Reducing the Digital Divide in Mexico: Analyzing the Impact of Telecenters

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ABSTRACT

Developing Countries have tried to reduce the impact of unbalanced technology access through the creation of telecenters in which low-income users can learn and get used to IT. In Mexico this effort has led to the implementation of the e-México project (electronic-Mexico). This project deals with the installation of Digital Community Centers (DCC), a kind of telecenter which provides users with Internet-enabled PCs. This paper presents a preliminary analysis of the impact of such DCC. We focus our attention on the State of Mexico, a densely populated state located in the center of Mexico. We describe the factors taken into account to install DCC and analyze whether or not the location of these telecenters is expected to positively impact low-income counties.

Keywords: digital divide, telecenters, IT Management in developing countries.

Since Internet became a communication tool for the public it established a difference between those countries with Internet access and those without it. The main outcome of this division is the unequal distribution of decision-making information among people. Unequal access to IT and high quality information is what we call the "digital divide".

This research analyzes an initiative of the federal Mexican government aimed at reducing the digital divide: the e-México (electronic México) project. We analyze the counties of the State of Mexico with higher index of poverty which have access to IT. The article is divided in four sections. First, we provide a general description of the digital divide problem; the second part describes the e-México project in further details; we continue by defining our methodology of study and end with a discussion of results and future research directions.

I. THEORETICAL FRAMEWORK: THE DIGITAL DIVIDE

According to the Internet World Stats, as of November 2006 there were 1,706 billion Internet users. This corresponds to a 16.6% world penetration rate, a small percentage of the global population. This shows the huge challenge represented by the digital divide. Larry Irving, quoted by Dragulanescu (2002) was the first author to use this term, he defined "digital divide" as:

"the existing gap in access to information services between those who can afford to purchase the computer hardware and software necessary to participate in the global information network, and low-income families and communities that cannot"

There are other definitions Johnson (2002), Cullen (2001) and Dewan et. al (2005) which propose different approaches to the digital divide term. The OCDE (2001) states that digital divide is "a term that refers to the gap that exists in the opportunities to access advanced information and communication technologies between geographic areas or by individuals at different socio-economic levels".

The digital divide concept is still on debate, there is no definitive consensus on whether this unequal access to technology refers to computers only or should also consider telephone lines. Norris (2000) and Del Álamo (2002) consider telephone lines, television and radio as information technologies. Some others like Kenny and the OCDE (2003) include the previous technologies but also consider Internet access.

We consider that digital divide can be understood as an unequal access to information that promotes human development and increases quality of life. Information Technologies are the main way to reach this goal. Internet access, phone lines, radio or television do not guarantee that information circulates with the same quantity and quality. Our research is focused on measuring the impact of national initiatives targeted at increasing access to IT for low-income populations. Our long-term research goal is to find a reliable measuring methodology to estimate the impact that access to IT has on reducing the digital divide and as a consequence come up with concrete proposals and recommendations to enhance the efficiency of both government and private projects and initiatives. Our first objective is to measure the amount of people that gets access to IT and how this can help reducing the digital divide. Next section continues by describing the e-México project: an effort of the federal Mexican government aimed at reducing the digital divide.

II. E-MÉXICO PROJECT

The digital divide in Mexico is analyzed by Curry and Kenny (2006), their study includes data about Mexican infrastructure: online domains, computer access and number of Mexican Internet users. The Asociación Mexicana de Internet AMIPCI (2006) publishes an annual study of Mexican online consumers and their habits. In 2006, only 20.2 millions of Mexicans had Internet access, less than 20% of the total population of the country.

The project called e-México (http://www.e-México.gob.mx/) was initiated in 2001 by the federal government. e-México intends to provide Internet access together with online services like education programs, health, trade and online transactions to 10 thousand communities representing 85% of the Mexican population, before the end of the current administration (December 2006).

Statistics show that DCC are being used by a large number of users in Mexico. As of October 2004, 29.8 millions of web pages were consulted through the network; 240 thousand hours of surfing is the accumulated total of countryside DCC. In the State of Mexico, a densely populated entity located in the center of the country, subject of this study, 13,300 hours of Internet surfing were registered in 2004 (Perez, 2004).

