Chapter 11
Inequalities in the Appropriation of Digital Spaces in Metropolitan Areas of Latin America

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Abstract This study discusses the role of information and communication technologies (ICTs), especially the Internet, in three Latin American capitals in people's ability to attain the lifestyle they value and how inequalities in this ability or "information richness" can be explained by sociodemographic characteristics that do not depend on the individual's decisions. The analysis is conducted using an Information Richness Index that includes information about the three barriers that people face in making significant use of the Internet: access to the Internet, skills for using ICTs, and the ability to function well in digital environments. Econometric estimations show that women, people who are not active in the workforce, and older adults, particularly senior citizens, have lower IRI levels, while each additional year of education and belonging to learning communities have a positive effect on the level a person achieves.

Keywords ICT4D • Open development • Digital inequality • Latin America • Metropolitan cities

11.1 Introduction

In recent years, information and communication technologies (ICTs) have been changing the way we live and relate to one another. The creation of structures and dynamics based on ICTs is not only important for reducing transaction costs and allowing access to a considerable amount of information, but it also is beginning to

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shape new venues for interaction and integration, where users can participate in a way that was impossible in non-digital spaces [1]. Digital environments thus become potential equalizers and offer an opportunity to accelerate the path toward development and toward freedom for people to choose the kind of lifestyle they have reason to value [2].

In contexts of great inequality, such as Latin America, however, the most vulnerable people tend to suffer different and varied types of exclusion; as a result, compared to those who are wealthier, they are at a serious disadvantage in significant access to and use of digital spaces [3, 4]. According to data from Peru's National Institute of Statistics [5], 52.9% of Peru's urban population does not use the Internet. This group largely belongs to low-income households. Because of gaps in other areas, digital inequality could therefore reinforce the exclusion experienced by the poorest people instead of opening up new opportunities for social inclusion.

The purpose of this chapter is to analyze the degree of appropriation of the Internet and sources of "information inequality" in three Latin American capitals: Buenos Aires, the capital of a high-income country; Lima, the capital of a middle-income country; and Guatemala City, the capital of a country where income is still low. This will provide an overview of Internet appropriation in areas of the region with high teledensity.

Besides analyzing differences in access by individuals, the study will also take a deeper look at the complexity of Internet use. An Information Richness Index (IRI) will be constructed incorporating information about the three barriers that people face in making significant use of the net: Internet access, ICT skills, and the ability to function well in digital environments [6]. The index will provide insight into how effectively people can expand their freedom through Internet use [1]. The data are taken from the "Survey about Internet use: Platforms and open data – 2014," one of the few surveys that has collected detailed, representative information about patterns of Internet access and use in the region.[1]

11.2 Internet, Development, and Inequality

11.2.1 Internet as a Means and an End: Open Development and Information Richness

ICTs, especially the Internet, are significantly changing the way we live and relate to one another. As the "Information and Communication Technologies for Development" (ICT4D) approach indicates, ICTs are a set of tools that are useful and necessary for overcoming the challenges posed by development [10]. The

[1] The survey is part of a significant research effort by the DIRSI network, with financial support from IDRC. Analysis of the descriptive statistics for each of the three cities can be found at DIRSI's web page [7–9] (Consulted: 05 July 2016).

Internet significantly reduces transaction costs for accessing information and resources and for establishing communication. It therefore increases the user's ability to make better decisions about consumption, with more information about the prices and quality of products and services, as well as decisions about production, with more information about providers, competitors, and demand [11].

This approach emphasizes the use of these innovations as tools for improving people's quality of life [12, 13]; as a policy development strategy, Castells proposes expanding access to ICTs and the education necessary for using them, to ensure that no one remains unconnected or left behind in the information society [14].

Castells' analysis, however, omits the relational and collaborative nature of the information society and presents ICTs merely as a means to a higher end [14]. This limitation became clearer with the rapid advance in mobile connectivity worldwide and its impact on people's lives and welfare.[2] As Smith et al. [11] argue, based on the ideas of Sen [2], the use of mobile telephones, and even more so of the Internet, affects users' abilities because they change their position with respect to the resources necessary for development. This occurs in at least two ways: first, by increasing access to recent, relevant information and, second, by expanding the possibility of establishing connections among people and of connecting with new people.

As the digital sphere penetrates more intensely into everyday life, ICTs not only become tools, but, as Benkler [16] argues, they also begin to shape new social systems with structures and activities based on information networks. Appropriation of ICTs, and especially of the Internet, allows a new level of interaction among people and institutions, making feasible the implementation and strengthening of three types of networks: social and community networks, economic and labor networks, and political networks [11]. New platforms and venues for integration are being shaped, in which users can participate in a way that is impossible for them outside the Web [1].

