Research Article

Measuring the Contribution of Infoplazas to Internet Penetration and Use in Panama

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Abstract

Infoplazas *arose in Panama as a means to combat the digital divide by providing Internet connectivity to the economically disadvantaged and geographically remote. Yet there is a dearth of information regarding their actual performance. This study constitutes a first attempt to assess the contribution of infoplazas to the diffusion and use of the Internet in Panama. In so doing, this study sets the ground for the development of a more rigorous measurement tool that might obtain better estimates of the dynamics of infoplazas and similar community information centers. Our research suggests that infoplazas account for approximately 7% of Panama's Internet users, that infoplazas might constitute the only connectivity option for at least 25% of users, and that the annual number of serviced visits might be considerably higher than the official figure. This study also draws attention to a number of challenges faced by the Infoplaza Project.*

Introduction

As the Internet has grown in popularity, more and more areas of human activity have been touched in one way or another by this technology. The capacity of the Internet to serve as a many-to-many communication medium, in both synchronous and asynchronous modes, and as a reservoir of vast amounts of information available at all times and in all places, raises the hopes of many that this novel information and communication tool will afford crucial new development opportunities for individuals and nations alike. In the economic sphere, for instance, there is evidence of an important increase in productivity attributable to investment in information and communication technologies (ICTs) (Castells, 2001).

At the dawn of the Information Age, however, not everyone stands equally poised to reap the benefits of digital networks. Already Internet access and use seem to mirror and reinforce traditional disparities between the rich and the poor, both among and within the nations of the world (Norris, 2001). The potential centrality of the Internet, therefore, threatens to marginalize those who lack or have limited access to the Internet, as well as those who are unable to take full advantage of it (Castells, 2001).

The term *digital divide* attempts to express this new form of social and economic inequality that accompanies the expanding presence of the Internet. At the first and most basic level, it refers to the gap between those who have access to the new digital tools and those who do not. Beyond access, the digital divide is reflected in people's unequal abilities to make effective use of these technologies. This second, more elusive, level of the divide is sometimes described as the *knowledge gap*. Evidence

so far suggests the magnitude of the digital divide is substantial and increasing, and points to economic development as the main factor driving access to the new digital technologies (Norris, 2001).

It is important to note that some authors do not subscribe to the notion of a digital divide. For example, referring specifically the United States, Compaine (2001a) and Clayton (2001) have questioned the very existence of a persistent divide or its alleged severity, and consequently, the need for any form of state intervention. Compaine in particular argues that the present forces and tendencies shaping the information landscape—lower prices of appliances and services, greater availability of access, and natural acculturation processes—all point toward a closing of the digital gap on its own, without the help of state programs (Compaine, 2001b).

The fact that the above arguments are circumscribed to the United States is an important limitation. As the case of the telephone illustrates, the premise that decreasing costs of new technologies implies the eventual disappearance of the access gap presents serious flaws in countries that do not enjoy the high income of the United States. Over a century after its invention, the number of stationary telephones in the world is only 18 phones per 100 inhabitants, with sharp differences among different regions of the globe (ITU, 2002a). Thus, similar costs worldwide continue to exclude large portions of the world's population, particularly in developing countries.

Given this precedent it is hard to imagine the situation would be different with Internet access, which requires not only a phone line, but a computer. Disparities in access to the Internet among and within countries seem unlikely to vanish on their own as a simple corollary of lower infrastructure and connectivity costs.

Data from the European Union gathered between 1996 and 1999 provide strong evidence for this. During that period, there existed substantial gaps in the online population as measured by income, occupation, and education across all 15 member states. Moreover, the size of these gaps did not diminish over time, even as the online population grew at an annual rate of roughly 10%. It is a telling fact that in several of the most technologically and economically advanced countries of the European Union (e.g., Sweden and Finland), some of the gaps actually increased (Norris, 2001).

Concerned that their countries or certain vulnerable groups within them will be left behind in what is widely perceived as a new window of opportunity for socioeconomic development, many governments have become actively involved in promoting Internet connectivity and use. One strategy has been the creation of public centers for Internet access. In Panama such centers are called *infoplazas.* Launched by SENACYT (Secretaría Nacional de Ciencia, Technología e Inovación) in 1999, the purpose of the Infoplaza Project is to provide low-cost connectivity to economically disadvantaged and geographically remote communities of the country, in the hopes that these marginalized people may have more opportunities for economic, professional, and academic development. The project is promoted and subsidized by the Panamanian government, and has benefited from the support of the Inter-American Development Bank.

Infoplazas are set up by the Infoplaza Foundation in conjunction with an *Associate.* The latter must be a nonprofit institution or organization. The contract (SENACYT, n.d.) signed between the two parties establishes that the Infoplaza Foundation will be responsible for providing 6 computers, 1 server, all communication equipment (including routers and hubs) and Internet access, 1 color printer, and 10 desk cubicles. The Associate must provide 4 computers (for a total of 10), 1 desk, and 11 chairs. The Associate must also cover the following fixed monthly expenses: salaries of the infoplaza administrators, rent of the space where the infoplaza is located, air conditioning and electric bills, and in case there is a telephone, the phone bill. The agreement grants the Infoplaza Foundation the sole right to set the tariffs for Internet access at the infoplazas.

Besides access to the Internet, typical applications and services offered at infoplazas include Microsoft Office, Encarta Encyclopedia, Microsoft Project, Microsoft Publisher, Microsoft Front Page, Microsoft Press, black & white and color printing, and computer literacy courses.

All efforts to overcome the digital divide, whether at the local or global level, should be accompanied by periodic assessments to determine, in comparative terms, the magnitude of the divide, measure progress in overcoming it, and detect bottlenecks. According to Minges (2000), there is a lack of comparable, publicly available data about the diffusion of the Internet across the globe, especially in

developing countries. In his view, albeit the quantity and quality of the information has improved since his 2000 publication, problems remain due mainly to wide variations in the definitions of the terms employed, the comparability of the data, and the reach of the studies.

The purpose of our study was to obtain first-hand information that would allow us to explore the contribution of infoplazas in bridging the digital divide in Panama. Attention focused primarily on connectivity aspects. Some preliminary explorations of frequency and sophistication of use were also performed.

In undertaking this study, and taking our cue from Minges as to the need for reliable, comparable data, we have designed a prototype measurement tool that might constitute the basis for the development of a truly scientific instrument to measure the impact of this network of community Internet access centers. It is our hope that this tool could then be extended, with appropriate modifications, to other, similar networks.

Our study entailed, first, observation of the arrival process at the infoplazas by means of a *count,* and second, application of a *survey* which inquired about reasons and frequency of use, nature of activities carried out on the Internet, and general demographic information.

We wish to emphasize the exploratory nature of this study. This case study of infoplazas is but a first effort to understand the role community information centers play in overcoming the socioeconomic barriers that prevent many people worldwide from accessing the opportunities for personal and community development offered by the ICTs.

Methodology

The fundamental research problem considered in this study was estimating the contribution of infoplazas toward Internet penetration in Panama. The method we devised to answer this question consisted of two parts: a *count* and a *survey.* The count served to obtain an estimate of the average arrival rate of users at the infoplazas, which was then extrapolated to estimate the total number of arrivals at the infoplazas in one year. The survey provided, among other things, information related to frequency of use of infoplazas and the portion of infoplaza users accessing the Internet, which was used to estimate the number of users. Some, though not all, of these estimates could have been obtained through information made available to us by the Infoplaza Project coordinators. However, we chose to work with primary source data to: (1) minimize unsuspected bias in the official data, and (2) identify dynamics that might not necessarily be apparent from the available data.[1] However, the main reason we sought to develop our own technique for obtaining reliable primary data is that in developing countries (such as Panama), governmental institutions responsible for projects like the Infoplaza Project are often not receptive to research by outsiders. Obtaining information, even information that is supposedly public, can be an insurmountable ordeal. Monitoring software applications are not always installed in public Internet access centers. And even when they are, gaining access to the information recorded by these programs may be difficult.

For the count, it was necessary to determine in advance how many times a day, at what time of day, and for how long to count. To these ends, we conducted preliminary observations and measurements at an infoplaza in Panama City, which, according to official statistics (Luis Cisneros, personal communication, 2002), was near the national average in terms of the annual number of visits. We concluded that four measurement intervals per day would capture well enough the daily variations in arrival rate. These preliminary explorations also suggested that periods of 30 minutes would suffice to estimate adequately the rate of arrival at a given time of day, since using longer periods did not significantly alter the estimates obtained during the shorter, half-hour periods.[2]

In what follows, the term *user* refers to a distinct individual, independent of which infoplaza the user visits, or how many times he or she returns to each

1. From speaking with infoplaza administrators and from our own observations, we had reasons to believe that the data recorded in the infoplaza databases (there is no centralized database, each infoplaza has its own) might not always be reliable or might not reflect the true dynamics taking place at the infoplazas (for instance, nonserviced visits). Hence the need for direct observation.

