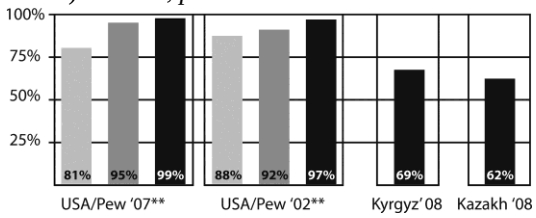


Fig 7. Do you use email? ** = p < .006

c) Information seeking (PU)

We investigated two questions that asked about information seeking on the Internet:

- The first question asked, "Do you ever get news online?" In this case, the Kyrgyz Internet users behaved most like the Innovator + Early Adopter groups in both US samples, and the Kazakh users behaved most like the Late Majority, see Fig. 8. The differences among Internet user groups in the US datasets were significant, χ^2 (2, N = 1434) = 63.37, p < .001 in the 2007 dataset and χ^2 (2, N = 2871) = 115.69, p < .001.

- We also investigated how respondents reported using the Internet to search for information about a job. Again, this question was not asked in the Pew/US 2007. Central Asian users behaved most like the Innovator + Early Majority group in the Pew/US 2002 sample in regards to looking for information about job, see Fig. 9. Differences among Internet users in the 2002 US dataset was significant, χ^2 (2, N = 2871) = 86.17, p < .001.

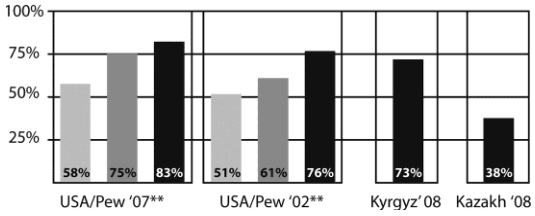


Fig. 8. Do you get news online? ** = p < .006

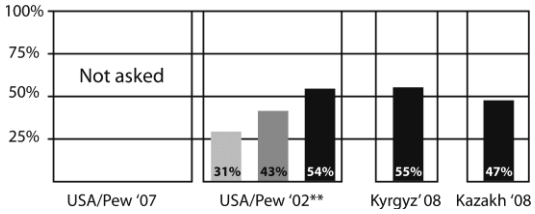


Fig. 9. Do you ever seek information about a job? ** = p < .006

d) Consumer-related (PU)

We investigated three questions that asked about consumer-related behavior on the Internet. In all cases, we found that there were almost *no* consumer-related behaviors on the part of the Central Asian Internet users, see Fig. 10-12.

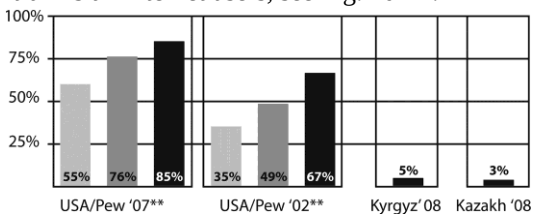


Fig. 10. Have you ever bought a product online? ** = p < .006

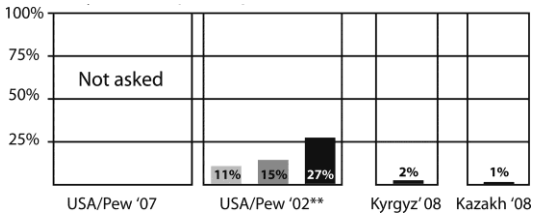


Fig. 11. Do you ever participant in an online auction? ** = p < .006

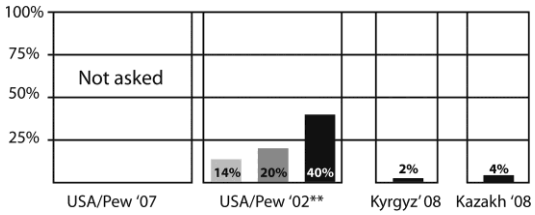


Fig. 12. Do you ever do online banking? ** = p < .006

Differences among Internet user groups in the US datasets were significant in all cases:

- Buying a product online, χ^2 (2, N = 1238) = 77.79, p < .001 in the 2007 dataset and χ^2 (2, N = 2873) = 174.94, p < .001 in the 2002 dataset.

- Participating in an online auction (only asked in 2002), χ^2 (2, N = 2866) = 84.95, p < .001.
- Online banking (only asked in 2002), χ^2 (2, N = 2870) = 175.85, p < .001.