It is in this context that, using the contributions of Amartya Sen [2] about the capability approach and development and those of Dorothea Kleine [17] about the role of ICTs as amplifiers of these capabilities, Mathew Smith et al. [14] unify and complement the work of Castells [10] and Benkler [16] to develop a new approach: Open Development. As Smith states, the Internet and the environments that the Web creates constitute a set of tools (a medium) that makes it possible to achieve development, as it allows users to exercise their capabilities more effectively through the significant reduction of transaction costs and improvement of their productive processes and consumption technologies. It also constitutes a venue for transformation and agency (an end), because it establishes conditions that expand people's freedoms by enabling them to create and reinforce social networks; be part of, share, and cooperate with larger communities; and form part of more participatory

[2] According to data from the ITU (International Telecommunication Union) for 2015, mobile teledensity in developed countries is 120.6, while in developing countries, it is 91.8. For 2014, in particular, mobile teledensity was 158.7 in Argentina, 102.9 in Peru, and 106.6 in Guatemala [15] (Consulted: 28 September 2015).

processes in which they not only have a voice, but their voice is also heard and used actively [14].[3]

We take that approach to the Internet and its relationship with development to define Information Richness as a person's ability to expand his or her freedom to choose a way of life through the use of ICTs, particularly the Internet, and the environments that they create [2, 6, 14, 17].

11.2.2 Information Inequality

Despite the benefits that stem from using ICTs and participating in the net, great differences or "technological distance" exist in access to and use of the Internet among individuals, families, enterprises, and geographic areas [18–20]. These differences are relevant, because as Robinson [3] states, people who take greater advantage of digital spaces have significant advantages over those who do not in almost all other spaces. As Tongia and Wilson [21] explain, this is because the positive effects of belonging to a network create a feedback loop that can be divided into two components: (i) an intrinsic effect that depends on the size of the network and corresponds to the direct benefits of communication and (ii) a complementary effect (of externalities) associated with goods, services, and interactions that become more available as the network grows – for example, a larger number of applications for an given operating system or a larger supply of specific contents for a community (contents in a particular language or about particular topics).

The existence of these two effects has two consequences for agents' opportunities. First, their existence implies that not belonging to the network has an opportunity cost borne by all people who are excluded from the user community. Second, both benefits (direct and indirect) depend on the size of the user community and the community's growth rate. The gradual inclusion of the group of people who are disconnected from digital spaces means that the user community will become larger and the non-user community will shrink, thus exponentially increasing the opportunity cost borne by those who remain outside of the network; in other words, those who lag farthest behind or are the most excluded eventually face higher costs for remaining outside of the network [21].

This concern is crucial, because as Robinson [3] notes, digital inequality tends to operate along with other preexisting conditions. The differences in the appropriation and intensity of ICT use tend to be associated with inequality in access to resources and rights. It is therefore no coincidence that groups that are socially, politically, and economically marginalized are also segregated within the digital system or are the last to be included, as that environment tends to reproduce patterns that exist in non-

[3] Nevertheless, Smith et al. [14] also mention that there is a latent risk in the expansion of digital systems and that development through these systems is not a matter of seeking not unlimited openness, but of seeking openness that is consistent with the expansion of cabilities and with people's development. This implies beginning with development problems and then looking at how "openness" can serve as a means for overcoming them.

digital spaces. The Internet could therefore end up exacerbating certain types of exclusion [3]. In particular, there is evidence that women [22, 23], older adults [24–28], unemployed people or those working in the informal sector [29, 30], and those with less education [31–34] tend to be the groups that lag in the digital space.

11.3 Informatıon Richness and Inequality in Metropolitan Areas of Latin America

Despite evidence about digital divides, little is known about these inequalities in Latin America, and there is even less information that can aid in understanding the situation beyond the dichotomy of access and non-access. The rest of this chapter, therefore, will analyze Information Richness and the sources of "information inequality" in three capital cities in the region: Buenos Aires, the capital of a high-income country; Lima, the capital of a middle-income country; and Guatemala City, the capital of a country where income is still low. Using data from the "Survey about Internet use: Platforms and open data – 2014," conducted by the Regional Dialogue on the Information Society (DIRSI), this chapter provides an overview of Internet appropriation in metropolitan areas of Latin America.