2. Later in the paper we address in greater detail the issue of the total number of hours needed in the sample for a given degree of certainty.

infoplaza. A *visit* is any arrival of a user at an infoplaza. Users who were already in an infoplaza at the beginning of a count period were not counted as an arrival, and hence, do not constitute a visit. Since not all visits are serviced, it is important to distinguish clearly between *serviced* and *nonserviced visits.* A *serviced visit* is a visit in which the user receives some service from the infoplaza. This includes situations where the service requested is actually performed by an infoplaza administrator, so that the user never interacts with a computer. Each user "actively" sharing a computer terminal was considered a separate serviced visit. A *nonserviced visit* is a visit which does not result in a user receiving any specific service from an infoplaza. Nonserviced visits occur, for instance, if all computers are in use when a new arrival occurs and the user leaves or the measurement period ends before a computer becomes available. During the count, serviced as well as nonserviced visits were recorded.

The survey was given only to serviced users who left the infoplazas during the 30-minute intervals during which the count was being conducted. Surveyed users do not necessarily correspond to counted users (some of those surveyed may have already been in the infoplaza at the time the count began). Occasionally, if the number of serviced users who exited during a given measurement interval was very low, the survey period (but *not* the count period) was extended beyond the 30-minute interval, on the assumption that such users remain representative of the surveyed population of interest.

We are aware that in polling it is considered good practice to frame a question several different ways to establish a scale against which to measure the certainty of respondents' answers (Neira, personal communication, 2003). Our questionnaire was purposely kept short (17 questions), with little redundancy, due to our concern that a longer survey might reduce the chance of users' agreeing to fill it out. Even so, it covered most of the points needed to satisfy the objectives set forth in this research project.

Among the most important omissions were questions related to socioeconomic characteristics of users. Our reasons for avoiding this subject had to do with: (1) the fact that a great many infoplaza users are youngsters who probably would not know details about their family's income; and (2) our impression that in Panama people generally do not feel at ease being asked these kinds of questions. We were concerned that if people did not know the answer to questions or were made uncomfortable, their answers might not be trustworthy or they might refuse to answer altogether.[3]

At the time we began to plan our research, in February 2003, 39 infoplazas were in existence and functioning. These 39 infoplazas constituted the universe for this study.

Figure 1 shows their geographic distribution according to the relative socioeconomic level of the district where they are located, as defined by Herrera (2003).[4]

Of the 68 districts in the country, only one, the district of Panama, which includes Panama City, falls in the *high* development category. Thus, of the 39 infoplazas, 33% are located within the Metropolitan Area of Panama City, while the remaining 67% are distributed throughout the Interior of the country, mostly in district capitals.[5]

Measurements were scheduled to be carried out in April 2002, and repeated two months later. The justification for repeating the measurements was our conjecture, based on available data (Luis Cisneros, personal communication, 2002), that the average rate of arrival might vary significantly throughout the school year. If significant differences in average arrival rates were found, this would suggest that in order to obtain better estimates, future measurements should be scheduled throughout the entire year. Since a major goal of this study was to investigate the design of the measurement tool itself, exploring this possibility was important. Hence, a first set of measurements was carried out during the first two weeks of April, near the beginning of the Panamanian school year (March). The second set

3. As we will see shortly, two sets of measurements were obtained. In the second data set we attempted to correct partially for this omission by including questions that inquired about the occupation of infoplaza users' parents. See page 5.

4. Herrera constructs a socioeconomic development index number for Panama's districts based on four variables: level of medical attention, degree of urbanization, standard of living, and level of education, each of which comprises several indicators. On this relative scale, each quintile corresponds to a different socioeconomic development level: high, mid-high, middle, low, and very low.

5. Interior *is the term used in Panama to refer to the rest of the country other than Panama City and its surroundings.*

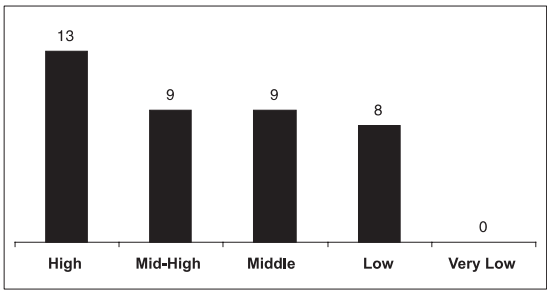

Figure 1. Distribution of the 39 infoplazas in the study by relative socioeconomic level of regions where they are located

was conducted during the first two weeks of June, well into the academic year. Measurements were conducted Tuesdays, Wednesdays, and Thursdays. Mondays and Fridays were avoided to exclude possible weekend effects.

The first data set was based on measurements conducted at 11 of the 39 infoplazas, for a total of 43 measurement periods.[6] The infoplazas in our sample were distributed as follows: 5 in the *high* socioeconomic development level, 4 in the *mid-high* level, and 2 in the *middle* level. Our sample did not include infoplazas in *low* level districts, and no infoplazas exist in districts of *very low* development level. It will be noticed that the number of infoplazas in each category in the sample does not follow the proportions shown in Figure 1. The reason for the discrepancy is that at the time the sample was put together, our intention was to choose our sample following the Panama City/ Interior distribution.[7] We planned to select 20 infoplazas, 7 (35%) of which would have been in Panama City and the remaining 13 (65%) in the Interior, approximating the Panama City–versus–Interior distribution of the 39 infoplazas. However, various practical considerations, such as distances to the infoplazas, availability of pollsters, infoplazas being open to the general public, and time frame to complete the study,[8] forced us to cut back to 11 infoplazas. In so doing, the proportions changed and were no longer representative of the Panama City/Interior distribution. When Herrera's book became publicly available in May 2003, the advantages of using her socioeconomic classification as a framework for proportional sampling in future work became apparent to us, especially since in our classifi- cation the Interior category was extremely broad and did not distinguish the multiplicity of socioeconomic and cultural conditions to be found throughout the country. In comparing the infoplaza population distribution to our sample under Herrera's classification, we discovered that the proportion in each category gave a better fit than the one we obtained using the Panama City/ Interior categorization. Hence, the decision was made to continue work within the framework of her classification.

Due to time constraints mentioned earlier, the second data set was smaller—only 23 measurement periods based on a subset of 6 infoplazas. This time the infoplazas were chosen at random from among the original 11 in a way that preserved the proportions we already had in each category of Herrera's classification.

The first data set yielded a total of 139 arrivals and 179 completed surveys. The second data set produced 84 arrivals and 66 completed surveys. The results presented below were calculated from the first data set. On two occasions only, both clearly stated, data from the second set were used. The first instance was to examine changes in statistics over time; the second, to correct for an overlap mistake in the age groups used in the first survey.

Results

The results presented in this section do not constitute a fully rigorous statistical analysis of the data. Instead, they attempt to show that it is possible to obtain reasonably accurate numbers to get a sense of the use made of the infoplazas.

Estimate of the Average Rate of Serviced Visits

From the data we calculated an average arrival rate of 3.23[9] visits/measurement period/infoplaza (6.46 visits/hour/infoplaza), with a standard deviation of 3.07. However, 31 visits (22%) are nonserviced visits. Subtracting these, we obtain an average ar-

6. One of the infoplazas opened later in the day, and so had only 3 measurement periods instead of 4.
7. Herrera's book (2003) had not yet been published.
8. The study was carried out in the context of a one-semester research seminar at the Universitat Oberta de Catalunya, and had to be completed by the first week of July 2003.
9. Throughout computations, decimal statistics were taken to the nearest hundredth to avoid severe round-off errors. In reporting social conclusions drawn from these statistics, however, the statistics are reported to the nearest unit.

rival rate of 2.51 serviced visits/measurement period/infoplaza (5.02 serviced visits/hour/infoplaza), with a standard deviation of 2.27. For a sample of 43 measurement periods, the standard error for serviced visits is approximately 0.35.

How accurate is this estimate of the number of serviced visits/measurement period/infoplaza? We distinguish between two types of error: the *error of estimate,* which arises from the natural variation among samples, and the *error of measurement,* introduced during the measurement process or through extrapolations, either by a faulty count protocol or imprecise information. Unlike the error of measurement, the error of estimate cannot be corrected by improving the measurement protocol or by obtaining better information. Thus, obtaining the error of estimate is essential to explore the validity of the count protocol as a measurement tool. This requires introducing a theoretical framework within which to model the statistical process under study.

We begin by considering the sample of 43 measurement periods (21.5 hours) taken from a hypothetical population of 214,968[10] measurement periods (107,484 hours). The random variable of interest is the number of *serviced visits per measurement period per infoplaza.* In what follows, and only as a model, this variable is assumed constant throughout any given time interval. Although this assumption is probably not justified, it illustrates the computations and estimates the order of magnitude of the error.

Given the relatively large sample size (greater than 30), it is reasonable to assume the sampling distribution of the sample mean to be approximately normal, with mean equal to the population mean (Hoel, 1960). The assumption that the sample mean is approximately normally distributed implies that, in repeated sampling, 95% of the times the sample mean will differ from the true value of the population parameter by no more than 0.68 serviced visits (1.96 times the standard error, 0.35). This is our error of estimate. It amounts to 27% of our estimate of the mean, 2.51.

