Information Technology for Development, 2014
Vol. 20, No. 3, 274–291, http://dx.doi.org/10.1080/02681102.2012.751573

Routledge
Taylor & Francis Group

VIEW FROM PRACTICE

When You Do Not Have a Computer: Public-Access Computing in Developing Countries

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In developing countries, people who do not have computers or the Internet go to public-access computing (PAC) venues such as libraries, telecenters and Internet cafes. What is the nature, scope and impact of the services offered by these PAC venues? Funded by the Bill & Melinda Gates Foundation, a mixed-methods investigation of libraries, telecenters and cybercafés in 25 developing countries around the world shows that there is a strong ecosystem of PAC venues in developing countries, and that users are shifting away from libraries in favor of commercially driven Internet cafes that provide good customer service and support to meet their information needs. Furthermore, an in-depth analysis of the benefits of using public-access computers indicates that while users enjoy faster and cheaper access to more sources of information, PAC venues appear to be used more for building and maintaining users' social networks, personal relations and entertainment, and less for education, health, e-government or e-commerce activities. We discuss the success factors that emerge in the study, the implications of the choices in public-access venues to use information and communication technologies (ICT) in developing countries and the focus on personal relations as a critical information need for underserved populations.

Keywords: public access; library; telecenter; cybercafé; development; underserved; ICT; social network

Introduction

Despite the unprecedented proliferation of computers and the growth of the Internet over the past two decades, there are still large sectors of the population – around the world and in developing countries, in particular – who do not own computers or who do not have affordable access to the Internet. This gap, which is one of the manifestations of the so-called digital divide (Barzilai-Nahon, 2006; van Dijk, 2005), is being slowly bridged by initiatives such as community telecenters, public libraries and Internet cafes or cybercafés, all of which offer public access to computers and the Internet. Such public-access computing (PAC) venues can play an important role in extending the reach and the benefits of computers and the Internet to sectors of the population that would otherwise be marginalized from the tools and information resources increasingly available online. Mobile phone use, despite its incredible growth in the past few years, tends to be rarely used as a tool to access the Internet among underserved populations, who tend to use mobiles mostly for traditional phone calls.

Most of the past research on this topic has studied PAC venues in isolation from each other. Community telecenters and their many variations began to exist in both developed and developing countries in the late 1990s. Telecenters are non-profit centers that offer access to computers and the Internet, frequently coupled with training and other social services, with the intent of contributing to people's social and economic development. There have been important studies

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about telecenters around the world over the past two decades, initially focusing on the challenges to their implementation and then on the challenges to their sustainability (i.e. Delgadillo, Gomez, & Stoll, 2002; Gomez, Hunt, & Lamoureux, 1999; Judd, 2006; Kuriyan & Toyama, 2007; Mayanja, 2006; Parkinson & Ramirez, 2006; Proenza, 2001; Rothenberg-Aalami & Pal, 2005). Even in successful telecenter operations, once external funding dwindled, most initiatives have been unable to operate and offer their computer-related services as financially sustainable businesses (Best, 2008; Best & Kumar, 2008).

In addition to telecenters, public libraries have started to offer public access to computers and the Internet. This started in the USA in the late 1990s, but, in many developing countries, PAC in libraries is still incipient. Recent findings of the impact of PAC in libraries in the USA highlight their important contribution to extend the nation's education system, to offer access to government services and to build stronger social connections (Becker et al., 2010). Even though the US context can be very different from the realities faced by public libraries in developing countries, some of the trends in the US findings may be found in other countries as well. With few exceptions, studies that have analyzed the phenomenon of PAC in developing countries are very rare (Islam, 2009; Pyati, 2009; Sears & Crandall, 2010; Walkinshaw, 2007).

In recent years, entrepreneurs in many developing countries have identified the business potential of offering computer and Internet access, and they have set up small businesses in the most profitable locations. They are frequently coupled with food or other entertainment services, which gives them their generic label of cybercafés, but they are no longer located only in the rich neighborhoods or tourist areas, as was the case in their early versions. Cybercafés are now found in the poor and marginalized neighborhoods of most developing countries. Cybercafés serve diverse sectors of low- and middle-income populations. They were not set up with the non-profit intent of contributing to social and economic development, but cybercafés can contribute to human development in direct and indirect, even if unexpected, ways (Burrell, 2012; Finquelievich & Prince, 2007).

Very few scholars have systematically studied cybercafés or their potential contribution to community development, and, until recently, almost nobody had studied the complete ecosystem of PAC, including telecenters, libraries and cybercafés (Gomez, 2012b). Our research sought to fill this void by offering a systematic assessment of the PAC landscape across different developing countries around the world and across different types of PAC venues, seeking to answer the following research questions: What are the nature and scope of PAC experiences in developing countries? What are some of the benefits PAC contribute to its users? How can PAC venues be strengthened to make a better contribution to community development?

This research is important because it offers for the first time a comprehensive assessment of different types of PAC-venues across multiple developing countries, conducted by local research teams working under a shared vision and research design. Initially funded by the Bill & Melinda Gates Foundation through a grant to the University of Washington Information School, the results of this research help inform program implementation, shape policy debates and contribute valuable knowledge on science, technology and information systems in underserved communities around the world.

Preliminary results have been presented in several conferences and journals. This paper presents a single snapshot of the different lessons drawn from this large-scale study, presented in a concise way with a focus on contributions to policy and practice. The remainder of the paper offers an overview of the research methods, followed by a summary of key findings and a discussion of their implications. We conclude with a reflection on future directions derived from the contribution of this research.