The lack of consumer-related uses of the Internet is likely due to other infrastructure issues like the availability of bank accounts, but the goal of this paper is to discuss **what** is going on; the discussion of **why** these behaviors occur is a different (and longer) paper.

e) Entertainment-related (PU)

We investigated two non-instrumental uses of the Internet. In both cases the questions were only asked of the 2007 Pew/US sample:

- Respondents were asked if they watched videos online. The Central Asia users behaved most like the Early Majority in the 2007 dataset. The difference among the US Internet user groups was significant, χ^2 (2, N = 1237) = 40.69, p < .001, see Fig. 13.
- Central Asia users were more likely to report that they listed or downloaded music than *any* of the US diffusion groups. Clearly, music is an important activity for Central Asia users. The difference among the US Internet user groups was significant, χ^2 (2, N = 1236) = 18.17, p < .001, see Fig. 14.

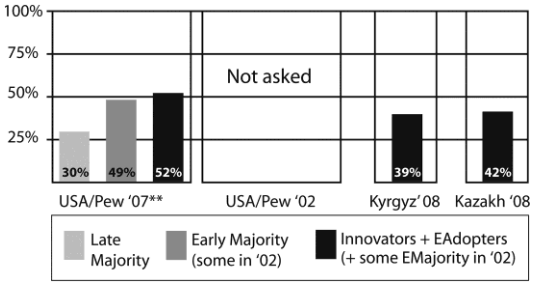


Fig. 13. Do you ever watch video clips online? ** = p < .006

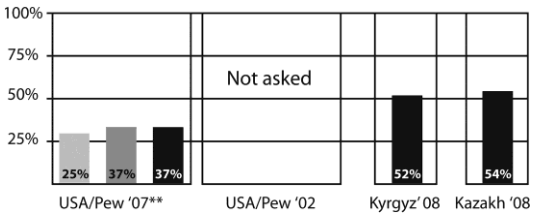


Fig. 14. Do you ever download or listen to music online? ** = p < .006

f) Summary: Internet behaviors

In sum, the online behaviors (implied perceived usefulness) of Central Asia users varied widely when compared to the US samples, see Table II for a summary of findings.

1) Connection speeds and locations of use (PEOU)

Next, we analyzed (a) home access and (b) work access to the Internet. We interpret access as contributing to perceived ease of use (PEOU). We used a Bonferroni adjustment to control for Type I error family-wise for the connection construct[14]. Note that Central Asian Internet users reported a variety of access points[15].

TABLE 2. SUMMARY OF COMPARISONS OF INTERNET BEHAVIORS

Recency of use	Central Asian users behaved most like Pew/US 2002 Late Majority
Email	Central Asian users behaved most like Pew/US 2002 Late Majority
Information Seeking	Varied. Krygyz behaved like Innovator + Early adopters groups while Kazakh behaved like Late Majority for news and early majority for information about jobs.
Consumer-related	Central Asian users behaved most like Pew/US 2002 Late Majority. Note that there was almost no consumer-related behaivor among the Central Asian Internet users.
Entertainment related	Varied. For videos, Central Asian users behaved most like the Early Majority in the Pew/US 2007 sample. For music, Central Asian users behaved most like Innovators + Early Adopters in the Pew/US 2007 sample .

a) Home access

Home access was much more common in the US/Pew samples; the Central Asian users accessed the Internet far less from home than even the Late Majority user group in the 2002 sample, see Fig. 15. The differences among Internet user groups in the US datasets were significant, χ^2 (2, N = 1435) = 15.70, p < .001 in the 2007 dataset and χ^2 (2, N = 1536) = 51.27, p < .001.

Respondents were also asked what type of connection they used at home; answers were recoded so that broadband access was binary. As Fig. 16 demonstrates, broadband access in homes in Central Asia is rare. The differences among Internet user groups in the 2002 Pew/US datasets were significant, χ^2 (2, N = 2727) = 81.87, p < .001; differences were not significant among the Pew/US 2007 sample.

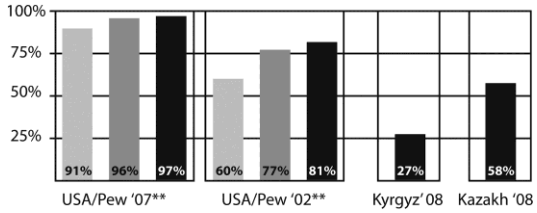


Fig.. 15. Do you ever go online from home? ** = p < .016

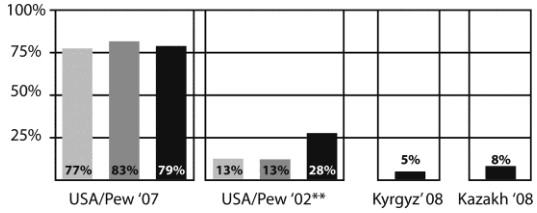


Fig. 16. Do you have a broadband connection at Home? ** = p < .016

b) Work access

Central Asian Internet users were just as likely to access the

[14] We conducted three separate univariate tests in the access construct; as such, our adjusted alpha was .05/3 = .016.