Although an error of estimate of this magnitude is not necessarily bad as a working estimate, it may be desirable to reduce this error to some agreed-upon threshold, say, 10%. To do this with the same degree of certainty (95%) we must increase the sample size to approximately 320 measurement periods (160 hours),[11] so that the total count approximates 800 serviced visits and the standard error is reduced to approximately 0.13. This can be accomplished, for instance, by sampling 10 representative infoplazas,[12] 4 times a year, 4 hours each time. These numbers suggest that a measurement scheme that complies with the desired maximum error could be designed and implemented without too much additional effort, even if there are some variations expected throughout the day and year.

The second kind of error affecting the estimate of the average rate of serviced visits, and statistics obtained from this number through extrapolation, is the error of measurement, which stems from inaccuracies in the counting process. The following list identifies the sources we have found of this type of error.

1. *Multiple users sharing a computer.* The description of user employed in this study allows all people actively sharing a computer to be counted individually. What constitutes *active sharing,* however, is a subjective decision and, consequently, prone to error.
2. *Problems distinguishing between serviced and nonserviced visits.* If a visitor does not actually use a computer, it is not always possible to ascertain without direct questioning whether that visit has been serviced or not. Thus, some visits may be incorrectly categorized.
3. *Infoplaza schedules.* Each infoplaza has its own schedule. For the extrapolations in this study we use the mean number of hours per day the 11 infoplazas in the sample are open

10. This is our estimate of the total number of measurement periods. The 39 infoplazas are open for service to the public during a 1-year period. This number was calculated as follows: (39 infoplazas x 52 weeks/year x 5 days/week x 9.8 hours/day [taken from known weekday schedules] x 2 measurement periods/hour) + (39 infoplazas x 52 weeks/year x 1 day/week x 4 hours/day [from known weekend schedules] x 2 measurement periods/hour).

11. The sample size, n, *is computed using the formula:* $n = \left(z\sigma/e\right)^2$, *where* z *is the desired confidence level,* σ *is the standard deviation of the population (approximated by the standard deviation of the sample), and* e *is the maximum allowable error. In this case* z *is 1.96,* s *is 2.27, and* e *is 10% of 2.51.*

12. Keep in mind that "representative" depends on the goals of the study.

to the public. The average is 9.8 hours/day during weekdays, and 4 hours/day on Saturdays.

4. *Computer-literacy courses.* Occasionally, infoplaza administrators teach computer-literacy courses. At such times, the number of computers available to the public at large may be considerably reduced, presumably altering the pattern of serviced visits. In some instances, infoplazas may be closed to the public altogether for part of the day or the whole day.
5. *Holidays.* Infoplazas are closed on holidays. When performing the extrapolations, these hours are not subtracted from the total number of open hours in a year.

Additionally, given that officially recorded statistics are used in the next section to validate our results, we try to identify possible sources of discrepancies between official statistics and the extrapolations obtained from our count. Factors that contribute to such differences are:

6. *Counting criteria.* Our counting criteria allow for multiple users, whereas infoplaza databases record only one user per computer.
7. *New infoplazas beginning operations throughout the year.* Of the 39 infoplazas constituting the universe for this study, 5 began operations at different times throughout 2002. Hence, they do not contribute serviced visits for the entire year. Our extrapolation assumes all 39 infoplazas are open during the whole year.
8. *Infoplazas included in the study turned out to be among the ones with most serviced visits.* Official statistics for the month of April 2003 (Luis Cisneros, personal communication 2003) reveal that during this month 4 of the 11 infoplazas in the sample are among the top 5 in terms of serviced visits, 7 are among the top 10, and all 11 are among the top 15.[13] In other words, if the distribution of measured infoplazas was not representative of the universe of infoplazas, the count process would be biased.
9. *Nonhomogeneous arrival rate.* Although we modeled our arrival rate as constant over all time intervals, it is probably the case that this rate varies over time.
10. *Inaccuracies in the official records.*

As pointed out earlier, 22% of visits are not serviced. At a mean arrival rate of 6.46 visits/hour/infoplaza, this translates into a very large number of nonserviced visits each year. To better understand the reasons for this, more detailed measurements need to be conducted. However, our data suggest that infoplaza congestion might be an important contributing factor. Infoplazas typically have 10 computers. Our records show that at the beginning of approximately half of the measurement periods there were already 7 or more users at the infoplazas. Thus, the observed difference between visits and serviced visits might be explained at least in part by infoplazas operating at or close to capacity during certain peak hours of the day.

Finally, plotting *hourly arrival rate per person per infoplaza*[14] versus *population density* (inhabitants/km^2) of the *corregimiento*[15] where the infoplaza is located reveals a clear inverse relationship between the variables (Figure 2). In particular, infoplazas located in less densely populated communities have higher arrival rates per person than infoplazas located in more densely populated areas.

In an attempt to find socioeconomic variables that might explain this trend, we examine plots of the hourly arrival rate per person per infopalza versus (1) socioeconomic development, (2) median monthly family income, and (3) standard of living—all three variables and data taken from Herrera (2003). In every case a general downward trend is observed. However, in none of these plots was the trend as pronounced nor did the independent variable give as good a fit to various mathematical models as did the original population density variable. This may reflect the fact that in low-density areas users have fewer connectivity options. Hence, in these regions infoplazas seem to play a crucial

13. We did not learn of this fact until June 2003.

14. Defined as the number of arrivals per hour per infoplaza divided by the population density (inhabitants/km^2) of the corregimiento *where the infoplaza is located.*

15. Smallest unit in the Panamanian political-administrative territorial division. Districts are made up of several corregimientos.

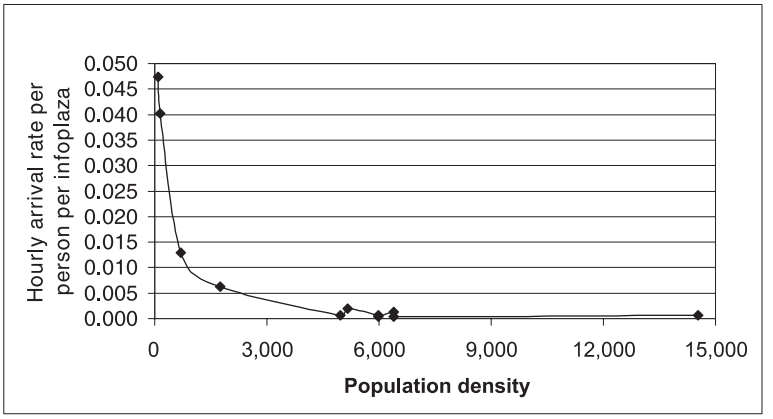

Figure 2. Inverse relationship between normalized arrival rate and population density

role in providing people with access to the new information and communication technologies. We believe this result merits further investigation.

Use of Infoplazas and Contribution to Internet Penetration in Panama

Visits

Earlier we indicated that in repeated sampling, we expect that 95% of the time the sample mean will be within 0.68 units of the value of the estimated parameter. Thus, for a sample mean of 2.51, the corresponding 95% confidence interval lies between 1.83 and 3.19 serviced visits/measurement period/infoplaza (3.66 to 6.38 serviced visits/hour/infoplaza). Thus, a conservative estimate of the number of visits serviced in one year may be obtained by extrapolating the lower limit of this interval.[16] The result is 393,390 serviced visits per year. In contrast, the official number of serviced visits recorded for 2002 is 241,294 (Luis Cisneros, personal communication, 2002).

A difference of the order of 150,000 serviced visits between the measured and official values is unlikely to be the result of chance variation. Measurement errors and other discrepancies provide a more plausible explanation. In particular, differences in counting criteria (multiple users) would seem to play a major role. To see this, note that an increase in the estimated arrival rate of only one additional serviced visit per hour translates into 107,484 additional serviced visits per year, an important fraction of the total difference. This is not an entirely hypothetical speculation. We frequently observed cases of multiple users, although we did not record how often these occurred nor did we take note of the multiplicity of users. Thus, there is reason to believe that the number of serviced visits is higher than what the records show. Even allowing for other discrepancy factors, it appears that the number of visits serviced per year by the infoplazas is considerably greater than what official records indicate.

To further support this claim, we estimate the number of serviced visits in the 11 surveyed infoplazas during the month when the count was conducted (April 2003), and compare this figure with the official record of the number of serviced visits in those same 11 infoplazas during that same month. This allows us to minimize or eliminate the effect of many of the discrepancy factors listed above. As before, we use the lower bound of the 95% confidence interval (1.83). Our computation yields 9,176 serviced visits for the month of April,[17] whereas the official record for this month indicates 8,979 serviced visits (Luis Cisneros, personal communication, 2003). Once again we find that after taking into account random variation, our count results in a greater number of serviced visits than the infoplaza databases indicate.