Research methods

The research that informs this paper was based on an approach to studying public-access venues in developing countries that is novel in at least four important ways: (1) a novel access, capacity and environment (ACE) research framework that goes beyond access alone, looking at the whole ecosystem of PAC instead of single venue types; (2) an unprecedented breadth and scope of study in 25 developing countries around the world with in-depth follow-up in one single country; (3) a research design that combined structure and flexibility for local adaptation and greater comparability of results and (4) a mixed-methods approach to the collection and analysis of a large volume of qualitative and quantitative data across different PAC venues in 25 countries.

ACE research framework

While most of the previous studies have focused on either libraries or telecenters or, to a lesser degree, cybercafés, we chose to study all three venue types at the same time, using a single framework of analysis, the ACE *framework* (Gomez, 2010b). This framework, developed and refined as part of this research process, offers a set of systematic criteria to understand PAC venues in their social, political, economic, political and economic contexts. With few exceptions, libraries, telecenters and cybercafés operate in a shared information ecosystem and tend to serve the same populations. Understanding the relative strengths and weaknesses of each type of PAC venue in terms of equitable access, human capacity and relevance, and the enabling environment in which they operate, is a unique contribution of this research.

The ACE Framework was developed based, in part, on the ideas of the real access framework from Bridges.org in South Africa and then enriched by the experience and contributions of the local research partners in the preliminary stages of this research. The ACE framework allows a systematic examination of not just physical access to technology – which is the focus of most assessments of information systems for development and of PAC initiatives, in particular – but considers issues of equity and suitability of said access, the notion of human capacities and the relevance of content and services as well as the social, political and economic environments in which PAC-venues operate. A schematic representation of the ACE framework is shown in Figure 1.

The ACE framework provided a basic, common structure for all researchers to investigate libraries, telecenters and cybercafés in each one of the countries studied. Furthermore, ACE provided the framework to code, analyze and interpret the data collected across all countries, allowing a more systematic comparison of multiple variables drawn from qualitative data. It

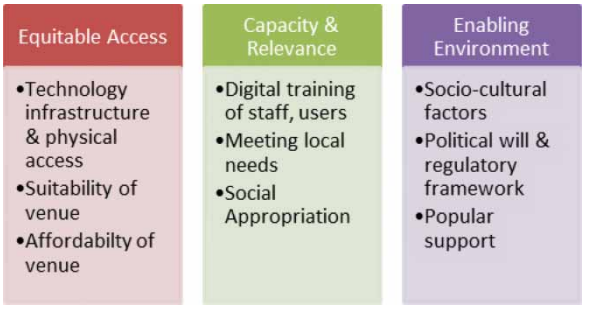

Figure 1. Schematic representation of ACE framework.

also served as the starting point for the in-depth analysis of PAC venues and their impact in the follow-up study of a single country.

Large-scale international research

The study is unprecedented in *breadth and depth of scope*: it covered 25 developing countries, representing a rich sample of experiences around the world, based on a carefully constructed country selection process that included demographic, feasibility and ranking criteria. In-depth follow-up research in different towns and cities of one of those countries, Colombia, allowed the deeper probing into the findings that emerged from the larger sample of countries and the exploration of the users' perceptions of impact and benefits of PAC use, which was not covered in the international study.

The country selection criteria helped to establish a sample of developing countries in the "middle of the pyramid" (i.e. not the biggest or the smallest, not the richest or the poorest etc.) focused particularly on countries with strong public library systems. Details of the country selection[1] can be useful to help establish comparisons with other countries not included in the sample. The final list of countries selected includes: Algeria, Argentina, Bangladesh, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, Georgia, Honduras, Indonesia, Kazakhstan, Kyrgyzstan, Malaysia, Moldova, Mongolia, Namibia, Nepal, Peru, The Philippines, South Africa, Sri Lanka, Turkey and Uganda. Even though India has pioneered the use of telecenters and Internet kiosks, and Russia has a distinct organization of telecenters, the size and diversity of these countries made it impossible to include them, given the limited resources available for this study. Colombia was selected for in-depth, follow-up research since this country was found to be near the average in most indicators of the international study and because the detailed country report for Colombia was found to be the most incomplete of them all, warranting further investigation.

Structure and flexibility in research design

The research drew from the talent and experience of local teams in each country studied, working in their local languages, and coming together under a single initiative that combined both structure and flexibility in the research design. The shared structure in the research design and data collection instruments allowed for more comparable results across different venues and different countries, while the built-in flexibility allowed each local team to adapt to the opportunities, requirements and needs of each context. In-depth research in Colombia was also led by the principal investigator (PI) and conducted in partnership with local research teams and research assistants in numerous cities and towns around the country.

The local research teams comprised academics, non-governmental organization (NGO) activists, independent researchers or consultants. Furthermore, some research team members were specialized in the use of information and communication technologies (ICT) for development while others were library and information sciences specialists. The richness and diversity of their perspectives enriched the research approach as a whole. All local research partners in the international study were brought together at least twice – in the beginning and again about halfway through the research process – to foster a shared, collaborative and iterative approach to the data collection. The preliminary version of the ACE framework was refined after input from the research partners, who agreed to conduct the in-country research based on document reviews, expert and operator interviews (10–15 per country), site visits (about 20 per country), user surveys (about 1000 per country) and other data collection activities (i.e. focus groups, in-depth interviews, observations, peer consultations etc.).

Rather than providing a ready-made blueprint, the flexible research design allowed each research team to adapt to the local needs and circumstances.

All local research teams conducted research about libraries, telecenters and cybercafés in their studies. While there is little variation in what constitutes a library (though in some countries religious libraries or popular libraries are of importance), the definition of what constitutes a telecenter or a cybercafé can vary from one country to another. To create a common understanding, we use the generic label of telecenter to refer to non-profit initiatives that offer PAC services with the intent of contributing to community development (telecenters are also called village knowledge centers, info centers, community technology centers etc.), while the generic label of cybercafé is used to describe for-profit initiatives that offer PAC services as a business to generate revenue (cybercafés are also called Internet cafés, kiosks or public cabins).