11.3.1 Information Richness Made Operational

Taking an operational approach to a person's level of Information Richness using a single indicator is complicated, because the impacts of ICTs on people's behavior and on the systems in which they operate exceed the boundaries of a single dimension. An economic approach (input-output relationship) generally will have one magnitude as an objective variable, measured in monetary units or volumes. There is no clear consensus about a general framework for analyzing appropriation of and participation in different ICT-based systems and even less about a variable that can measure the different dimensions [35].

Because the purpose of this study is to examine how people use the Internet to attain the lifestyle to which they aspire [17], the strategy developed by Mendonça et al. [6] will be used to create an Information Richness Index that allows this complex dynamic to be incorporated, through three components related to the three barriers to making significant use of the Internet: (i) access, (ii) skills for using it, and (iii) the users' capabilities for functioning fully in spaces created through ICTs. Details of the construction of each component can be found in Appendix 1.

This strategy is especially useful because, as Mendonça notes, it considers that making significant use of ICTs does not consist merely of taking the person to the door (access) or of them being able to open it (skills for use), but also implies that the person is able to cross the threshold, socialise with other agents, and function fully in the environment they find behind that door (capabilities). The incorporation of this third component is a bridge between the index developed by this author and

the Open Development approach proposed by Smith et al. [14], because this methodology makes it possible to add information about people's exercise of their freedoms through the use of open platforms, participation in digital spaces, creation of value through relationships with other users and institutions, and achievement of more functionings [2]. The values used in the index, from a minimum of 0 to a maximum of 100, will offer an approximation of how appropriation of the Internet contributes to users' development and will be defined as follows:

$$\mathrm{IRI}_i = 0.5^* \mathrm{AI}_i + 0,25^* \mathrm{SI}_i + 0,25^* \mathrm{CI}_i \tag{11.1}$$

Where:

RI: Information Richness Index
AI: Access Index
SI: Skills Index
CI: Capabilities Index

The ability to analyze each component separately using the overall measurement will also provide a clearer understanding of the sources of inequality and how they vary depending on the facet observed.

As Eq. (11.1) indicates, the proposed Information Richness Index assigns greater importance to the Access Index. This strategy is chosen because the CI and SI results are limited by access to devices and access to the Internet, respectively. Giving greater weight to access therefore reduces the differences in results between those who do not access the Internet and those who do.

11.3.2 Level of Appropriation in the Three Capitals

Based on analysis of the IRI descriptive statistics, one initial result that stands out is that the levels of Information Richness attained by users in the three cities are concentrated in low values of the distribution. Considering that the highest score possible is 100, it is noteworthy that users, on average, do not take full advantage of the opportunities created by digital spaces, to such an extent that the average score (35.6 points) is only about one-third of the maximum score.

A more detailed look at the components shows that the Access Index (AI) also has low average and median values; this is an initial indication that Internet access (first barrier) remains an important constraint, even when the information comes from capital cities where mobile teledensity indices tend to be high. In Lima in 2012, teledensity was 159.2, while in 2015, mobile teledensity was 158.7 in Argentina and 106.6 in Guatemala (Table 11.1).[4,5]

[4] Data taken from OSIPTEL [36] for Lima and from ITU [15] for Argentina and Guatemala

[5] Similarly, in the sample, only 7% of respondents do not have a mobile telephone (13.9% in Buenos Aires, 6% in Lima, and 1.3% in Guatemala City), and 96% have access to some technological device.

Table 11.1 Statistics of components of the information richness index

Index	Mean	Median	Std. dev.	Minimum	25% Perc.	75% Perc.	Maximum
IRI	35.6	38.4	22.1	0	18.3	51.7	97.8
AI	31.3	40.0	24.2	0	20.0	40.0	100
SI	55.8	62.0	27.6	0	33.3	78.3	100
CI	24.1	21.1	22.9	0	0.0	38.9	100

Compiled by authors
Source: Survey about Internet use: Platforms and open data – 2014

In particular, 22.8% of respondents in the sample do not access the Internet. In this group, the proportion of women (61.9%) is considerably higher than men, and the percentage of women who do not connect to the Web (24.6%) is slightly greater than that of men. Older adults constitute a larger part of the group that does not access the Internet (52.7% adults and 32.3% older adults), especially considering that 61.9% of all older adults do not access the Internet. Finally, the results show that about half the group that does not access the Internet is economically inactive (46.7%); specifically, they are people who are dedicated to household tasks, retired, permanently disabled, or people who report that they neither work nor study.