Users

The previous paragraphs concentrated on estimating serviced visits, which gives a sense of how busy the infoplazas have been during the year. To measure the contribution of infoplazas toward Internet penetration in Panama, we need to estimate the number of users who visit the infoplazas in the course of

16. The extrapolation factor is 214,968 measurement periods/year.
17. The extrapolation factor is 5,014 measurement periods/month. It is calculated as follows: (11 infoplazas x 4.3 weeks/month x 5 days/week x 9.8 hours/day [weekdays] x 2 measurement periods/hour) + (11 infoplazas x 4.3 weeks/month x 1 day/week x 4 hours/day [Saturdays] x 2 measurement periods/hour).

one year. To this end we divide the estimated total number of visits (not only serviced visits) per year in all 39 infoplazas by an estimate of the average number of times users visit the infoplazas per year (frequency of use). However, a considerable portion of the users claim to use other infoplazas, in addition to the one where they filled out the survey. We must correct for this repetition factor to avoid counting these users more than once. Finally, we must multiply the result by the portion of users who use the infoplazas to access Internet.

We thus find that the number of infoplaza users who connect annually to the Internet is on the order of 4,000, with a percent error of approximately 20%.[18]

Although the above estimate is reasonably precise, it is almost certainly too low. The source of this downward bias in the number of users lies in our estimate (too high) of the frequency of use. This overestimate results, in turn, from the process of observation itself: given a small period of observation (21.5 hours out of a total of 107,484), users who visit infoplazas more frequently are more likely to be seen and counted than users who visit less frequently.

The mean frequency of use computed from the observed data yields an estimate of 128.5 visits per user per year. An estimation of the extent to which the observation process distorts this estimate suggests that the actual frequency of use could be as little as half the observed value, thereby doubling the number of infoplaza Internet users from the 4,000 previously reported to 8,000.[19]

According to the latest population census (Contraloría, 2000), Panama's population is 2,839,177. Thus, fewer than 1% of the population annually uses the infoplazas to access the Internet. The International Telecommunication Union (ITU), for its part, estimates that in Panama 41 out of every 1,000 inhabitants—some 116,406 people—access the Internet (ITU, 2002b). From these nominal figures, infoplazas would contribute on the order of 7% of the country's online population.[20]

Despite the error involved in the above calculations, estimates such as these at least provide some idea of the magnitude of the contribution of infoplazas to the diffusion of the Internet in Panama. To the best of our knowledge, no other such estimates exist or are publicly available. We hope that putting forth these estimates may (1) motivate others to carry out more rigorous studies and thereby improve our crude statistics, and (2) generate further interest in promoting the use of infoplazas by widening the range of information and communication services they offer.

Coverage

Another way to view the significance of the number of infoplaza users who connect annually to the Internet is to estimate what percentage of the population covered by the infoplazas it represents. Minges (2000) defines *coverage* as "the portion of the population of a country within *easy* access of the Internet, whether they use it or not." According to Minges, this statistic is an ideal indicator since it expresses the potential Internet user market, which in his view is the fundamental measure of *universal access* to the Internet. Using this indicator, however, requires characterizing the notion of *easy access.*

Considering that of those surveyed, 94% reside permanently in the Republic of Panama, 65% arrived at the infoplazas by foot, and 83% took no more than 20 minutes to reach the infoplazas, it seems reasonable to use this information as the basis for a concrete characterization of "easy access." It is known that the average speed at which people walk is approximately 3.6 km/hr (Inman, Ralston, & Todd, 1981). Hence, the distance covered by foot in 20 minutes would be 1.2 km. This might be proposed as the radius of a circle of easy access surrounding an infoplaza.

Using this radius, together with demographic information about the population density by

18. Since the number of users is a nonlinear function of several (probably correlated) variables, the method of moments *was used to estimate this quantity;* propagation of error *techniques were employed to estimate the error involved in the estimation.*

19. Estimation of the observation bias required modeling the phenomenon mathematically. Details of the complex statistical computations are omitted from this paper.

20. More recent private estimates by local sources (Escobar, personal communication, 2003) put the number of Internet users in Panama as at least 1.5 times the ITU figure. Thus, our estimate of the contribution of infoplazas should be interpreted as a working estimate only.

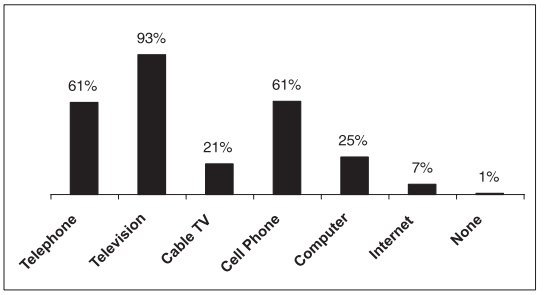

Figure 3. Telecommunication devices and services in the home

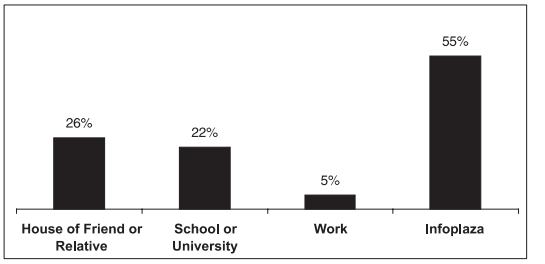

Figure 4. Internet access from outside the home

corregimiento (Contraloría, 2002), we find that the population covered by the 39 infoplazas included in this study is 385,445. Our estimate of 8,000 Internet users would correspond to approximately 2% of this population; that is, 1 of every 50 people covered by the infoplazas actually uses them to connect to the Internet.

Access to Internet

Given that one of the main goals of the infoplazas is to provide connectivity to the economically underprivileged or geographically remote in Panama, it is crucial to examine what other Internet access options are available to infoplaza users in those regions. In looking at Internet access, we consider two complementary aspects: access from within the home and access from outside the home. Access from within the place of residence Is determined from question 7 in the survey about devices and services present in the user's household.[21]

Figure 3 reveals that a small percentage of infoplaza users (7%) indicates that they have access to Internet from within their homes. Furthermore, considering the combination of telephone plus computer as a measure of the potentiality of accessing the Internet from the home in the near future, it follows from the original data that only 20% of users have both devices (not shown in graph), and thus, are potentially in a position to connect to the Internet from their homes.

The second dimension of access refers to access from outside the home. In question 8, users are asked whether they had access to the Internet from (1) the house of a friend or relative, (2) school or university, (3) work, or (4) infoplazas.[22] For users who chose at least one of the first three options, it is clear that infoplazas are not indispensable but, rather, another alternative. On the other hand, users who chose only the infoplaza option must have no other possibility to connect to the Internet except, perhaps, commercial access sites such as cybercafés. In Figure 4, the bar labeled Infoplaza represents those users who chose only the infoplaza option, that is, those who do not have access to the Internet from the house of a friend or relative, school or university, or work.

As the graph shows, for a majority of infoplaza users (55%) these centers constitute, along perhaps with cybercafés, their only possibility to connect to the Internet. However, over a third (35%) of those surveyed claim they have never used commercial sites to access the Internet (Figure 5), and from the original data (not shown), we find that this percentage is somewhat higher (41%) for those users who chose only the infoplaza option in question 8.

Clearly, *use* and *access* are two different concepts. Some portion of those who say they have never used cybercafés or the like to connect to the Internet may nonetheless have access to such sites. Unfortunately our questionnaire does not allow us to determine what this portion might be. What we can say is that for approximately one quarter of infoplaza users (41% of 55%) these centers constitute in practice their only connectivity option.

21. According to the latest population census (Contraloría, 2000), 40% of Panamanians have a telephone in their homes, 77% have a television, 22% have a cell phone, and 9% have a computer.
22. Unfortunately, polls went out without the "cybercafé or other commercial access point" option being included. Nonetheless, as shown in Figure 5, this omission is not expected to alter results significantly for infoplaza users.

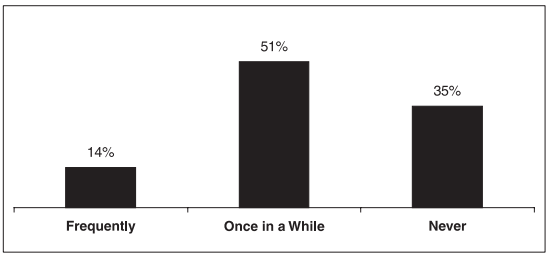

Figure 5. Use of commercial Internet access points by infoplaza users

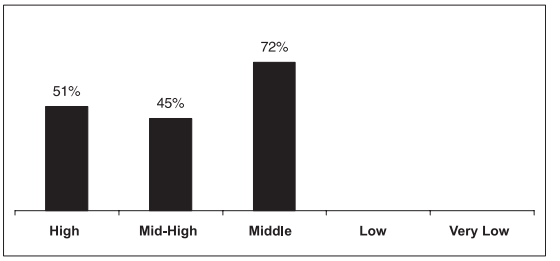

Figure 6. User dependence on infoplazas by relative development level

Relation of access to socioeconomic development

It is interesting to examine the distribution of users who selected only the infoplaza option (in question 8) for accessing the Internet with respect to the relative socioeconomic level of the district in which the infoplaza is located.[23]

Figure 6 shows similar results for users in high and mid-high level districts. For these two categories, the percentage of users who lack access to the Internet from either the house of a friend or relative, school or university, or work are 51% and 45%, respectively. In contrast, for middle level districts this percentage increases to 72%, roughly 1.5 times more than the other categories.