We will focus our study on the DCC located in the State of Mexico. According to official data, there are 345 DCC in this state, but we do not know whether they are distributed following a particular criterion like poverty index, literacy or lack of technological infrastructure. Officially, there are no established criteria to determine actual DCC locations. We assume that as far as they are controlled by the micro-regions program of the Ministry of Social Development (SEDESOL) they are using the poverty index to locate the centers.

Poverty index is a measure provided by the Mexican National Council of Population: "…this index is a summary measure to differentiate states and counties according

to the global impact on population caused by: lack of access to education, living conditions, income, and context in small counties". (CONAPO, 2004)

In order to measure and evaluate the impact of DCC on reducing the digital divide, we started by finding out the main criteria applied when installing a DCC in a particular county. Interviews with personnel from the federal government in charge of this project revealed that there is no official criterion for the location of DCC, a methodology to measure their impact is still to be defined. Next section describes our approach to these problems.

III. METHODOLOGY

The core methodology consists on evaluating the statistical data with the poverty index. We selected the State of Mexico for this study because it concentrates more than 10% of national population. According to the National Census Bureau of Mexico (INEGI), on 2005 the population of this state was about 13 million 58 thousand and 611 people living in 125 different counties, mostly urban areas. Thus, we consider that studying the impact of DCC in this federative entity will be highly representative at a national scale.

The Hypothesis on which we focus this work are:

1. The poverty index calculated by Mexican government as a normalized measure for qualifying the overall degree of poverty of a population is a meaningful indicator. This is important since the second hypothesis is based on poverty index as an indicator of expected impact of DCC for reducing digital divide.
2. Digital divide will be reduced if DCC are located in populations with a strong poverty index.

In order to proof these hypotheses we proceeded as follows: In the first stage we collected information about poverty index and DCC in the State of Mexico. In the second stage we validated the poverty index with its components (see table 1) before attempting to find any correlation between this index and the DCC locations. The third stage did a correlation analysis between the poverty index and the DCC location in the counties belonging to the State of Mexico. Finally, we discussed and analyzed the obtained results.

Table 1. Components of poverty index

Poverty Index Indicators
Percentage of analphabets aged 15 or more
Percentage of population aged 15 or more with incomplete primary school
Percentage of population living in private houses without tap water
Percentage of population living in private houses without drainage and private toilets
Percentage of population living in private houses with earth floor (unconditioned floor)
Percentage of population living in private houses without electricity
Percentage of overcrowded private houses
Percentage of population living with less than 10USD per day
Percentage of population living in places with less than 5000 inhabitants

Source: CONAPO (www.conapo.gob.mx)

IV. DISCUSSION AND RESULTS

The first result is that the poverty index is valid. According to the results of the multiple regression (see table 2 and table 3) there is a strong correlation (R2 = 0.9341). With the exception of total population, the rest of the components are meaningful enough. Correlation between components and poverty index was tested with a 5% significance level. As a conclusion we can state that there is enough evidence of linear relation of the index and its components: Mexican poverty index is a strong indicator that supports statistical test.

As second result, we can affirm that there is no evidence of lineal correlation between poverty index and the number of DCC in the case of State of Mexico (see table 4 and table 5). If we consider that the digital divide will be reduced by means of providing Internet access through telecenters – DCC – this work shows that the current location of the DCC is not properly done to achieve this goal.

However, with the available information we can not really measure the impact of DCC on the Mexican digital divide. This preliminary research explores the idea that the DCC locations are important to reduce the digital divide on Mexico, we need to provide more elements, for instance, by means of a longitudinal study in order to complement this research.

CONCLUSIONS AND FUTURE RESEARCH

This is a pioneer work that contributes to the research of the telecenters – DCC – and their impact on reducing the digital divide on low income populations. Our results showed the poverty index as a strong and valid measure to understand and quantify poverty; moreover, our tests demonstrate that the component of total population has not significant impact on the computation of the poverty index, and thus can be omitted.