Mixed-methods approach

A mixed-methods approach to data collection and analysis was utilized for both the international study and the in-depth study. As described above, the international study in 25 countries was based on expert and operator interviews (~250) and user surveys (~25,000) of libraries, telecenters and cybercafés, using a typical case-sampling rationale (Patton, 2002), complemented with extensive document reviews, in order to assess the ACE of an estimated total of 250,000 PAC venues in the selected countries. Moreover, the in-depth study in Colombia was based on conversational interviews with experts (10), structured interviews with venue operators (100), life-history interviews with selected users (6), user surveys (1300) and focus groups (6) conducted in different venues across towns and cities in different regions of the country, using a stratified, typical case-sampling rationale.

The scale of the data collection effort was matched by an appropriate scale of data analysis, which was conducted at the University of Washington Information School. In this effort, teams of faculty, graduate students and research staff were brought together to analyze different aspects of the data by developing a detailed interpretive coding scheme based on the variables in the ACE framework and additional emergent categories, using qualitative and quantitative analysis software (ATLAS.ti, Statistical Product and Service Solutions (SPSS) and Excel) and conducting numerous facilitated workshops, research conversations, data visualization exercises and peer debriefings.

While the strength of the findings is in the qualitative richness of the data, it is complemented by quantitative analysis that offers a relative sense of the magnitude and frequency of the observed phenomena. After describing the most critical features of the research methods employed, let us examine some of the most salient findings of this large-scale research initiative.

Findings

PAC venues are a relatively new phenomenon: very few were in existence just 15 years ago (one of the early international studies identified about 50 telecenters around the world in 1998 (Gomez & Hunt, 1999)), but about a quarter million PAC-venues existed in 2010 in the 25 countries we studied. In 2011, we found over 18,000 PAC venues in Colombia alone, about twice the 9600 per-country average of the international study. Exact numbers are hard to establish for all venues, but especially for cybercafés. While libraries tend to have more consistent counts in the government records and the telecenter inventories among community development, non-profit and NGOs are fairly credible, cybercafés are mostly small businesses driven by market forces that tend to come and go, and most of them are not registered or affiliated to any central body or organization (a detailed country-by-country breakdown of the estimated

Table 1. Distribution of PAC venues.

Total PAC venues	25 developing countries –2010 (% of total)	Colombia – 2011 (% of total)
Public libraries	27,783 (12%)	1588 (9%)
Telecenters	30,549 (13%)	2552 (14%)
Cybercafés	182,552 (76%)	14,166 (77%)
Total	240,884 (100%)	18,306 (100%)

number of libraries, telecenters and cybercafés is available at Gomez (2009)). Bearing this limitation in mind, it is noteworthy that the distribution of the different types of PAC venues in 25 countries is, on average, remarkably similar to the one we found after a closer look in Colombia. The PAC landscape is dominated by cybercafés, with libraries and telecenters representing only a small fraction of the PAC venues in most countries studied. On average, there are about six or seven cybercafés for every library or telecenter, and most of them tend to be in urban areas. There are few PAC venues in rural areas, making rural populations in developing countries the least served by public access to computers and the Internet (Table 1).

The users of PAC-venues appear to be dominated by young, moderately educated and low- or middle-income individuals; while cybercafés are far more numerous than telecenters and libraries, their users all appear to follow a similar distribution. Following is a description of the general trends in PAC-venue usage by age, education, income and gender across the 25 countries studied. Although this picture may not exactly match any particular country or venue, it is indicative of a general trend across multiple developing countries, a trend that is useful to understand particular differences and behaviors in each context.

PAC usage tends to be heavily concentrated around *youth* and dramatically declines among older adults (Figure 2). The majority of PAC users are high-school and college *students* with very few users having no education at all and relatively few users with an advanced degree (Figure 3). Use of PAC venues also drops as *income* levels rise, presumably because higher income users acquire their own computers or use them at work and only utilize PAC venues as a complement to these resources or for the value of its social interaction (Figure 4). Finally, both *males and females* appear to use PAC venues, but with some general trends in

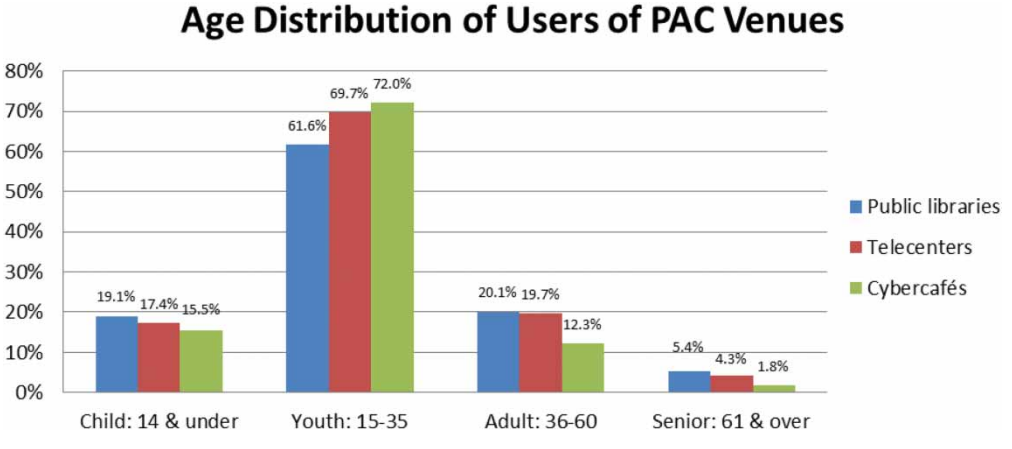

Figure 2. Age distribution of users of public-access venues (based on aggregated data from 25 countries, totals do not add up to 100%).