[15] Many accessed the Internet from Internet cafes: 53% in Kyrgyzstan and 11% in Kazakhstan. Other common access points included the homes of friends (8-10% reported access from friends' homes).

Internet from work as Innovators + Early adopters in the 2002 US/Pew sample, see Fig. 17. However, by 2007 work access was common for all users in the US. The differences among Internet user groups in the US datasets were significant, χ^2 (2, N = 1426) = 47.04, p < .001 in the 2007 dataset and χ^2 (2, N = 2198) = 49.97, p < .001.

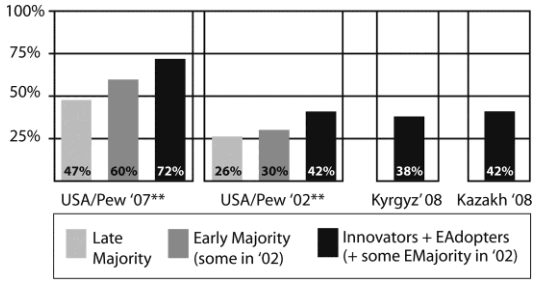


Fig. 17. Do you ever go online from work? ** = p < .016

c) Summary: Connection speeds and locations of use

In sum, Internet access in Central Asia looked much different when compared to the US. Home access was not common while work access was more common for Central Asian Internet users.

2) Attitudes about the Internet

There were five attitude questions in which we could compare among Internet users in Central Asia and the US[16]. These questions asked first (a) how much would you miss the Internet if you no longer had access (PU)? The remaining questions asked for the level of agreement to statements about the Internet. Statements included: (1) Internet is primarily a source of entertainment (PU), (2) the Internet is confusing to use (PEOU), (3) the Internet is dangerous (asked in Pew/US) or a threat to local culture and ways (asked in CAICT) (PU) and (4) the Internet is too expensive (PEOU). The last four questions were only asked in Pew/US 2002.

a) How much would you miss the Internet if you no longer had access (PU)

Most Internet users in Central Asia reported that they would miss the Internet 'a lot' or 'some', see Fig. 18. The high reported levels were most like Innovators + Early Adopters and Early majorities in the US/Pew samples. The differences among Internet users in the Pew/US were significant, $F_{(2,\ 1421)}$ = 38.91, p < .001 in the 2007 dataset and $F_{(2,\ 2825)}$ = 107.14, p < .001 in the 2002 dataset.

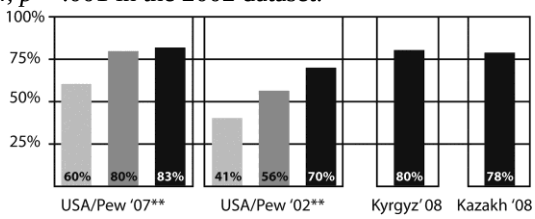


Fig. 18. How much would you miss going online? ** = p < .01

[16] Questions used four point likert scales. Figures indicate those respondents reported agreement. The Bonferroni adjusted alpha for tests of significance was .05/5 = .01.

b) The Internet is primarily a source of entertainment (PU).

Central Asian Internet users were less likely to agree to this statement when compared to the 2002 US responders, see Fig. 19. The differences among the 2002 Pew/US Internet users was significant, $F_{(2,\ 2846)}$ = 21.94, p < .001.

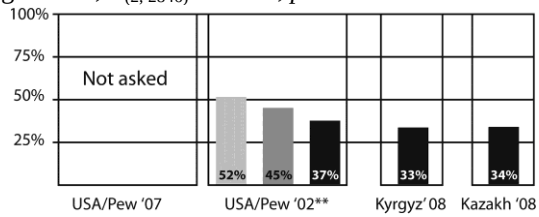


Fig. 19. The Internet is mostly a form of entertainment. ** = p < .01

c) The Internet is confusing to use (PEOU)

Central Asian Internet users did not find the Internet confusing and hard to use, see Fig. 20. In fact, all the US 2002 user groups were more likely to agree to this statement. The differences among the 2002 Pew/US Internet users was significant, $F_{(2,\ 2849)}$ = 88.05, p < .001.