11.3.3 Information Inequality in the Three Capitals

Regarding inequality in the level of Information Richness, first of all, the level of vertical information inequality – the distance between those who take greatest advantage of the Internet and those who use it least – is relatively low, as the Gini index for the IRI is 0.35, close to that of income at Uruguay in 2013 [37]. Nevertheless, the indicator drops to 42.9% (a Gini index of 0.20) when the sample is limited to users who access the Internet; this means that one of the main sources of inequality comes from the existence of a group of people who remain disconnected or isolated from digital spaces [3].

A second approximation of information inequality among people can be obtained from looking at horizontal inequalities [4]. This is done by comparing the levels of Information Richness attained by the different groups. As Table 11.2 shows, there is a highly significant difference of 4.43 points in favor of men, a difference that decreases only slightly (by 1.1 points) when it is calculated for the sample limited to people to access the Internet. Analysis of the values by age group reveals important differences that increase with age; the differences are even greater and significant to the detriment of adults (8.98) and older adults (25.51). Surprisingly, when the differences are calculated for the limited sample, these figures fall consistently, decreasing by 7.4 points (−82%) between adolescents and adults and 18.5 points (−72%) between adolescents and older adults. These variations indicate that the Internet access component is extremely important in explaining Information Richness inequality between age groups; apparently, as Colombo et al. [27] found, once the problem of access is overcome (not only in supply but also in demand), the effect of age as an impediment to appropriation of the Internet is reduced.

Table 11.2 Statistics of components of the information richness index

	Full sample				Limited sample			
	N	Mean	Median	Dif.	N	Mean	Median	Dif.
Total	3465	35.6	38.4		2675	44.9	44.8	
Sex								
Male	1480	38.2	41.5		1179	46.8	46.8	
Female	1985	33.7	35.6	−4.43***	1496	43.5	43.5	−3.3***
Age group								
Adolescents [13, 18]	524	42.6	44.1		493	45.1	44.9	
Youth [19, 29]	891	43.7	46.2	1.09	803	48.2	47.8	3.03***
Adults [30, 59]	1637	33.6	34.1	−8.98***	1221	43.6	43.2	−1.53*
Older adults [+60]	413	17.1	8.3	−25.51***	158	38.2	36.7	−6.98***
Main occupation								
Inactive	967	25.9	24.6		598	39.5	38.0	
Students	529	44.7	45.4	18.77***	503	46.8	46.2	7.36***
Work w/ stable income	1169	41.8	45.0	15.85***	989	48.5	48.2	9.07***
Work w/ variable income	756	32.2	31.5	6.25***	550	42.6	40.9	3.11***
Unemployed	44	36.6	42.8	10.71***	35	45.4	45.6	5.93**

Compiled by authors. Source: Survey about Internet use: Platforms and open data – 2014
Statistical significance: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

11.4 Sources of Information Inequality in the Three Capitals

Although explicit inequalities between the different groups are seen in the level of appropriation, it is necessary to determine whether these differences are due to other characteristics of the individuals and their context. It is not enough to analyze only belonging to certain groups and the result obtained in the index; the analysis must include variables that also influence or determine the level of Information Richness. The next section presents econometric estimations that make it possible to identify the existence and sources of these differences.

11.4.1 Determinants of Level of Information Richness

The first approach is based on proving that the differences observed previously do not correspond to differences in other characteristics and do correspond to differences in appropriation between groups. Different estimation models (OLS, probit model and truncated poisson regression model) will be used, as shown in the first panel of Table 11.3.[6]

[6] White's correction for heteroscedasticity is used [38].

Table 11.3 Econometric estimations over the IRI and each component

Variables		IRI	Access or non-access to the Internet	N° of devices from which the Internet is accessed (AI)	Skills index	Capabilities index
Modelo de Estimación		OLS	Probit – Marg. effects	Truncated Poisson – incidence rate ratios	OLS	OLS
Sex	Female	−2.910***	−0.0253*	0.890***	−3.578***	−0.832
		(0.632)	(0.0153)	(0.0262)	(0.832)	(0.837)
Age group (base = adolescents)	Young adults [19, 29]	−1.606	−0.0821**	0.982	−2.397	0.183
		(1.131)	(0.0411)	(0.0504)	(1.584)	(1.566)
	Adults [30, 59]	−7.706***	−0.206***	0.852**	−9.548***	0.369
		(1.287)	(0.0381)	(0.0531)	(1.760)	(1.951)
	Older adults [+60]	−18.83***	−0.574***	0.615***	−22.12***	−0.791
		(1.590)	(0.0590)	(0.0654)	(2.396)	(3.253)
Principal occupation (base = inactive)	Students	1.959	0.0546*	1.128**	2.176	−2.147
		(1.200)	(0.0291)	(0.0610)	(1.598)	(1.531)
	Work w/ stable income	3.235***	0.0382*	1.055	2.593**	5.885***
		(0.982)	(0.0206)	(0.0527)	(1.233)	(1.265)
	Work w/ variable income	−0.480	−0.0104	0.960	−1.574	2.956**
		(1.021)	(0.0225)	(0.0545)	(1.302)	(1.362)
	Unemployed	2.438	0.0267	1.173	0.777	2.093
		(2.959)	(0.0565)	(0.129)	(3.438)	(3.384)