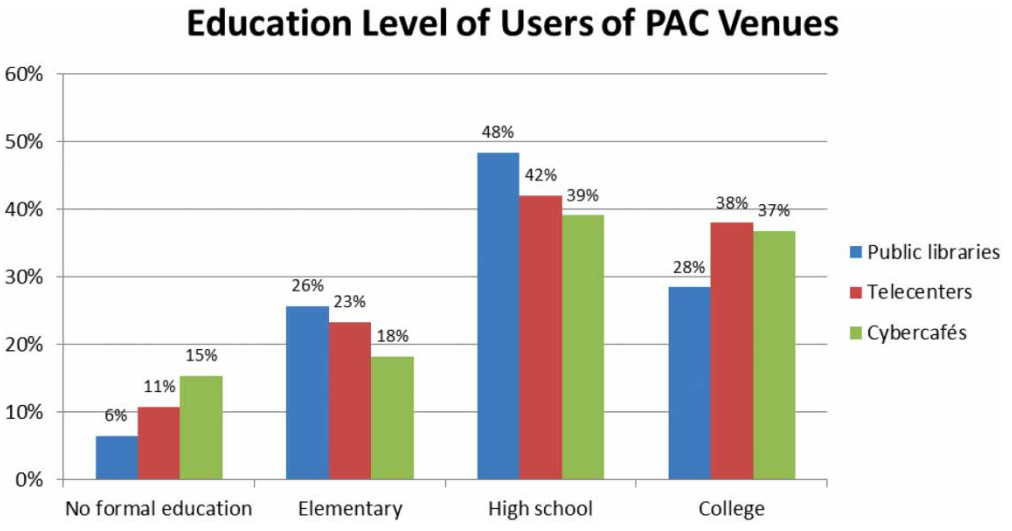

Figure 3. Education levels of users of public-access venues.

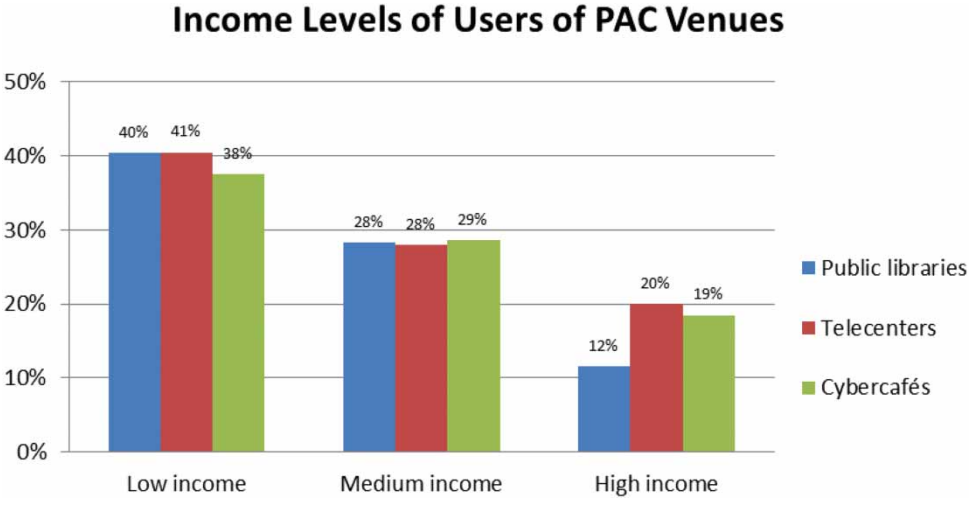

Figure 4. Income levels of users of public-access ICT venues.

preferences: men tend to prefer cybercafés and telecenters while women tend to prefer libraries (Figure 5). This may be related to perceptions of trust and safety in the venues, as we shall discuss later; furthermore, the appearance of gender differences is exacerbated by the fact that there are far more cybercafés (preferred by men) than libraries (preferred by women). For a more detailed description of user profiles and differences across countries or venue types see Gomez & Camacho (2011).

These findings about the types of users of PAC venues are consistent not only between the international study in 25 countries and the in-depth study in Colombia, but also they are corroborated by other studies of PAC in developing countries (Sciadas, Lyons, Rothschild, & Sey, 2012).

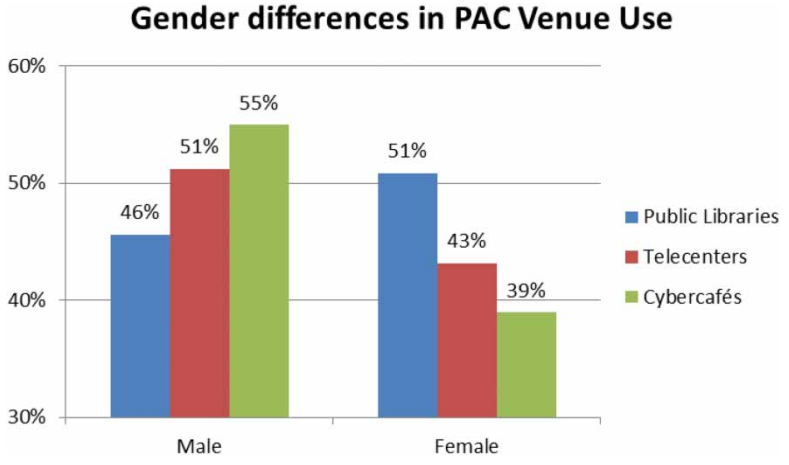

Figure 5. Gender differences in PAC-venue use (based on aggregated data from 25 countries in the landscape study; totals do not add up to 100%).

