CONVERGENCIA
REVISTA DE CIENCIAS SOCIALES

https://doi.org/10.29101/crcs.v0i79.10332

# Digital divide, frequent use of Internet and benefits in Mexico

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**Abstract**: Despite the need to validate the assumptions that intend to participate in the construction of the theory, the digital divide of frequent Internet users in the socioterritorial approach constitutes an unusual path. Considering this situation, this contribution has the objective of determining the validity of a multistage accessibility model moderated by the population size of Mexican localities. The research is based on microdata from the National Survey on Availability and Use of Information Technologies in Households, and for the validation of its hypothesis, it recurs to modeling with structural equations. Within the framework of this exploration, the multidimensionality and the high level of abstraction of the second-order constructs used in the research model are verified, revealing significant differences between groups of population size. Overall, the findings seem to show a frequent use that does not reflect in all cases skills of use and benefits use of the Internet.

**Key words:** digital divide, multistage accessibility, frequent users, beneficial use, locality size.

**Resumen:** El abordaje de la brecha digital en el contexto de los usuarios frecuentes de Internet constituye un acercamiento poco usual, a pesar de la necesidad de validar los supuestos socioterritoriales que pretenden participar en la construcción de su teoría. Con base en ello, este artículo tiene el objetivo de averiguar la validez de un modelo de accesibilidad moderado por el tamaño de las localidades donde habitan los usuarios mexicanos. La investigación se sustenta en microdatos de la Encuesta Nacional sobre Disponibilidad y Uso de las Tecnologías de la Información en los Hogares (Inegi, 2016[a]) y recurre a la modelación con ecuaciones estructurales para la validación de las hipótesis planteadas. Los resultados de la investigación dejan entrever una multidimensionalidad en el modelo socioterritorial, la cual es estructurada alrededor de diferencias significativas entre grupos locales y un uso frecuente que no parece asociado en todos los casos con habilidades y un aprovechamiento de Internet.

**Palabras clave:** brecha digital, accesibilidad multietápica, usuarios frecuentes, aprovechamiento del uso, tamaño de localidades.

Recepción:
02/05/18

Aprobación:
24/09/18

## Introduction

By and large, digital divide has been a generic concept focused on population's availability and material access to Internet, positioning in the logic of those who have access and those who do not (Chen, 2003; Schleife, 2010; Warf, 2001). However, beyond the physical accessibility to the web, other approaches also evince a digital divide that depends on the skills and use of the Internet users themselves (DiMaggio et al., 2004; van Deursen e*t al.,* 2015b).

The digital appropriation of Internet as a means to obtain benefits and advantages becomes a research concept to enquire, among other aspects, on the limits and barriers that hinder this sort of use. Studies on these spheres are few, and somewhat circumstantial, and as regards the exploration of the impact of the localities' size on the final appropriation of the web are virtually inexistent (Blank and Groselj, 2014; Hargittai and Hinnant, 2008; van Deursen, 2015b). Beyond the intellectual challenge of monitoring the impact of location on the final stages of the digital divide, this knowledge also allows designing policies and localized strategies to improve the use and harnessing of the web.

The productive specialization of specific areas that favors ICT development, in addition to pinpoint relatively disconnected and forgotten spaces, also expresses a relation of order and hierarchies in the case of the territories connected to the web (Castells, 2000; Gillespie and Williams, 1988). In the context of these relations and implications, the validation of the research on the causal links that influence on the digital breach may resort to one of the theoretical models, which allow explaining the final appropriation of Internet (Toudert, 2016; Tirado-Morueta *et al.*, 2017; van Deursen and van Dijk, 2015).

In this sense, the multi-stage accessibility model is one of the most explanatory instruments of the logics of use and harnessing of the Internet, both by users and non-users. This gives the appropriation of the Internet a multi-stage dimension, which also allows monitoring the frequent users of the Internet, who are usually excluded from the population linked to the digital divide.

The present study has as a goal to verify, in the first place, the validity of the multi-stage accessibility model, which enables explaining the final appropriation of the Internet in the context of frequent users in Mexico. Following, we will analyze the moderating consistency of four different sizes of residence localities of users involved in these processes of Internet appropriation.

## Literature review and hypotheses

### *Internet uses: demographic sizes of agglomerations*

The importance that the size of localities has in the adoption and use of Internet was not considered, generally, because of the prominent perspective, as a factor with a direct incidence (Toudert, 2015; Shleife, 2010; Sinai and Waldfogel, 2004). For such perspective, a possible impact would be, according to Sinai and Waldfogel (2004) and Shleife (2010), the territorial weight of specific demographic segments, which usually influence on such practices. Segments defined by the proportion of youth population, students, ethnical minorities, foreigners, highly-qualified unemployed and employed people, among others, were evinced by their incidence on the sort and appropriation stages of the Internet at various territorial scales (Chen, 2013; Pick *et al.*, 2015).