(continued)

Table 11.3 (continued)

Variables		IRI	Access or non-access to the Internet	N° of devices from which the Internet is accessed (AI)	Skills index	Capabilities index
Modelo de Estimación		OLS	Probit – Marg. effects	Truncated Poisson – incidence rate ratios	OLS	OLS
Human capital characteristics	Years of education	1.725***	0.0241***	1.046***	2.198***	1.412***
		(0.125)	(0.00295)	(0.00735)	(0.175)	(0.229)
	Enrolled in educational center?	5.107***	0.0512**	1.067	3.204***	11.28***
		(0.947)	(0.0211)	(0.0432)	(1.173)	(1.151)
Personal assessment of the Internet	Is the Internet important for being integrated?	4.634***	0.0825***	1.068***	6.035***	2.628***
		(0.487)	(0.0108)	(0.0265)	(0.633)	(0.747)
Characteristics of the household	Years of education of head of household	0.577***	0.00960***	1.015***	0.743***	0.334**
		(0.109)	(0.00261)	(0.00533)	(0.145)	(0.148)
	Log of net spending in Telecom	4.426***	0.0449***	1.239***	5.451***	4.066***
		(0.521)	(0.0116)	(0.0318)	(0.633)	(0.686)
	Rate of dependency	6.782***	0.0897***	1.266***	7.487***	3.958**
		(1.416)	(0.0320)	(0.0931)	(1.870)	(1.992)
	Female head of household	1.949***	0.0175	1.089***	1.673*	1.632*
		(0.690)	(0.0160)	(0.0353)	(0.885)	(0.890)
	Presence of minors inside the household	1.615**	0.0500***	1.080**	0.886	−1.733
		(0.771)	(0.0181)	(0.0409)	(1.000)	(1.061)
	Household has a landline	7.331***	0.0894***	1.339***	–	–
		(0.618)	(0.0149)	(0.0465)	–	–

Variables		IRI	Access or non-access to the Internet	N° of devices from which the Internet is accessed (AI)	Skills index	Capabilities index
Modelo de Estimación		OLS	Probit – Marg. effects	Truncated Poisson – incidence rate ratios	OLS	OLS
City (base = Guatemala City)	Buenos Aires	−0.472	0.0572***	0.907***	1.389	1.072
		(0.782)	(0.0149)	(0.0344)	(1.142)	(1.043)
	Lima	3.502***	0.151***	0.980	1.475	2.424**
		(0.756)	(0.0142)	(0.0344)	(0.955)	(1.218)
	Constant	−44.67***	–	0.101***	−35.88***	−36.46***
		(4.021)	–	(0.0214)	(5.573)	(8.242)
Mills ratio	Lambda				4.862	−3.032
					(5.722)	(3.393)
Model adjustment	Observations	3465	3465	2660	3465	3465
	Prob > F	0,000	0,000	0,000	0,000	0,000
	(Seudo)* R-squared	0.433	0.3256*	0.0756*	–	–

Statistical significance: ***$p < 0{,}01$, **$p < 0{,}05$, *$p < 0{,}1$

First, it shows that being a woman has a negative effect on the IRI results, as seen in the test of differences in means. Belonging to older age groups also has a negative effect on the level of Information Richness; the IRI estimation (first panel) shows that both the negative effect and the significance of the estimator increase substantially as the age group increases, with a negative effect of 18.8 points in the index for older adults, compared to younger people.

Regarding occupation, it was found that only having as the main activity being a worker with a stable income (employees, laborers, and foremen) has positive and significant effects on the level of Information Richness, compared to people who are inactive (dedicated to household tasks, retired, permanently incapacitated, or people who report that they neither work nor study).