Uses and impact of PAC venues: personal needs and relationships

What do people seek in PAC venues? What do they do and what do they find? Our investigation of PAC venues in Colombia explored these questions in greater detail than what was possible in the international study, and it corroborated the most salient trends in relation to the uses of PAC. On the one hand, PAC users indicate that education (30%), personal needs (25%) and entertainment (19%) are their most pressing information needs they seek to meet at the PAC venues, while the need for information about jobs, health, government services or agriculture – which are most frequently cited in the literature – are in fact significantly less important to PAC users (6%, 5%, 4% and 2%, respectively). There is little variation in these trends when comparing the use of cybercafés (more numerous), and libraries and telecenters (less numerous).

The importance of personal information needs and entertainment is emphasized in the analysis of the way users report how ICT has transformed their lives. While the majority of the themes reported in the survey mention a *generic* gain of faster, cheaper and easier access to more information (63%), the most important *specific* gains that users report are related to cultivating stronger personal relationships (38%); increased opportunities for learning and education (30%); facilitating online transactions, including those related to jobs (only 16%). These percentages are indicative of the order of magnitude, but they represent non-exclusive categories with some overlap; the totals do not add to 100%.

Cybercafé users tend to report a higher prevalence of personal relationships as an important benefit than users of other types of venues, but all users find having public access to computers and the Internet to be an important benefit. Under the theme of relationships, we see three distinct trends: relations with friends and family, a sense of connectedness to the world around them and new ways to share entertainment.

PAC users enjoy the feeling of closer contact and *communication with friends and family*. This includes reducing distances to maintain ongoing relations with those who are far away, as well as maintaining relations with others who live nearby. Furthermore, a large proportion of users report not only just maintaining friendships, but also making new friends online. For example, a cybercafé user reports:

> My use of the net is very frequent; I will go in about four times per week. I use email to communicate with my work team, but also to communicate with friends, to share with friends interesting emails

> about many topics, and to stay in touch and well connected. This is what technology offers us today, and that is why it is indispensable to stay connected with the whole world.

The operator of a telecenter describes the pleasure of "saying hello" to friends online:

> So we enter on MSN, my contacts in Venezuela and in other countries who are my friends, also from other cities in Colombia, so I come in and say hello. I take advantage of it and stay in contact with them, it makes me happy, and I say hello.

Similarly, the testimony of a library user exemplifies the importance they place on meeting new people online, "I have enlarged my circle of friends, because I have been able to meet new people on the Internet," while another user indicates he is willing to spend money at the cybercafé because he values the relationships it helps him to maintain: "I now have to pay more bills, like the cell phone and the hours on the Internet. But I have more closeness with my family and with friends in other countries."

These testimonials emphasize the contribution of ICT to maintaining and enlarging a circle of friends and family. A secondary component related to relationships that emerged in the interviews has to do with a stronger *sense of connectedness*, a stronger sense of belonging in the world and being an active part of it. This goes beyond the mere cultivation of friendships, with potential to contribute to self-efficacy and self-esteem. In the words of a library user:

> It changed my life vision. I used to think I could only work in the fields, because I come from the countryside, and I thought my whole life would be about harvesting potatoes, and that I would die that way. But today I look at other options, I think I may be able to take technical courses at [technical college] SENA. This has helped me a lot, this has changed the way I see my future.

There is also a sense of empowerment in being able to learn about what is being done in other parts of the world, as expressed by another library user: "it has changed my life . . . it has made my social imagination (*imaginario social*) a bit more global, because now everybody can know what is done in any part of the world."

In addition to the sense of connectedness, PAC users report a third way in which ICT helps them cultivate relationships. While the use of social media such as Facebook and Hi5 is explicitly mentioned as tools that help communication among friends and family, they are also credited with providing a new way to share *entertainment*. For example, a cybercafé user candidly says "I am now more entertained, I have more friends and the distances become shorter." Overcoming boredom is frequently mentioned; for example, a library user said, "I am now more entertained and have more pastimes; now I depend on the Internet; my life used to be boring." Having fun and playing games with friends is a valuable gain for many cybercafé users: "[My child] used to be bored at home, watching TV and listening to music, but now goes to Internet [café] to have fun and chat with friends." Public access to the otherwise expensive video games is equally appreciated: "I love games and since I cannot buy an Xbox I come to the Internet [café] and they have many types [of games]."

Our research has studied what users *say* they do and what they *perceive* as important benefits, which may be different from what they *actually* do or what others might determine are *actual* benefits. Further research can contrast our self-reported data with observation of computer use, computer-use logs, or externally defined measures of impact to further nuance these findings. A more detailed analysis of the users' perceptions of the impact of PAC in Colombia is available in Gomez (2012a).

Differences across PAC venues

The picture of PAC use would be incomplete if we presented only the general trends of all PAC venues grouped together. There are important differences in the way libraries, telecenters and cybercafés operate as well as in the way they are perceived by users. Particularities of each

Table 2. Differences between PAC venues.

	Components	Public libraries	Telecenters	Cybercafés
Access	• Physical access	• Offers few non-urban locations	• Offers convenient hours and non-urban locations	• Mostly urban locations
	• Suitability	• Viewed as physically safe	• Meets local needs	• Place people want to go
	• Affordability	• Most affordable type of venue (free)	• Perceived as affordable	• Least affordable type of venue, but still seen as affordable
	• ICT access	• ICT access varies	• ICT access varies greatly	• Offers most ICT access
Capacity	• Staff capacity	• Low-staff capacity and digital literacy	• Staff capacity and digital literacy vary	• High-staff capacity and digital literacy
	• User capacity	• User capacity varies	• User capacity varies	• High user capacity
	• Local needs in content and services	• Outdated materials	• Offers locally relevant content	• Offers access to the Internet, but does not create content
Environment	• Socio-cultural factors	• Varies from country to country	• Varies from country to country	• Varies from country to country
	• Political will	• High political will, but very limited budgets	• Some political will; varies	• Low political will
	• Popular support	• Low-popular support, some local champions	• Strong popular support; NGO and stakeholder support	• Perceived as "cool" venue where people want to go

type of PAC venue in terms of access, capacity, environment and the main categories of the ACE framework (see more details on the differences between venues in Clark & Gomez, 2012) are given in Table 2.