Table 2. Low-income counties and their indicators used to compute the poverty index

TABLA 3. Indice de Marginación y Municipios del Estado de México												
Municipio	*POBLACI*	*ANALFABE*	*PRIMINCO*	*SINSERVS*	*SINENERG*	*SINAGUA*	*HACINAMI*	*PISOTIER*	*MENOSHAB*	*POB2SMIN*	*INDMARGI*	*CCDS*
ACAMBAY	58,389.00	20.09	48.00	54.84	9.91	20.91	56.00	21.47	91.07	75.49	0.31	4.00
Aculco	38,827.00	16.78	46.34	57.70	20.46	14.24	57.85	13.87	100.00	73.13	0.31	3.00
Almoloya de Alquisiras	15,584.00	15.44	46.21	44.08	6.97	28.78	57.23	20.45	100.00	71.51	0.16	3.00
ALMOLOYA DE JUAREZ	110,591.00	15.41	40.95	46.49	9.31	29.65	59.35	23.48	85.55	63.13	0.06	4.00
AMANALCO	21,095.00	23.13	54.03	52.98	7.91	17.69	65.34	38.05	100.00	77.50	0.63	1.00
AMATEPEC	30,141.00	24.80	50.17	43.50	10.60	53.70	49.19	20.04	100.00	71.45	0.43	3.00
CHAPA DE MOTA	35,068.00	18.34	50.32	40.32	6.66	17.31	58.31	23.15	81.44	76.47	0.17	2.00
COATEPEC HARINAS	22,828.00	18.45	46.12	52.91	6.97	11.62	61.53	17.22	100.00	66.82	0.15	4.00
DONATO GUERRA	28,006.00	27.45	60.85	51.07	18.33	40.75	68.43	41.05	100.00	72.39	0.99	1.00
IXTAPAN DEL ORO	6,425.00	20.80	55.10	52.23	8.56	23.83	62.10	21.74	100.00	82.54	0.55	2.00
IXTLAHUACA	115,165.00	17.17	38.07	44.13	5.93	22.44	58.80	27.90	59.95	64.51	-0.09	7.00
JIQUIPILCO	56,614.00	19.28	44.57	48.10	5.32	8.48	56.25	28.32	88.79	71.18	0.09	4.00
MORELOS	26,971.00	26.05	51.62	54.99	11.64	22.42	56.03	26.73	100.00	80.14	0.57	2.00
Oculilán	25,989.00	13.07	44.63	29.71	3.76	5.24	62.89	29.42	100.00	76.78	0.02	2.00
OTZOLOAPAN	5,196.00	24.24	52.98	32.70	4.50	15.07	61.87	32.66	100.00	71.60	0.31	2.00
SAN FELIPE DEL PROGRESO	177,287.00	27.06	59.59	61.79	17.27	44.70	70.43	34.47	100.00	67.82	0.99	11.00
SAN SIMON DE GUERRERO	5,436.00	19.20	43.01	44.53	5.75	22.86	54.45	21.61	100.00	67.49	0.08	1.00
SANTO TOMAS	8,592.00	18.17	44.35	36.32	1.48	23.22	58.64	17.82	100.00	59.97	-0.07	2.00
SULTEPEC	27,592.00	27.53	54.81	69.79	20.66	38.93	62.85	43.02	100.00	66.24	0.96	5.00
TEJUPILCO	95,032.00	23.94	48.49	37.88	8.29	33.88	56.07	22.46	67.59	54.75	0.03	6.00
TEMASCALCINGO	61,974.00	19.78	46.72	49.65	5.33	10.78	58.69	20.47	70.74	67.53	0.02	5.00
TEMASCALTEPEC	31,192.00	16.68	45.61	57.54	8.12	19.16	63.60	33.40	100.00	77.21	0.43	4.00
TEMOAYA	69,306.00	17.32	48.61	40.61	3.59	1.16	69.10	38.03	84.79	70.74	0.18	3.00
TEXCALTITLAN	16,370.00	17.21	46.77	47.80	6.82	26.35	61.47	25.55	100.00	68.90	0.26	2.00
TLATLAYA	36,100.00	26.77	49.48	55.39	6.00	51.59	53.09	26.50	100.00	65.55	0.50	4.00
VILLA DE ALLENDE	40,164.00	22.36	54.15	60.18	19.84	28.42	69.76	27.23	87.29	66.90	0.68	2.00
VILLA DEL CARBON	37,993.00	18.76	46.19	54.08	9.90	10.40	62.40	22.03	80.05	67.49	0.16	2.00
VILLA VICTORIA	74,043.00	26.26	59.70	68.33	22.16	58.48	69.39	34.84	100.00	60.44	1.08	7.00
ZACUALPAN	16,101.00	19.55	53.29	60.44	10.14	49.48	60.59	31.23	100.00	67.39	0.63	2.00
ZUMPAHUACAN	15,372.00	21.93	52.21	44.95	4.11	28.86	66.15	42.48	100.00	81.27	0.63	1.00
Fuente: Elaboración propia con datos del CONAPO y SCT												