Finally, regarding an individual's human capital, the results show that the number of years of education received has a positive and highly significant effect on the level of Information Richness that people attain, as shown by Howard et al. [33], Hargittai and Hinnant [31], Helsper and Galacz [32], and May et al. [39]; one additional year of education is estimated to increase the IRI result by 1.7 points. It was also found that being enrolled in an educational institution has a substantial influence on the results of all the indices. These estimations are consistent with previous case studies that highlight the benefits of open educational resources and the learning communities created in educational centers [16].

Although it is useful to identify whether the differences observed can be attributed directly to these sociodemographic characteristics, identifying the ones that are the main sources of these inequalities would make a strong contribution to public policy aimed at closing these gaps. With this in mind, the next sections analyze the effects on each of the components in order to identify the channels of exclusion.

Because there is limited information about people who do not access to devices or the Internet – we can only know if an individual uses the Internet for educational purposes and if the person has accessed the Internet previously – and because the decision to access the Internet and to engage in some online activity can be expected to stem from different decision-making processes [40], two-stage estimations were used. In the first stage, the informant's access or non-access is analyzed (an exercise conducted in the next section) and in the second stage, each component is analyzed conditioned on the informant's access to the Internet or to a device.[7]

[7] The estimation strategies chosen for each component are different depending on the nature of the data. For access, a Hurdle model is used, which first estimates a probit model for the access decision with the entire sample, and then a truncated Tobit count model is used to estimate the effect on the dependent variable only for users who access the Internet [41]. For the skills and capabilities components, a Heckman model is estimated in two stages, where the first is the same as in the previous model (probit), with the difference that the information from the latter is included in a second estimation (OLS) through the incorporation of the probabilities of access from the first stage as a new explanatory variable; this corrects for selection bias [42]. For the skills component, selection is based on the use of devices, while for the capabilities component, selection is based on Internet access.

11.4.2 Access: The First Barrier

As mentioned in the preceding sections, access is a very important component for taking advantage of digital environments and communities; it is therefore necessary to analyze the determinants of access to the Web in order to better understand the differences identified in the level of appropriation.

Estimating a probit binary-dependent variable model, as shown in the second panel of Table 11.3, we find that men and women have on average the same probability of accessing the Internet; that is, the differences observed between men and women in the first panel are not driven mainly by the decision to access.[8] We also see that older adults have less probability of access than younger people; in particular, it is estimated that being an older adult decreases the likelihood of accessing the Internet by 57 percentage points compared to adolescents, while being an adult reduces it by only 20 points. Being a student or worker with a stable income also increases the probability of accessing the Internet, compared to the group of inactive persons. Being enrolled in an educational center and each additional year of education also increase the chance of being connected (by 4.7 and 4.78 percentage points, respectively).

11.4.3 Intensity of Access: Beyond a Dichotomous View

Conventional studies of Internet access tend to limit analysis to the decision to access the net. But intensity of access or the ability to be connected at different times and in different places also influences the range of functionings that an individual can have through ICTs. It is therefore interesting to know what characteristics influence a person's ability to stay connected. To address this question, a Hurdle model [41] is estimated in two parts, the first to analyze access to the Internet (analysis conducted in the preceding section and corresponding to the second panel of Table 11.3) and the second to analyze the number of devices from which users access the Internet – the only component of the Access Index.

This estimation shows that women access from 10% fewer devices than men, while older adults access from slightly more than half the number of devices as younger people. The results also show that only students have more accesses than the unemployed (12%), and each additional year of education increases the number of devices from which the user accesses the Internet by a factor of 1.05.

[8] Although a significant difference of 10% is seen, it is lost when a logit model is used or when White's correction for heteroscedacity is used [38]; it therefore cannot be stated that the observed effect is robust.

11.4.4 Digital Skills: The Second Barrier

The use of new technologies implies incurring a cost of learning that is necessary for taking advantage of these tools, what Mendonça et al. [6] refer to as the set of skills needed to open the door. The second component of the Information Richness Index seeks to understand the digital skills necessary for doing this. To identify the characteristics that influence the result of the second component, a Heckman model is estimated in two stages [42], where the first stage evaluates access to digital devices and the second stage evaluates the result in the Skills Index (SI).

The estimation shows that women attain 3.6 points less than men in the SI, a difference that could explain the gap observed in the number of devices from which women connect to the Internet. There are no differences between the skills of adolescents and young adults, but there is a difference in favor of younger people compared to adults (9.5) and a much larger one compared to older adults (22.1). Regarding principal occupation, being a student no longer has a significant effect compared to the group of inactive persons; having a job with a stable income, however, has a small but significant positive effect on the Skills Index. There is also no difference between the group of inactive persons and those who are unemployed.