It is somewhat surprising to find that the percentage of users who lack access to the Internet from the house of a friend or relative, school or university, or work is actually higher in high level districts than in mid-high level districts. One explanation might be that there is only one high level district in the country, namely the district of Panama, which includes Panama City. The infoplazas in Panama City, however, tend to be located in middle- and lower-class neighborhoods. Thus, it may not be surprising to find that infoplaza users in the capital have fewer connectivity alternatives than users from infoplazas in mid-high level districts.

This same general pattern persists when other aspects of Internet access are examined. For instance, potential access from the home (previously defined as having a telephone line and a computer in the household) is 25% for the high level, 25% for the mid-high level, and 6% for the middle level. Compare those numbers to the percentage of users who report never having accessed the Internet through commercial access point: 34% for the high level, 25% for the mid-high level, and 48% for the middle level.

The above results provide evidence that infoplazas are used significantly more by people who have no other connectivity options. This dependence on infoplazas for access to the Internet seems more acute at infoplazas located in areas with lower socioeconomic development (middle level in our samples), consistent with expectations.

Frequency of Use of Infoplazas

In this study, estimating frequency of use is an essential part of the computation of the number of infoplaza users. Frequency of use is also of interest in its own right. To establish *frequency of use* of the infoplazas, survey question 3 presented users with the following options: (1) occasionally (1–6 times per year), (2) monthly, (3) weekly, or (4) daily. The percent of users in each category is shown in Figure 7.[24]

If we define *regular users* as those who use infoplazas on a weekly or daily basis, 62% of infoplaza users would be regulars. This suggests that a majority of users have integrated the digital technologies available at infoplazas into their daily lives.

But how can we gain an appreciation for what these numbers mean in the Panamanian context? To understand better the significance of these statistics, let us take a closer look at the set of regular users, and consider in particular the subset consisting of

23. Recall that no polling took place in low *development districts, and no infoplazas exist in* very low *development districts.*

24. This graph is almost certainly skewed to the right due to the observation bias mentioned earlier.

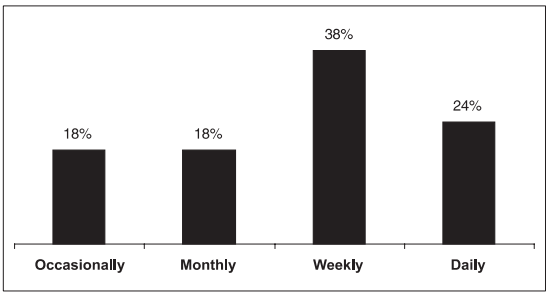

Figure 7. Frequency of use of infoplazas

students under 19 years of age. This group constitutes approximately 70% of all regular users. We attempt to estimate how much this group spends each year at the infoplazas and what that amount might represent in the local socioeconomic milieu.

For elementary and secondary students (generally under 19 years old), the cost of using a computer at an infoplaza is $0.25 for the first hour. Assuming users spend a minimum of one hour per computer session,[25] our data on frequency of use suggest that the average amount spent by students under 19 who regularly use infoplazas is on the order of $40 per year (see Appendix B for details). Since students often require complementary services (word processing, printing, scanning, etc.), the annual expenditures at the infoplazas for this particular user subgroup is probably somewhat higher. In addition, it seems fair to assume this subset of users is not economically self-sufficient. Hence, the cost for their use of the infoplazas must generally be picked up by their families.

Although our survey does not query users directly about family income, it is possible to sketch a rough socioeconomic profile of the subset of students under 19 who regularly use infoplazas based on penetration of information and communication technologies in the household. In particular, we find that 61% of this subset of users have at most two telecommunication devices or services in their homes, whereas 86% have at most three. No one in this subset (students under 19 who are regular users) has Internet, and only 11% have a telephone line and a computer, which means that a small portion of these users would be in a position to access the Internet from their homes in the near future. Furthermore, 86% of users in this particular subcategory cannot gain access to the Internet through their circle of friends and relatives, nor through the academic institutions they attend. Their only possible access to the Internet is through infoplazas or, perhaps, a commercial access point.

The average median monthly family income is approximately $492.30 for the districts where the measured infoplazas are located. Thus, we can get an idea of the significance of the amount spent at the infoplazas by the subset of users by comparing this sum with the amount allocated to recreation by a typical metropolitan area household in the $400.00–499.99 monthly income bracket. For this bracket, data from 1997–98 indicate that the family budget for recreation was just under $40 per month (Contraloría, 2002). According to the latest population census (Contraloría, 2000), a typical household consists, on average, of four members. For a four-member household, $40 per month amounts to about $120 per person per year. The $40 spent per year at the infoplazas by one student household member represents one-third of that member's annual budget devoted to recreation and one-twelfth of the household's annual recreation budget.

A brief glance at the cost of public transportation may also shed some light on the significance of these results. In 2001 a proposal was put forth to "adjust and unify" the prices of the public transit system (buses) in the metropolitan area of Panama City, which had remained virtually unchanged for the past 20 years. The proposal was vehemently opposed by many quarters, resulting in much public protest. Opposition notwithstanding, after the transportation sector agreed to make certain improvements in the quality of the service, the proposal was approved by the government and the bus fare was fixed at $0.25.

Special fees exist for school uniforms for elementary and secondary school students. Elementary school students travel free, while secondary school students pay $0.10 on any metropolitan area bus. Thus, the cost of going from home to school and back again for secondary school students (assuming they require a single bus ride in each direction) is $0.20 per day. Since the school year in Panama has roughly 200 days, secondary students spend approx-

25. A reasonable lower bound given that, as we will see in a later section, users spend on average more than one hour per session.

imately $40 per year in transportation to and from school, more or less the same amount spent at the infoplazas. The fact that secondary school students, who receive an important state subsidy, were among those who most heatedly opposed the increase in bus fees (which in their case was $0.05, up from the $0.05 they were paying previously) gives some idea of what these numbers mean for the pockets of ordinary Panamanian citizens.

User Demographics

In this section we present results on three demographic variables considered in the survey: gender, age group, and occupation. We found that 55% of infoplaza users who completed the survey were male; 45% were female. In terms of age group, 3% of users were under 12 years of age, 58% were in the 12–18 bracket, 35% in the 19–40 bracket, and the remaining 4% were over 40 years of age.[26] As for occupation, the distribution of users is shown in Figure 8.

It is interesting to note that 54% of infoplaza users are students at the elementary, secondary, or technical school level, while 28% of users are university students. Nonstudent users account for the remaining 18%.

Several factors might explain the overwhelming majority (82%) of students among infoplaza users. By virtue of their occupation this group has concrete and continuous information needs which cannot easily be satisfied elsewhere, since public and school libraries in Panama are scarce and, in most cases, deficient in resources. Owing to their youth, students tend to be more attracted than other users to computer games (online and off line) and certain forms of online social interaction such as chatting. Finally, the prices charged for the use of computers at the infoplazas distinctly favor students, particularly elementary, secondary, and technical school students. Until recently, the general public paid four times as much as this group of users for the first hour of computer use and university students paid twice as much.

However, given that one of the main objectives of the Infoplaza Project, as stated in the contract signed by the Infoplaza Foundation and its associates, is to "facilitate access of as many people as possible to the knowledge, use, and benefits of Internet technology . . . so that it may become a practical tool for the maximization of the productive potential of the region [in which the infoplaza is located] and the academic and professional development of its population" (SENACYT, n.d.),[27] an in-depth exploration of the factors contributing to the differential use of infoplazas by students and nonstudents is one of our recommendations. This would allow infoplaza administrators to understand better the needs of their individual communities, thereby enabling them to take specific actions to attract a larger portion of the nonstudent population covered by the infoplazas but who presently do not make use of them.

Typology of Internet Use

Figures 9, 10, and 11 portray three aspects of infoplaza use: (1) reason for visiting the infoplazas, (2) specific chores performed on the computers, and (3) for users who accessed the Internet, the nature of the activities carried out online.