It is important to note that even though libraries offer PAC services mostly for free and cybercafés tend to charge the highest user fees (telecenters fall somewhere in between the range of fees while some cybercafés do not charge user fees for computer use as long as patrons consume food or other services), the fees charged for PAC services are generally not a very salient driver for users to choose or avoid them. Other important criteria are convenience and quality (location, hours of operation, number and quality of computers, connection speed and peripheral equipment), customer service (especially, the availability of helpful staff to answer questions and help to solve needs and problems), and general trust in the venue (perceptions of safety, relevance and reputation of the venue). Furthermore, a subjective notion of how "cool" the venues are as places to spend time with friends (online and in person) was also found to be an important factor that draws users, especially youth, to prefer cybercafés over libraries or telecenters (Clark & Gomez, 2011; Gomez & Gould, 2010).

Success factors

The recommendations that emerged from each country were combined and then grouped into five common themes identified as the most salient and common factors that enhance the

success of public-access venues, with a particular focus on meeting the needs of underserved communities: (1) meet local needs first; (2) build alliances and collaboration; (3) strengthen sustainability and (4) train infomediaries and users. Additional details and examples of each in different countries are offered by Gomez (2010a), but they are synthesized and revisited here upon completion of the study.

(1) Meet local needs first

Successful implementation and maintenance of public-access-computing initiatives requires a solid understanding of the information needs and resources of the communities the venues intend to serve. Most successful initiatives typically offer concrete solutions for specific issues of local contexts – such as a community's specific information needs and their ability to build on existing practices in these communities. Community-needs assessment and social-development orientation are especially important if the public-access initiatives are intended to reach underserved communities. Shneiderman (2002, p. 2) underscores the challenges in underserved communities: many people cannot benefit from technology "because of high cost, unnecessary complexity and lack of relevance to their needs." Meeting local needs is a cornerstone of community approaches in the field of library and information science (Aabo, 2005; Hillenbrand, 2005; Worcester & Westbrook, 2004), as well as Community Informatics (CI) or ICT for Development (Heeks, 2009; Raiti, 2007; Unwin, 2009). Researchers in almost all 25 countries concluded that for successful implementation of public-access venues that serve local development, it is important to have accurate data about the user community, their information needs and the information systems already in use; many of the researchers reported that while government efforts to expand ICT services are commendable, these efforts do not succeed if the ICT services fail to meet the needs of the local community.

Local communities also need to take ownership of the development of ICT programs and content, engaging community members to create practical solutions that improve the lives of individuals in the community. Many of the research teams emphasized that for ICT to reach and effectively serve local communities, venue operators need to promote a positive information culture that includes constructive attitudes to information-sharing and public awareness of ICT services. Public libraries, in particular, are undermined by perceptions that they service students only, produce old and outdated information or are simply not "cool" to visit. Most cybercafés, on the other hand, have no explicit strategy for assessing community needs. They rely on growing demand for ICT services, even in marginalized communities, and the population's capacity to pay for these services. In this way, the mission of cybercafés is simpler, and their success does not require a sophisticated understanding of local needs or ways in which ICT can contribute to development. Libraries and telecenters, however, do have a development goal, and they require a more in-depth understanding of local needs and how to serve the local population, not just with regard to access to computers but also with respect to services that contribute to development.

(2) Build alliances and collaboration

Crucial to the success of most projects and programs, regardless of industry, is collaboration and cooperation. Most research teams indicated that collaborations among and between different public-access venues are currently limited, but can yield powerful results if collaboration was promoted and strengthened. Collaboration between networks of libraries, telecenter associations and cybercafés can enhance partnerships between these venues within a community, making public access to ICT stronger and more effective at achieving the first success factor outlined

above: serving the needs of the local population. The collaborative model is convergent with van Dijk's notion of interdependence among different actors, an idea that is characteristic of the information society. "Actors are no longer independent . . . They are dependent on each other. In networks, actors make agreements and more or less freely engage in associations. They cooperate on the basis of complementary strengths and they become *inter*dependent" (van Dijk, 2006, p. 73).

Most research teams in our study noted that the collaboration takes many forms. Although this trend was noted across all countries, it was especially prevalent in Latin American countries. The case of Colombia offered some of the most fertile examples: a vibrant telecenter network collaborating actively with government policy-makers, and an increasingly focused network of libraries that is exploring collaboration opportunities with telecenters. An area that still requires more exploration is the opportunities for collaboration between libraries and telecenters with cybercafés.

PAC venues were more successful when they extended partnerships and collaborations beyond PAC venues to include other community services and media important to the community. Most notably, these collaborations include successful partnerships with community radio stations, health clinics, community organizations and government offices, as well as creative uses of mobile phones in combination with public-access venues. This partnership model is similar to models used in other public services. "Public services are now often provided by a complex network of partnerships, contracts, and alliances between government agencies, nonprofit organizations, and businesses, rather than by hierarchical government bureaucracy" (Huang & Provan, 2007).

(3) Strengthen sustainability

Sustainability of public-access venues is a critical issue that involves multiple dimensions: financial, political, technical, social and cultural sustainability. Government funding and support for public libraries has been declining in many countries while donors' interest in telecenters has declined as well, threatening the sustainability of these public-access venues. Successful telecenters have found creative ways to generate revenues, and popular libraries have explored innovative ways to build strong community support. But local community involvement alone cannot ensure the sustainability of public-access ICT. Governments must also work to create an environment that strengthens and sustains public access to information and ICT resources if they are to meet the needs of underserved communities.