The estimation also shows that education has a positive effect on digital skills, as May et al. [39] note. In particular, it is estimated that each additional year of studies increases the SI by 2.1 points, while being enrolled in an educational center increases this index by 3.2 points.

11.4.5 Digital Capabilities: The Third Barrier

To analyze how Internet use can expand people's ability to choose the lifestyle they value [14], it is necessary not only to analyze access or the set of digital skills but also to evaluate whether the user is able to function fully in digital environments and in the communities he or she finds there [6]. The third component or Capabilities Index (CI) seeks to estimate the user's free functioning and the set of significant activities in which he or she engages in digital environments. As with the analysis of the skills component, a Heckman model is estimated in two stages [42], where the first stage evaluates access to the Internet and the second stage evaluates the result in the Capabilities Index (CI).

The analysis shows no significant difference in scores between women and men; the main sources of inequality, therefore, stem from the gaps in digital skills. Similarly, no significant differences are found between the scores of individuals from different age groups, not even between adolescents and older adults; inequalities are therefore driven by differences in access and in digital skills. With regard to people's main occupation, it is estimated that a worker with a stable income scores 5.9 points higher than an inactive person, while a worker with unstable income has a 2.9-point advantage. No significant differences are found with regard to students or unemployed persons.

Finally, as with the other two components, the estimation shows that education has a positive effect on digital capabilities. It is estimated that each additional year of studies increases the CI by 1.4 points, while being enrolled in an educational center has a fairly high and significant impact on the result, estimated at 11.28 points. This is consistent with the relational aspect of digital environments [16] and the effects of externalities [21] discussed in the first sections.

11.5 Conclusions

Internet penetration is creating a large number of opportunities that can expand people's freedom to attain the lifestyle that they have reasons to value [14]. This is because they not only constitute powerful tools (means) that enable users to exercise their capabilities more effectively and access a larger amount of information, reduce transaction costs, and increase their ability to stay in communication [14] but also because, as Benkler [21] explains, they configure new social systems with structures and activities based on information networks, where users can participate, interact, share, and exercise their freedoms in ways that are not possible in physical space (ends).

Nevertheless, appropriation of ICTs and digital spaces has not been uniform among all people. The existence of digital divides implies that certain groups show lower levels of appropriation and take less advantage of digital spaces that puts them at a clear disadvantage compared to groups that do make significant use of them [3]. This chapter analyzes the sociodemographic characteristics of the people who have the greatest influence in this process in urban areas of Latin America and the sources of information inequality.

To accomplish this, based on studies by Mendonça et al. [6], an Information Richness Index (IRI) is proposed as a way of studying the complexity of the level of appropriation of the Internet. The index incorporates information about the principal barriers that users face in making significant use of the Internet: access, the skills needed to use ICTs, and the user's capabilities for functioning in digital spaces.

The study shows that the degree of appropriation of digital spaces in the Latin American cities studied is still low, averaging 35.6 points out of a maximum of 100. This means that users, on average, do not take full advantage of the opportunities created by digital spaces. Even when the majority of people use a cellular telephone (92.2%) or a technological device (96%), 22.8% of the sample does not connect to the Internet; non-access to the Internet does constitute a problem, therefore, although it is not explained by access to a device.

The results show that inequality mainly stems not from differences between users who take more advantage of the Internet and those who take less advantage, but from inequality between people in specific groups. In particular, being female and being older have a negative effect on the level of Information Richness, while being a worker with a stable income and having more education have positive and highly significant effects on users' level of appropriation.

Regarding inequality between women and men, the results show that the main source of differences lies in digital skills and in the number of devices from which the user accesses the Internet, two variables that are closely related.

Regarding age groups, it is estimated that age has a strong negative effect on both the user's initial access to the net and the number of devices he or she uses for access and on digital skills; older adults are at a severe disadvantage in almost the entire process of appropriation. Nevertheless, no negative effects are seen on the Capabilities Index; this is consistent with the findings of Colombo et al. [27], who postulate that once the problem of access is overcome (not only by supply but also in demand), the effect of age as an impediment to appropriation of the Internet decreases.