Figure 9 shows the main reasons given are study (45%) and amusement (39%). In the personal category, where users were asked to explain their reasons, answers included "keeping in touch with friends and relatives" and "getting help with a

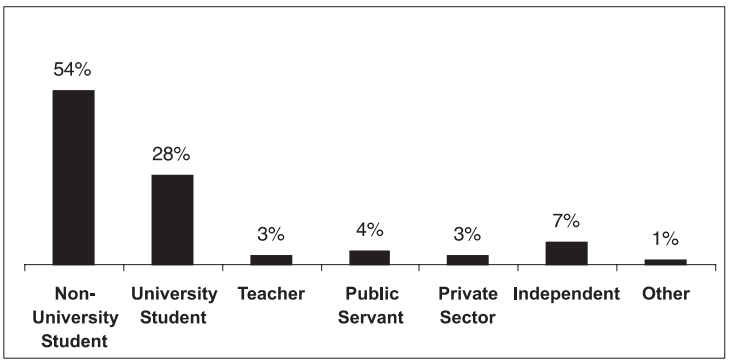

Figure 8. Distribution of infoplaza users by occupation

26. These statistics on age group are derived from the second data set for the reason previously mentioned in the methodology section.
27. Author's translation.

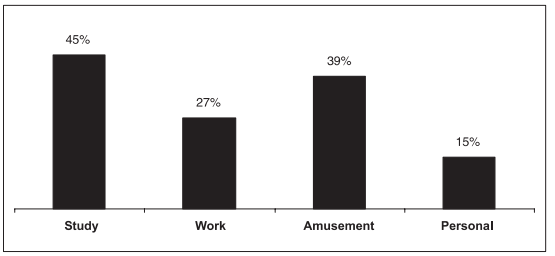

Figure 9. Reasons for using infoplazas

school project for a child." Although there is some overlap among the categories from the original data (not shown), we find that over three quarters of users visit the infoplazas for one of four purposes: study, work, amusement, and personal.

As Figure 10 makes plain, computers at infoplazas are used primarily to gain access to the Internet: 92% of users use computers for this purpose. This use stands far above the closest runners-up: word processing and printing, with 24% and 22% users engaging in these activities, respectively. As for games, we must point out that the original question was ambiguous on this item, not making it clear that it referred to games *off line* (*online* games were included under the Internet category). Thus, we suspect from observing the raw data that the 15% shown in the graph under games includes those who play games both on- and off line.

Finally, in Figure 11 we see that the main activities conducted on the Internet are searching for specific information and e-mail, followed by chat, entertainment, and surfing the Web. From the original data (not shown), we find that 44% of users engaged in a single activity on the Internet; 25% performed two activities, and 20% performed three activities. It is interesting to note that only 17% of infoplaza users who accessed the Internet visited Web sites whose content was in some way related to Panama, either a Panamanian Web site or a site with content on Panama.

Cross tabulations between pairs of variables were performed in the hopes of discovering statistically significant relations or behavioral patterns which might be relevant to the impact of the infoplazas. The results that follow were obtained by means of contingency tables in which a probability of $P = 0.05$ was set as the threshold for rejecting the null hypothesis: namely, there is no association between the pairs of variables considered. In the tables below, boxes corresponding to significant associations are highlighted and the level of significance (*P–value*) is given.

Table 1 exhibits the relationships between reasons for visiting the infoplazas and two user characteristics, gender and occupation.[28] A significant relation was found between gender and amusement. Apparently women are less likely to use infoplazas for entertainment. On the other hand, occupation was found to be significantly associated to both amusement and personal reasons for using infoplazas. Concretely, non-university students (i.e., elementary, secondary, and technical school students) seem more likely than other users to use infoplazas for fun, but less likely to use them for personal reasons.

Table 2 shows the results of cross tabulations between specific activities carried out on the Internet and user characteristics. Significant associations were found between gender and three online activities: e-mail, entertainment, and chat. In all cases, men were more likely to engage in the particular activity than were women. As for occupation, we found statistically significant associations with the use of Internet for enter-

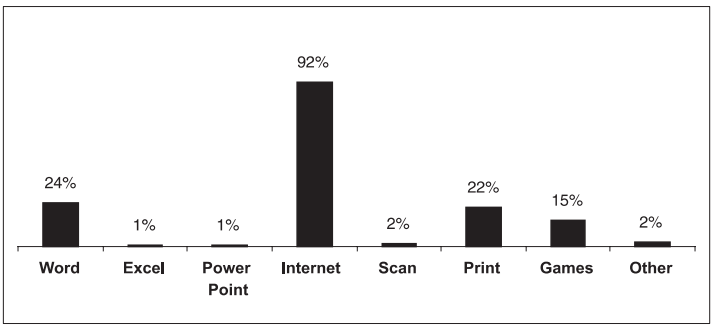

Figure 10. Use of computers in infoplazas

28. In the survey, the original occupation *variable had seven categories. For purposes of this cross tabulation, however, it was consolidated into a dichotomous variable with two categories:* non-university student *and* other.

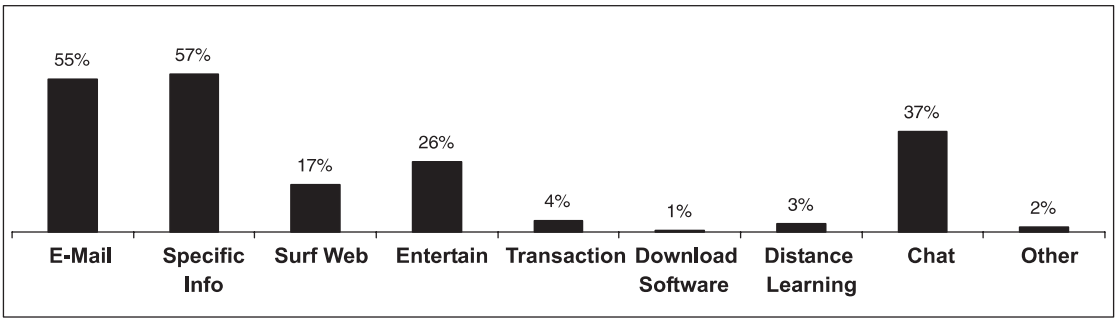

Figure 11. User activities on the Internet

Table 1. Cross tabulations between reasons for using infoplazas and user characteristics

Reasons for Using Infoplazas		User Characteristics			
		Gender		Occupation	
		Men (100%)	Women (100%)	Non-University Student (100%)	Other (100%)
Study	Yes	39%	53%	49%	41%
	No	61%	47%	51%	59%
Work	Yes	24%	30%	21%	33%
	No	76%	70%	79%	67%
Amusement	Yes	49%	28%	48%	29%
	No	51%	72%	52%	71%
		P = 0.004		P = 0.011	
Personal	Yes	17%	12%	10%	21%
	No	83%	88%	90%	79%
				P = 0.030	

tainment and chat. Non-university students appear to be more inclined to these types of activities on the Internet than other users.

If in Tables 1 and 2 university students are included with the rest of students, the results vary somewhat. In Table 1 we find that students become more likely to use infoplazas for study than nonstudents, and less likely to use them for work, whereas the students remain less likely to use them for personal reasons. In Table 2 the only significant association we find now is with chat. In general, students continue to be more inclined to chat than nonstudents.

It is interesting to note that when university students are included, the relation in Table 1 between occupation and amusement ceases to be significant. The same is true of the association in Table 2 between occupation and entertainment. This suggests that the significance of these associations may not have been because the user is a student but due to some other factor, such as age. Cross tabulations using the age data (from the second set of measurements) appear to confirm this. Users under 19 years of age are significantly more likely to use infoplazas for amusement and to engage in entertainment activities on the Internet than older users.

Possible relations involving physical and geographic location of infoplazas were also examined.

Table 2. Cross tabulations between main activities carried out on the Internet and user characteristics

Activities on the Internet		User Characteristics			
		Gender		Occupation	
		Men (100%)	Women (100%)	Non-University Student (100%)	Other (100%)
Electronic mail	Yes	62%	37%	46%	56%
	No	38%	63%	54%	44%
		P = 0.001			
Search for specific information	Yes	51%	55%	53%	52%
	No	49%	45%	47%	48%
Surf the Web	Yes	20%	10%	12%	19%
	No	80%	90%	88%	81%
Entertainment (videos, music, games, etc.)	Yes	32%	12%	33%	13%
	No	68%	88%	67%	87%
		P = 0.002		P = 0.002	
Chat	Yes	40%	25%	44%	22%
	No	60%	75%	56%	78%
		P = 0.030		P = 0.003	

Since 4 of the 11 infoplazas surveyed were located in public libraries, we defined a physical space variable with two categories: public library and other. Tables 3 and 4 summarize our findings.

Significant associations were obtained between physical space and two reasons for using the infoplazas: study and amusement. It seems that infoplazas located in public libraries are more likely to be used for study and less for amusement. Locating infoplazas in public libraries also appears to have significant bearing on the type of Internet activities carried out by users. In particular, users in public libraries appear to be more inclined to use the Internet to search for specific information, but less inclined to use it for entertainment or chat. These results are consistent with the relationships found between physical location and reasons for using the infoplazas (Table 3).

The apparent influence of physical space on user behavior in virtual space may be to some extent the result of different use policies imposed by infoplaza administrators. In some infoplazas located inside public libraries, for instance, administrators gave priority to those whose motives for using a computer were school- or work-related, above others whose motives they considered "frivolous" or "a waste of time."