Challenges to sustainability have been extensively reported in the literature about public access to ICT, especially for the telecenters (Bailey, 2009; Best & Kumar, 2008; Gurstein, 2005; Jensen & Esterhuysen, 2001; Proenza, 2001; Toyama et al., 2005). Many telecenter projects have simply failed after the original donors have left. Mayanja (2006) observed, "financial and social sustainability of telecenters remains one of the key challenges of the digital inclusion programming more than a decade after."

In an editorial of the *Journal of Community Informatics* dedicated to telecenter sustainability, Michael Gurstein suggests:

> What is meant by "sustainability" in the ICT context is less a matter of a broad configuration of "civilization" and more to do with day to day slogging by community members in meeting the payroll and keeping the machines running amidst the wear and tear of daily life (both physical and electronic) while always keeping in mind how the technology could be used to respond to the needs (and opportunities) of their local communities .... When we are speaking of "sustainability" in the context of ICTs we should perhaps be speaking of "sustainabilities" rather than "sustainability," for there are many dimensions of this issue which go much beyond the simple economic and the meeting of weekly payrolls. (Gurstein, 2005, p. 2)

As succinctly summed up by the team of researchers in Costa Rica, the "digital divide is only a small part of the economic divide." When governments plan and implement ICT services, they should be mindful of the needs of disenfranchised and marginalized communities. In our study, most research teams pointed out the importance of political sustainability, e.g. having government departments devoted to ICT development. Collaborating with other governmental units, a "Ministry of ICT" – as it is called in Colombia – could oversee the provision of online content regarding citizens' rights and governmental services. In addition to financial and political sustainability, technological sustainability needs to be ensured by making technology work in low-resource environments. Public-access venues aimed at underserved communities frequently face technical limitations due to working in resource-constrained environments; poor electricity, connectivity and outdated technology make it especially hard to operate effectively. Making ICT sustainable anywhere obviously requires basic infrastructure: electricity, equipment and Internet connections. This infrastructure also includes support systems (e.g. technical support, troubleshooting and networks) to maintain information systems and ensure that they function efficiently, even in environments where resources are scarce. Issues of social and cultural sustainability were only tangentially reflected by the majority of the research teams, and yet they are critical to the success of any initiative that will contribute to development (Melkote & Steeves, 2001). More research is needed to explore and better understand the implications of cultural and social sustainability of public-access centers.

(4) Train users and infomediaries

If communities are to benefit from public access to ICT, both users and operators need to have the basic training and know-how in order to use and operate the services. Building this capacity starts with basic user literacy training (reading and writing) and includes basic digital literacy (use of computers and their basic applications and features). Strengthening the training and capacities of librarians and other operators of public-access venues is also critical to the operator's success, especially if they are to provide guidance, training and support services to users, directly or indirectly. Trained and motivated librarians and operators make better information brokers, or "infomediaries," who help to make information resources more meaningful to the local communities and help to bring local knowledge and information resources to the public-access venues.

Extending the notion beyond the formal role of librarians or telecenter operators, other informal infomediaries play a critical role as well. Abrahamson and Fisher (2007) describe this informal role as "lay information mediary behavior" (LIMB). For example, LIMB refers to the behavior of a person who finds information for another member of the family, a friend, or a neighbor. This indirect usage was also analyzed by Schilderman (2002) who suggested that "social networks are the foremost source of information of the urban poor" and that the poor tend to believe people they trust rather than perhaps more informed contacts with which they do not have close ties. He then developed the concept of "key informants" (aka "infomediaries") defined as "people inside, or sometimes outside, a community who are knowledgeable in particular livelihoods aspects, and are willing to share that knowledge" (Schilderman, 2002, p. 5). In order to tap into this resource to help serve the information needs of this underserved population, he cited a number of success factors, including: involvement of the poor themselves as equal partners, building on local knowledge, the use of community-based communication methods and building the capacity of community-based organizations and key individuals within them. More research on LIMBs and the resulting indirect usage of ICT can help us better understand the role of infomediaries and the effects of ICT use in public-access locations,

especially when dealing with underserved and marginalized communities, as documented in a large-scale study of public libraries in the USA (Becker et al., 2010).

Implications for practice

This study identifies important similarities between libraries, telecenters and cybercafés, as well as important differences between them. While most of the past studies of PAC have looked either at libraries, or telecenters or cybercafés in isolation from each other, understanding the PAC ecosystem as a whole offers a more nuanced and detailed perspective of their relative strengths and weaknesses and the opportunities for collaboration and mutual learning that have frequently been ignored.

Public access to computers and the Internet helps to extend the benefits of ICT to sectors of the population who would otherwise not have access to them. Yet, users of PAC tend to be young, moderately educated, and low- to middle-income individuals with some gender differences depending on context and specific venue types. With few exceptions, the urban and especially the rural poor, those who have little or no education and older populations, all seem to be outside the area of influence of libraries, telecenters and cybercafés. If PAC helps to meet the information needs of the mildly underserved through broader access to computers and the Internet, who meets the needs of the extremely underserved? Specific outreach programs in libraries and telecenters appear to make small inroads in this direction, but there is far more that needs to be done, especially given the predominance of cybercafés in the PAC ecosystems of developing countries. There tend to be roughly six or seven cybercafés for every library or telecenter, according to our findings.

Our study points to four important success factors that contribute to effective PAC venues:

Meet local needs first: Failure to understand and respond to local needs may be the most frequent reason for the failure of public-access initiatives to ICT (and many other development projects). In public-access ICT initiatives, meeting local needs is most clearly expressed in the production and availability of locally relevant content, available in local languages and with appropriate support and help for users from marginalized groups to make effective use of such content. Sound community-needs assessment and continued interaction and reassessment to adapt to changing needs, are critical factors in the success of public-access ICT initiatives, particularly to help realize the community-development role of libraries and telecenters.