Table 3. Regression analysis of poverty index and its components

Regression Statistics	
Multiple Correlation Coefficient	0.9665
Determination Coefficient R^2	0.9341
Adjusted R^2	0.9199
Typical Error	0.2892
Samples	122

ANOVA

	Degrees of freedom	*Squares sum*	*Square's average*	*F*	*F critical value*
Regression	10	132.78	13.28	158.81	6.26E-61
Residuals	112	9.36	0.08		
Total	122	142.15			

Table 4. Low-income counties and DCC

Low-income Counties and DCC			
County	**population**	**Poverty index**	**#DCC**
ACAMBAY	58389	0.30771	4
ACULCO	38827	0.3116	3
ALMOLOYA DE ALQUISIRAS	15584	0.16479	3
ALMOLOYA DE JUAREZ	110591	0.06082	4
AMANALCO	21095	0.62671	1
AMATEPEC	30141	0.42755	3
CHAPA DE MOTA	22828	0.14749	2
COATEPEC HARINAS	35068	0.16786	4
DONATO GUERRA	28006	0.99409	1
IXTAPAN DEL ORO	6435	0.54971	2
IXTLAHUACA	115165	0.09407	7
JIQUIPILCO	56614	0.09192	4
MORELOS	26971	0.57121	2
OCUILÁN	25989	0.01908	2
OTZOLOAPAN	5196	0.31451	2
SAN FELIPE DEL PROGRESO	177287	0.9929	11
SAN SIMON DE GUERRERO	5346	0.07743	1
SANTO TOMAS	8592	0.0712	2
SULTEPEC	27592	0.96099	5
TEJUPILCO	95032	0.03437	6
TEMASCALCINGO	61974	0.02196	5
TEMASCALTEPEC	31192	0.43085	4
TEMOAYA	69306	0.18225	3
TEXCALTITLAN	16370	0.25935	2
TLATLAYA	36100	0.49559	4
VILLA DE ALLENDE	40164	0.6792	2
VILLA DEL CARBON	37993	0.15923	2
VILLA VICTORIA	74043	1.07649	7
ZACUALPAN	16101	0.63044	2
ZUMPAHUACAN	15372	0.63397	1

Source: CONAPO, SCT

Table 5. Regression analysis of DCC located in low-income counties

Regression Statistics	
Multiple Correlation Coefficient	0.102472462
Determination Coefficient R^2	0.010500605
adjusted R^2	0.002254777
Typical Error	0.780983337
Samples	122

ANOVA

	Degrees of freedom	*Squares sum*	*Square's average*	*F*	*F critical value*
Regression	1	0.776718388	0.776718388	1.273444585	0.261372511
Residuals	120	73.19219678	0.609934973		
Total	121	73.96891516			

A question remains unanswered: How does Mexican government determines the number and location of DCC to reduce the digital divide in the country? The data we collected and the statistical analysis we performed in this study show that there is not correlation between the poverty index and DCC location. What is the main reason to locate a DCC into a specific community? Is it a political reason?

This research shows that there are no definitive criteria to locate a telecenter. We consider the poverty line as one valid criterion; however, there are other international measures to validate poverty. A future contribution of this research could be the definition of a set of criteria related to literacy, poverty line or digital literacy – computational skills – which could be used as indicators to decide the location of a DCC.

Finally, this exploratory research is only focused on publicly available data about Mexican DCC. There is a need for exploring more detailed information such as: number of computers in each location; real number of computers in operational conditions –the amount of broken equipment after some months of use can be rather high; computers with internet access –not every computer in a DCC has a working Internet connection; number of users in the telecenter at different times of the day; activities performed in every center, technical problems faced and how they are solved.

Future research includes extending this study to a national scale, analyzing different regions or states. We recommend the continuous application of this test in the next years to better understand the evolution of DCC and their impact on digital divide.

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