Finally, we considered the dichotomous variable, geographic location, with categories "Panama City" and "Interior." For this variable, the only significant relation we found was with the activity search for specific information, which seems to point to a greater dependence on infoplazas as a source of information in the interior of the country, compared with Panama City. This result, shown in Table 5, provides evidence for the need to establish more infoplazas in the interior where people have fewer, if any, information resources available to them.

Second Set of Measurements

As previously mentioned, the count and survey were repeated on June 2003, two months after the first measurements were carried out, to detect changes in the statistics over time. The second measurement found an average arrival rate of 7.30 visits/hour/infoplaza. This rate is higher than the rate we found in April 2002 (6.46 visits/hour/infoplaza). In testing the significance of the increase, the rate was not found to be statistically significant (the same is true

Table 3. Cross tabulations between reasons for using infoplazas and physical location

Reasons for Using Infoplazas		Location Characteristics: Physical Space: Public Library (100%)	Location Characteristics: Physical Space: Other (100%)
Study	Yes	60%	38%
	No	40%	62%
		P = 0.005	
Work	Yes	26%	27%
	No	74%	73%
Amusement	Yes	26%	45%
	No	74%	55%
		P = 0.012	
Personal	Yes	12%	17%
	No	88%	83%

Table 4. Cross tabulations between activities carried out on the Internet and physical location

Activities on the Internet		Location Characteristics: Physical Space: Public Library (100%)	Location Characteristics: Physical Space: Other (100%)
Electronic mail	Yes	47%	53%
	No	53%	47%
Search for specific information	Yes	64%	47%
	No	36%	53%
		P = 0.036	
Surf the Web	Yes	17%	15%
	No	83%	85%
Entertainment (videos, music, games, etc.)	Yes	14%	28%
	No	86%	72%
		P = 0.035	
Chat	Yes	19%	40%
	No	81%	60%
		P = 0. 004	

Table 5. Cross tabulations between activities carried out on the Internet and geographic location

Activities on the Internet		*Location Characteristics: Geographic Location: Panama City (100%)*	*Location Characteristics: Geographic Location: Interior (100%)*
Search for specific information	Yes	41%	61%
	No	59%	39%
		P = 0.007	

if one uses serviced visits instead of visits). The fact that the difference turned out to not be significant would imply that the increase is probably due to sampling variation as opposed to an actual difference over time in the average arrival rate. The calculations involved in the test, however, may not be entirely reliable (a relatively small sample size—23 measurement periods—was used in the second count), so this result should be interpreted with caution.

We believe the greatest differences will be observed between the vacation months (December through February) and the rest of the year when school is in session. In fact, we intended to obtain our first data set during the vacation period precisely for this reason. Unfortunately, official permits to carry out our study were granted in March, just after the beginning of the 2003 school year, and we were not able to gather our first measurements until April. To settle the seasonality question more definitively, future studies should include measurements obtained during the vacation months.

In the second data set we attempted to make up for the lack of information in the first data set on the socioeconomic background of infoplaza users. To this end, questions were added inquiring about the occupations of users' parents. Results are shown in Figure 12.

In the Figure 12 classification, groups 0–9 correspond to the categories of the International Standard Classification of Occupations, ISOC-88.[29] We

29. Group 0 = armed forces; group 1 = legislators, senior officials, and managers; group 2 = professionals; group 3 = technicians and associate professionals; group 4 = clerks; group 5 = service workers and shop and market sales workers; group 6 = skilled agricultural and fishery workers; group 7 = craft and related trades workers; group 8 =

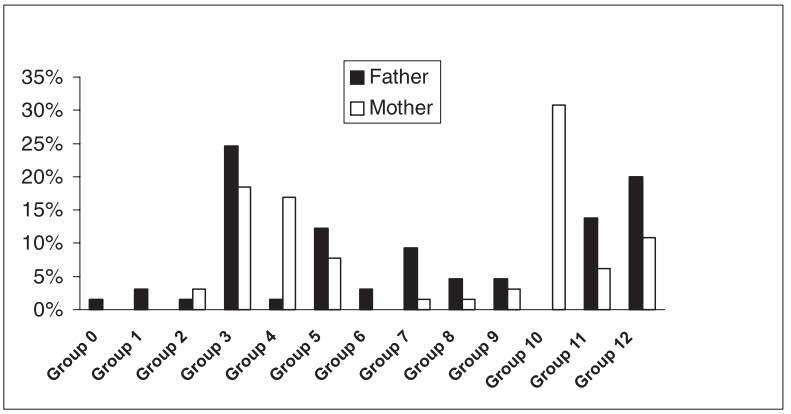

Figure 12. Classification of users' parents' occupations

have included three more groups: group 10 represents those who stay at home to attend to house chores; group 11, retired people; and group 12, those who left the question unanswered. As can be seen, fathers' occupations are concentrated in technical areas, service and commerce, and crafts and trades. Many fathers are retired. Interestingly, for a significant number of fathers no occupation was given. Mothers' occupations lie mostly in technical fields and the service and commerce sector, but include office jobs as well. A large percentage of mothers stay at home. For many, no occupation was reported.

A few questions about time spent at infoplazas and main reason for leaving were added to the second survey. We found that 65% of users spent over an hour in the infoplazas, despite the $0.25 charge for each additional hour. Moreover, the main reasons given for leaving were: "finished what I came here to do" (46%), and "have something else to do" (31%). Only 17% said their reason for leaving was financial ("don't want to spend more money"). These results would seem to indicate that the prices presently charged are affordable for most infoplaza users.

Conclusion

This study had two major goals: first, to design and implement a tool to assess the use of infoplazas; and second, to use this instrument to explore the contribution of infoplazas in overcoming the existing gap in Internet connectivity and use in Panama.

The tool consists of a *count* and a *survey.* Both parts are necessary since they gather complementary information. For example, to calculate the number of users who access the Internet through infoplazas each year, we need to know the average arrival rate (obtained from the count), along with the average number of visits per year per user (obtained from the survey), and the portion of Internet users (also from the survey).

Implementing the count required determining the number, length, and time of day of the measurement intervals. Preliminary measurements of different durations, conducted at different times of the day at an infoplaza in Panama City, suggested that four 30-minute intervals, beginning at 9:00 a.m. and spaced by periods of 2 to 2.5 hours, would probably be sufficient to estimate adequately the average arrival rate.[30]

In the first round, 11 infoplazas were measured, and the first data set was based on a total of 43 measurement periods. This sample yielded an average rate of 5.02 serviced visits/hour/infoplaza. The error of estimate was about 27%. To reduce this error to 10% would have required approximately 160 hours of measurements. Ideally, these should be spread over an entire year to allow for possible variations in arrival rate related to the seasonality of the school year. One could measure, for instance, 10 infoplazas 4 times a year for 4 hours each time. Other equally reasonable measurement schemes are possible. What matters is that: (1) the combination must contain the minimum number of hours to guarantee the estimate is within the maximum acceptable error; and (2) the hours must be distributed so as to capture the daily and yearly variation in the

plant and machine operators and assemblers; group 9 = elementary occupations. For further details on this classification visit www.warwick.ac.uk/ier/isco/frm-is88.html.

30. For future measurements, we feel it would be preferable to work with 1-hour periods. Besides being in some sense a more "natural" time interval to work with, it would also lead to greater overlap between the counted and surveyed population, since most people stay at least 1 hour at the infoplazas.

mean rate of serviced visits. We plan to formalize in the near future a count protocol proposal taking into account the experience gained in the course of this preliminary study.

We wish to emphasize that, besides being relatively easy to carry out, another virtue of the method is that its implementation does not require participation of the agency responsible for administering the infoplazas. Nor does this method use official statistics in the computations performed (official figures were used only to verify the plausibility of certain results). Thus, comparable estimates could be obtained across countries by an external observer, avoiding possible complications related to authorities not granting or delaying permissions, or lack of availability or reliability of previous statistics.

As for the second objective—using this instrument to explore contribution of infoplazas—we found that the mean arrival rate was 6.46 visits/hour/infoplaza and the number of infoplaza users accessing the Internet through these centers was, after correcting for observation bias, of the order of 8,000.[31] Our results suggest that a considerable number of visits (about 20%) were not serviced. Thus, the average hourly rate of serviced visits per infoplaza was only 5.02. Computer congestion at certain peak hours seems to be the major culprit. To further explore this situation, refinements to the count protocol are necessary. These should include keeping track of users who wait in line for a computer and the time they wait. Our results also suggest that more visits are serviced annually at the infoplazas (393,390) than official records indicate (241,294). This may be because in our measurement protocol users sharing a computer were counted individually, whereas infoplaza databases register only one user per computer. To investigate this issue, future studies should include maintaining records of users who share computers, as well as the number of people they share with.