Build alliances: Bridges for collaboration between libraries and telecenters are rare, and those including cybercafés are almost non-existent (despite the fact that cybercafés are far more numerous than libraries and telecenters combined). With the telecenters and especially libraries in many developing countries that are facing a crisis of credibility and trust, partnerships between libraries, telecenters and cybercafés might be the key to their survival and sustained relevance. Furthermore, other media and community services complement and support the role of public-access ICT initiatives and their contribution to development. Collaboration with community radio stations and partnerships with community organizations that offer training, job placement, childcare, adult education etc. are required for public-access ICT to effectively contribute to human development. The interaction between public-access venues and mobile phones also needs to be further investigated. While some believe mobile phones will replace computers, and that the proliferation of mobile phones in developing countries makes public-access computers superfluous (e.g. Veeraraghavan, Yasodhar, & Toyama, 2009), it is more likely that mobile phones complement, rather than replace, the information services and opportunities offered by computers and public-access ICT.

Strengthen sustainability: Sustainability includes political, financial, social, technical and cultural factors. Financial sustainability appears to be more easily accomplished in cybercafés,

a phenomenon reported a decade ago by Proenza and others (Proenza, 2001). On the other hand, cybercafés experience a strong tension between their need for revenue generation and serving the needs of community development. All venues face difficulties related to technical sustainability (e.g. equipment maintenance and obsolescence), and all venues face different challenges related to political, social and cultural sustainability. More successful venues tend to have stronger political and community support and serve local populations in a local and culturally appropriate manner. Nonetheless, financial sustainability gets more attention than other types of sustainability for public-access venues across all countries in our study. More research is needed on the differences and similarities related to political, cultural and social sustainability across public-access venues. A larger question also warrants further study: if cybercafés are more successfully offering sustainable public access to ICT, what is the role for libraries and telecenters to ensure that public-access effectively contributes to community development?

Train infomediaries and users: Effective training includes training users to use the technologies and services, as well as training infomediaries (librarians and operators) to support and serve the needs of the disadvantaged communities who use their venues. Schilderman identified seven key characteristics of effective infomediaries: (1) their capacity to provide information in an accessible format; (2) their willingness to share information rather than hold onto it; (3) their ability to get hold of information and adapt it to a local context; (4) their experience, education, knowledge and reliability; (5) their accessibility, proximity and helpfulness; (6) their social sensitivity and capacity to involve residents and (7) their leadership qualities, influence and moral authority (Schilderman, 2002, p. 28). Combining all these with technical proficiency and digital literacy may be a tall order for any librarian, operator or staff of a library, telecenter or cybercafé. But effective attention to these skills and capacities may be, in turn, the solution to creating a new role for libraries and telecenters in the community.

The predominance of cybercafés in the supply of PAC services in developing countries raises important questions about their contribution to social and economic development: rather than promoting digital inclusion, leaving underserved populations in the hands of market-driven services to access and use of computers and the Internet further exacerbate existing social, economic and political inequalities? How can the social-development contribution of libraries and telecenters be maximized to help underserved communities make effective use of ICT beyond what commercial providers can offer? This is especially critical, given the nature of the perceived benefits that users tend to value more highly. The most often-reported benefit of the access to more information afforded through PAC services is related to the cultivation of personal relations with friends and family.

We have argued elsewhere that a stronger sense of connectedness can help contribute to building social capital (Baron & Gomez, 2012), but in-depth analyses of online relations have also been shown to make us not more social but anti-social, to result in further isolation and loneliness rather than connectedness, to make us be "alone together" (Turkle, 2011) with the illusion of connectedness but without the risk of real commitment. How can we encourage PAC venues, especially libraries and telecenters (funded by governments or non-profits and intended to contribute to community development) to help focus the benefits of PAC toward broader social inclusion rather than furthering exclusion, marginalization or isolation with the illusion of connection?

PAC may be bringing the benefits of computers and the Internet to a broader sector of the younger population in low-to-medium socio-economic status, but further marginalizing those that are worse off (those in extreme poverty, and the elderly, among others). Furthermore, the dominant uses of the now-available services offered by PAC appear to favor cultivating personal relations with friends and family and new forms of entertainment, albeit with some indication of fostering a stronger sense of connectedness and belonging to a wider world. More recent

research on the perceived impacts of PAC indicates that PAC venues are highly frequented by first-time users, and that with government support, libraries can more effectively target community-development activities as part of their PAC offerings (Clark, Sey, & Sullivan, 2012). But the expansion of access to computers and the Internet through cybercafés may end up just favoring an uncritical use of ICT that result in the multiplication of the opportunity to be, in Turkle's words, "alone together."

PAC may not be able to solve all social and economic problems, but it certainly helps to take some steps in that direction by offering access to information and communication technologies to a broad sector of the population who would otherwise not have access to them.

Note

1. Country Selection criteria: *Demographic* criteria helped to focus on a subset of 90 out of 237 countries around the world, excluding countries with very small populations (under 1 million), those with very large populations (India and China), those with high per capita income (over $11,116) and those countries with lowest human development index (below 0.5). *Feasibility* criteria helped to focus on 74 of these countries by excluding those where independent research was not feasible due to political unrest (US Department of State travel advisories) or restrictions on freedom of expression (Freedom House index over 6.5). *Ranking* criteria helped to further narrow the sample to 30 countries based on composite measures that we called needs and readiness criteria. Needs criteria included measures of inequality (Gini index), ICT usage (CIA World Factbook) and ICT cost (ITU). Readiness criteria, on the other hand, included composite measures for politics, skills and ICT infrastructure. *Tipping factors*: Drawing from these 30, the final selection of 25 countries included in the international study was based on tipping factors such as regional distribution, anticipation of planned infrastructure or policy changes in the countries and availability of qualified local research teams to conduct the fieldwork within the timeframe and requirements of the research project.

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