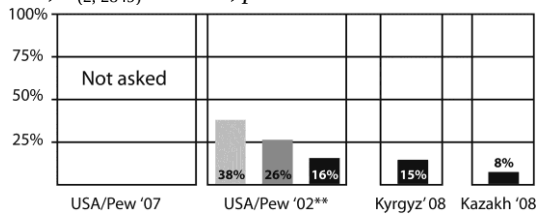


Fig. 20. The Internet is confusing and hard to use. ** = p < .01

d) The Internet is dangerous (asked in Pew/US) or a threat to local culture and ways (asked in CAICT) (PU).

This question was asked a little differently. Central Asian respondents were asked their level of agreement to "The Internet is a threat to local culture and ways." Conversely, the US/2002 respondents were asked their level of agreement to "The Internet is a dangerous thing." The level of agreement in Central Asia was most similar to US earlier adopters groups. The differences among the 2002 Pew/US Internet users was significant, $F_{(2,\ 2831)}$ = 50.97, p < .001, see Fig. 21.

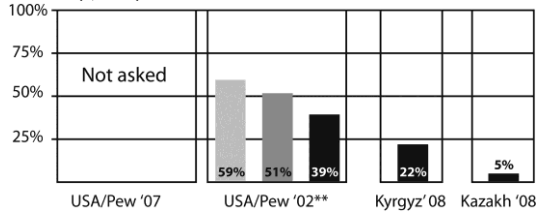


Fig. 21. The Internet is dangerous /threat. ** = p < .01

e) The Internet is too expensive (PEOU).

About half of all users agreed that the Internet was too expensive in all three datasets, see Fig. 22. Differences among Internet users Pew/US sample were not significant.

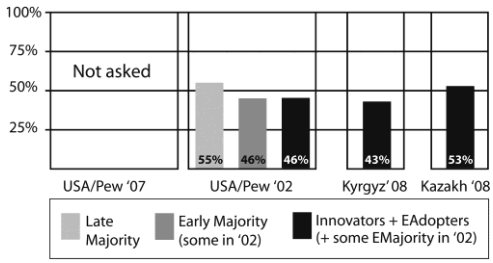


Fig. 22. The Internet is too expensive. ** = p < .01

f) Summary: Attitudes about the Internet

In sum, Central Asian users would miss going online at the same rates as earlier adopters in the US/Pew samples. Additionally, Internet users in Central Asia tended to have more favorable opinions of the Internet.

3) Summary: RQ2

Based on commonly used analytical frameworks like TAM or DOI, we would expect the online experiences of the Central Asian users (as Innovators/Early adopters) to be similar to the same DOI group in the US because they occupy the same "type" of user. However, across the datasets, Central Asian Internet users behaved most of the time like the 2002 Late Majority in the US with a couple of important exceptions.

Kyrgyzstan users were just as likely to get news online as the earlier adopter groups in both US samples, and both Central Asian groups looked for information about jobs at about the same rate as earlier adopters in the 2002 US sample.

While there were almost no consumer-related behaviors reported in the Central Asian samples, non-instrumental use (videos and music) was very common among Central Asian Internet users.

Central Asian Internet users do not have the same type of fast broadband connections at home shared by many US users in 2007. Their connection profile is different across several vectors; they have less access at home, and access at work is similar to earlier adopters in US 2002. In Kyrgyzstan, Internet cafes were used more often than either home or work.

When it comes to attitudes, Central Asian Internet users tended to have more favorable opinions than US/Pew respondents. Central Asian users reported at rates as high as the Early Majority groups in the 2007 US sample that they would miss the Internet if it was no longer available. In the remaining attitude comparisons with the 2002 US sample, the Central Asians were consistently most like the earliest US adopters.

V. Conclusion

The findings presented in this article demonstrate that Internet users are differentiated from non-users by similar variables across cultures and time. Although Internet users share demographic similarities, they vary widely in how they use the Internet (implied usefulness) and their opinions about the Internet when separated into user groups using the DOI framework. Our goal with this analysis is to build on previous work that discussed the varied meaning of technology for adopters [1, 2, 3] and quantitatively demonstrate that Internet users across contexts cannot be assumed to be similar in how and why they integrate technology into their everyday lives[17]. The social meaning of ICTs across contexts can vary dramatically, and the ways technology finds purchase in communities defies easy characterization. A better understanding of what technology means to those who adopt it will provide a more effective framework for developing technologies that are appropriately useful.

Acknowledgment

This CAICT material is based upon work supported by the National Science Foundation (NSF) under grants #0326101 and #0219350. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.

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[17] While quantitative analysis can demonstrate *what* differences/similarities exist, it does not help explain *why*, i.e. reasons or mitigating factors that lead to differences/similarities among users. For future work, a deep ethnography similar to [1,3] would be needed to fill this gap.