Our data indicate that the majority of infoplaza users (62%) use these centers on a regular basis, and almost all (92%) use them to access the Internet. Over half of infoplaza users (55%) do not have access to the Internet from the house of a friend or relative, school or university, or work; and 41% of these users have never used commercial access sites to connect to the Internet. Hence, we estimate that in practice infoplazas constitute the only real connectivity option for about 25% of all infoplaza users. To improve this estimate of user dependence on infoplazas, however, future surveys should inquire in greater detail about access and use of cybercafés and the like, and about the socioeconomic background of infoplaza users. As with the count protocol, we plan to update our survey format to reflect the lessons learned in carrying out this project.

Among those presently covered by the infoplazas, we estimate that about 2% (approximately 1 of every 50 people covered) use them to connect to the Internet. In our sample, a majority of users (82%) are students, and more than half of all users (54%) are students from elementary, secondary, or technical schools. Such low attendance and use by the general public seem to indicate a need to broaden the infoplazas' user base by, among other things, making these centers and their content more relevant and meaningful to their respective communities. Greater efforts on the part of the Infoplaza Project coordinators should be directed toward identifying specific information and communication needs of the communities in which infoplazas are located, which in turn, would enable infoplazas to offer customized applications, content, and services that truly respond to local needs and aspirations.

Finally, there is the fundamental question: How many infoplazas are needed to close Panama's digital divide? This question requires, of course, some qualification. First, as Norris (2001) points out, the digital divide is a multidimensional phenomenon, made up of many social chasms, such as the gender divide, the income divide, and the age divide. In this context, however, we simply mean the general access gap. Second, we must specify with respect to what country the gap is being considered. The United States would appear to be a good candidate, since it is one of the leaders in terms of ICT adoption and is a standard reference in many other regards.

According to various studies conducted by The Pew Research Center, approximately half the U.S. population is currently online (Norris, 2001). Hence, we can rephrase our question as: How many infoplazas would it take for half of Panama's population to have access to the Internet? This question,

31. A great deal of uncertainty may be associated to this number. It is to be taken simply as a working estimate.

too, ought to be qualified as the answer will depend on population density, and Panama presents extreme contrasts in this regard. Specifically, the average population density in regions of *high* and *mid-high* socioeconomic development (according to Herrera's categorization), is 273.1 inhabitants/km^2, whereas in regions of *middle* to *very low* socioeconomic development the mean density is 18.5 inhabitants/km^2.

Thus, in reformulating the question we ask how many infoplazas are needed to cover half of the population in the more developed regions and half in the less developed regions. Using the same characterization of coverage and easy access as before, we find that the number of infoplazas needed to cover 50% of Panama's population, in the manner described above, is in the order of 8,000.

This calculation does not take into account cybercafés and other commercial access sites which are increasingly common in the more populated communities. However, over 90% of these 8,000 infoplazas represent the coverage needs of the less developed regions of the country, where people are unlikely to be able to procure access to ICTs by their own means, and where chances for establishment of commercial Internet access sites in the near future appear slim. This figure is two orders of magnitude greater than the number of infoplazas presently in existence.

The fact than in Panama only 39 infoplazas have been created in the 4 years since the project took off seems even more worrisome when one compares the Panamanian results with the results of the Peruvian Cabinas Públicas Project, for instance, which was the inspiration for the Panamanian infoplazas. In less than a decade, the Peruvian model has resulted in the creation of over 2,000 cabinas públicas, and estimates indicate that approximately 8 of every 10 Internet users in Peru (just over 80%) gain access to the Internet through a cabina pública (Bossio, 2002). These numbers stand in stark contrast to the Panamanian experience, where, at most, 7% of Internet users connect to the Internet through an infoplaza. It would seem, then, that if the Infoplaza Project truly aspires to provide sufficient coverage to close the gap within a reasonable time frame, other strategies for the creation of more infoplazas, in addition to those currently in place, should be considered.

One final thought. In the previous paragraphs we have offered an answer to the question of how to close the digital divide in Panama. We must keep in mind that this answer addresses only the first and most obvious aspect of the divide: namely, the connectivity gap. Some authors (e.g., Castells, 2001) would argue that the knowledge gap may well constitute the most important dimension of the digital divide. This a much harder problem to tackle. On the one hand, there is no easy way to define the knowledge gap and measure progress in overcoming it. On the other hand, the knowledge gap stems largely from chronic problems in countries' educational systems. Thus, overcoming the knowledge gap is one of the major challenges facing the nascent information society. ■

Appendix A

First Survey of Infoplaza Use

Please indicate your answer by clearly marking the corresponding box.

1. Age group:
☐ Younger than 12
☐ Between 12–18 years old
☐ Between 18–40 years old[32]
☐ Older than 40

2. Gender:
☐ Female
☐ Male

3. How often would you say you use this infoplaza? (Mark *only one* option)
☐ Occasionally (1–6 times per year)
☐ Monthly. Please specify how many times per month: _____
☐ Weekly. Please specify how many times per week: _____
☐ Daily

4. Have you used other infoplazas?
☐ Yes. How many? _____
☐ No

32. This is the overlap error we pointed out in the article.

5. Have you used commercial access points (e.g. cybercafés) to access the Internet?
- ☐ Frequently
- ☐ Once in a while
- ☐ Never

6. What were your reasons for using this infoplaza *today?* (Choose all that apply)
- ☐ Study
- ☐ Work
- ☐ Entertainment
- ☐ Personal reasons. Please specify:_____

7. Indicate which of the following are available to you in your place of residence (Choose all that apply):
- ☐ Telephone
- ☐ Television
- ☐ Cable T.V.
- ☐ Cell phone
- ☐ Computer
- ☐ Internet
- ☐ None of the above

8. Indicate the places from which you have access to the Internet:
- ☐ The house of a friend or relative
- ☐ School or university
- ☐ Work
- ☐ Infoplazas

9. How long did it take you to reach this infoplaza from your home, work or place of study?
- ☐ Less than 10 minutes
- ☐ Between 10 and 20 minutes
- ☐ More than 20 minutes

10. What form of transportation did you use to reach this infoplaza?
- ☐ By foot
- ☐ Public transportation
- ☐ Private car[33]

11. Your permanent place of residence is:
- ☐ In Panama[34]
- ☐ Outside of Panama

12. What would you say is your level of comprehension of written English?
- ☐ None
- ☐ Basic
- ☐ Intermediate
- ☐ Advanced

13. What is your occupation?
- ☐ Elementary, secondary or technical school student
- ☐ University student
- ☐ Teacher
- ☐ Government employee or public sector
- ☐ Private sector employee
- ☐ Independent
- ☐ Unemployed
- ☐ Other. Please specify: _____

14. Indicate the highest level of studies you have completed:
- ☐ Elementary school
- ☐ Junior-high school
- ☐ High school
- ☐ Technical career
- ☐ Bachelor degree
- ☐ Masters degree
- ☐ Doctoral degree

15. What activities did you perform on the computer *today?* (Choose all that apply, even if the infoplaza administrator or some other person helped you or performed them for you)
- ☐ Using a text editor (e.g., Word)
- ☐ Using a spreadsheet (e.g., Excel)
- ☐ Preparing a presentation (e.g., PowerPoint)
- ☐ Accessing the Internet
- ☐ Scanning documents
- ☐ Printing documents
- ☐ Games
- ☐ Other. Please specify: _____

16. If you used the computer to access the Internet today, what activities did you perform on the Internet? (Choose all that apply)
- ☐ Use e-mail
- ☐ Search for specific information

33. Future surveys should include "bicycle" as another option. In our case, only one person came by bicycle.
34. This question referred to the country of Panama. That should be made explicit in future surveys.

☐ Explore the World Wide Web
☐ Entertainment (videos, music, games, etc.)
☐ Perform commercial transaction (e-commerce, bank transaction, pay taxes, etc.)
☐ Download software
☐ Distance learning
☐ Chat
☐ Other. Please specify: _____

17. If you used the Internet *today,* did you visit any Panamanian Web page or Web site, or a site with content pertaining to Panama?
☐ Yes. Please specify: _____
☐ No

Thank you very much for your cooperation

Three additional questions were included in the second survey taken in June 2002.

18. What is your parents' occupation?
☐ Father: _____
☐ Mother: _____

19. How long did you remain at the infoplaza *today?*
☐ Less than 1 hour
☐ More than 1 hour, but less than 2 hours
☐ More than 2 hours

20. What was the main reason for leaving *today?*
☐ Have something else to do (work, study, social engagement, . . .)
☐ Don't want to spend more money
☐ Finished what I came here to do
☐ Other. Please specify: _____

Appendix B

Computation of amount spent by students under 19 years of age who regularly use infoplazas:

Regular users were defined as those who use infoplazas on a weekly or daily basis. From the original data set, weekly users were found, on average, to use infoplazas 2.43 times a week; daily users are assumed to use infoplazas 5 times per week.

At a rate of $0.25 for the first hour, and assuming user sessions last 1 hour (probably an underestimate), weekly users would spend $31.59 each year, while daily users would spend $65 per year.

From the second data set we find that of students under 19 who use infoplazas regularly, 79% use them weekly, and 21% use them daily. Using these weights yields an average of $38.74 spent each year by regular users.

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