Small effects are associated with the person's main occupation; in particular, it is estimated that being a worker with a stable income has a positive effect and that this effect is driven by the skills and capabilities components; these results conform to findings by Navarro [29] about the acquisition of digital skills in established enterprises or in the mature stage and with the relational and community aspect of digital environments developed by Benkler [16]. Belonging to other occupational groups shows no significant effects.

Finally, having more years of education and belonging to educational communities have positive effects on all components and appear to constitute a potent tool for closing the gaps identified in the three capital cities examined in the study.

11.6 Policy Recommendations

These results reveal the urgency of placing greater importance on the needs of the telecommunication sector on the public agenda in the region. First, access is an important problem, even in places where teledensity is high. Government policy must intensively promote access to broadband Internet and the construction of fiber-optic networks throughout the country, to make this service more accessible, of higher quality for citizens, and affordable.

A more aggressive digital literacy strategy is also needed, with efforts focused on reducing the cost of learning and increasing the benefits expected from the use of ICTs [40], to ensure a significant reduction in the percentage of the population that, despite having access to devices, remains sidelined from digital spaces.

The active creation and dissemination of orderly, flexible learning platforms are another effective way of accelerating and facilitating appropriation, which must be exploited; moreover, targeted initiatives that distinguish not only between whether or not people belong to one of these groups (women and men, or young people, and older adults), but which also understand how the incorporation of ICTs helps satisfy particular needs and people's productive processes will have important impacts.

Appendix 1: Construction of the Components of the IRI (Tables 11.4, 11.5, and 11.6)

Table 11.4 Construction of the access index

Access index (AI)		
Number of devices from which you access to the Internet		
Types of devices:	N° of devices:	Score:
Cellular phone (smartphone or mobile)	5 devices	100
Tablet	4 devices	80
Notebook	3 devices	60
PC	2 devices	40
Smart TV	1 device	20
	0 devices	0

Compiled by author
Source: Survey about Internet use: Platforms and open data – 2014

Table 11.5 Construction of the skills index

Skills index (SI)[a]		
Age of use of the device (SI_1)		
Unit of measurement:	N° of months:	Score:
Maximum length of time device has been used (in months)	Does not use devices:	0
	0> N° months >100	N° of months
	N° of months ≥100	100
Number of activities undertaken on the network (SI_2)		
Types of activities	N° of activities	Score:
Surf in the web	8 activities	100
Use social networks	7 activities	87.5
Using chat	6 activities	75
Reviewing electronic mail	5 activities	62.5
Watching or downloading videos	4 activities	50
Listening or downloading music	3 activities	37.5
Playing online games	2 activities	25
Accessing online banking	1 activity	12.5

Compiled by authors
Source: Survey about Internet use: Platforms and open data – 2014
[a]The Skills Index is constructed as follows:
$SI = (SI_1 + 2 \times SI_2) \div 3$

Table 11.6 Construction of the capabilities index

Capabilities index (CI)[a]		
Do you know about programs that can be freely modified on the Internet? (CI_1)		
Answer:	Score:	
Yes	100	
No	0	
Is the Internet your first choice when you are looking for information about one of the following? (CI_2)		
Types of purposes:	N° of purposes:	Score:
Learning activities	3 purposes	100
Labor or business	2 purposes	66.7
Interaction with the government	1 purpose	33.3
When you search for information on the Internet for learning, work or to communicate with the government, how do you find it? (CI_3)		
Alternatives:	Score by affirmative answers:	
Complete (find everything sought)?	6,67 × (N° of affirmative responses)	
Readable and adequate?	5 questions per item (3) = 15 questions	
Is it in large amounts??	$CI_3 \epsilon [0, 100]$	
Is it free?		
Is it updated?		
Educational uses of the net (CI4)		
Types of uses of the net:	N° of uses:	Score:
Taking online courses	3 uses of the net	100
Accessing educational resources (bibliography or databases)	2 uses of the net	66.7
Participating in social networks with educational purposes	1 use of the net	33.3
Work-related uses of the net (CI5)		
Types of network usage:	N° of uses conducted:	Score:
Accessing social networks to look for work	2 uses of the net	100
Participating in social networks for work-related purposes	1 use of the net	50
Uses of the net related to access to public services and exercise of rights (CI6)		
Types of network usage:	Answer:	Score:
Administrative procedures, consultations, complaints, payments, or making appointments in public entities	Yes	100
	No	0

Compiled by authors.
Source: Survey about Internet use: Platforms and open data – 2014
[a]The Skills Index is constructed as follows:
$CI = (CI_1+CI_2+CI_3 + CI4 + CI5 + CI6) \div 6$

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