The research on the impact of location allowed linking the adoption and use of Internet with various structures and sorts of territorial organization (Agarwal *et al.*, 2005; Shleife, 2010; Chen, 2013; Pick *et al.*, 2015; Pick *et al.*, 2015; Shleife, 2010; Sinai and Waldfogel, 2004). In the context of this search, we displayed items of evidence of the variation in the digital breach in function of the *vis a vis* location of the dominant urban and metropolitan agglomerations (Toudert, 2015; Grubesic, 2006; Chen, 2013; Pick *et al.*, 2015). However, the studies that focus on the demographic weight of the localities are scarce, and even fewer as regards the final appropriation of Internet by frequent users (Toudert, 2015; Billón *et al.*, 2008).

The incidence of population size in the use and adoption of Internet makes sense, usually, with the increase in revenues as the network expands, a characteristic of what is known as network effects (Shleife, 2010; Goolsbee and Klenow, 2002). Such effects were evinced by Goolsbee and Klenow (2002), in the case of ICT dissemination by means of devices with access to Internet, by Agarwal *et al*. (2005) in the decision making of whether accessing the web and by Billón *et al.* (2008) and Shleife (2010) in the probability of becoming a user.

Thus, the adoption level of ICT in a community seems to have a transcendent role in the dissemination of the use toward the other non-user inhabitants (Agarwal *et al.*, 2005; Billón *et al*., 2008). Additionally, this seems to surpass the influence of the market size in the availability of the infrastructure that conditions the offer of Internet service, mainly in developing countries (Toudert, 2015; Pick *et al.*, 2014).

From a different standpoint, there are other readings that come from the center-periphery logic as regards the adoption and use of Internet as a substitute means to compensate the distance from the centers and/or a complementary one to potentiate the existing capacity (Billón *et al.*, 2008; Shleife, 2010; Sinai and Waldfogel, 2004).

The substitute function comes into play in low-density localities via the adoption of Internet to remediate lack of interaction and access to the offer of a virtual mode of interaction; whereas complementariness intervenes in high-density localities to expand and diversify the offer in face to face interactions. From this logic, low-density localities are more prone to adopt Internet when the evidence seems to pinpoint at the coexistence of substitution and complementariness (Shleife, 2010; Sinai and Waldfogel, 2004).

## Theoretical-conceptual support of the research model

The present study will be approached by adapting the Multifaceted Model of Internet Access, proposed by van Deursen and van Dijk (2015), to the conditions and needs of the research. The initial model of the authors above was supported on a concept of digital divide structured by the four successive stages: motivational access to Internet, material access to Internet, skills to access Internet and access to productive use of the Internet. Since this article exclusively focuses on the frequent users of Internet, the motivational stage seems to be reasonably met, therefore it will be discarded in the present research model.

### Material access to Internet

This stage of the digital divide focuses on displaying the differences in Internet availability, the technological gadget that allow accessing and the accessibility levels of the users (Toudert, 2016; van Dijk, 2005; DiMaggio *et al.*, 2004). This is initial step to Internet appropriation occurs, in the first place, in the possibility to connect to the web in the places where one remains the longest (house, job or school). The availability of connection in these places became, in the few references on this subject, better disposition to use and harness the Internet (Toudert, 2016; Zhao *et al.*, 2010).

In like manner, access to various technological gadgets (computers, tablets, smartphones and smart TVs, among others) was considered essential to access various sorts of contents (van Deursen and van Dijk, 2015). As regards these aspects, despite the great advance in Internet

dissemination, the digital divide is still ample, mainly between those who have the gadgets and Internet connection and those who do not (Toudert, 2015; Pick *et al.*, 2014).

These differences are stressed by the cost and quality of the Internet service and mobile telephony, which are provided unevenly, depending on the hired plans and even in the same plan. At the level of users, the set of such differentiations expresses as a variation in the effectivity of the available service, and indeed, as its usefulness to access and use Internet. The restrictions imposed by the variation in the quality of the reception signal tends to build dissatisfaction and living bad experiences, which usually discourage the user to progress in the use of the web (Narteh, 2015; Meuter *et al*., 2000).

## Skills to access the Internet

The structure and the sophistication degree of the contents available on the Internet contribute to user segmentation in function of their skills to access such contents and make the most of them (Hargittai, 2002; van Dijk, 2005). These user skills define what Hargittai (2002) and van Dijk (2005) characterized as the second level of a digital divide, structured by a number of determinants of use and harnessing of Internet. As a set, the determinant skills come from the social cognitive theory and to a large extent, define the perception of individual capacity to undertake actions which enable reaching a goal they set for themselves (van Deursen and van Dijk, 2009).

In the literature on inequalities in the use of Internet, the skills are self-reported by the users or measured by direct interaction (Hargittai and Hinnant, 2008; Hargittai, 2002; van Deursen and van Dijk, 2009). These two approaches concur in relating online actives with dexterities necessary to carry such activities, as it is the case of basic activities to use a browser, perform a search and fill in questionnaires, which require operational skills. However, browsing and orientation need formal skills, locating and assessing the information by means of informational skills, and finally following the right road to reach the assigned objective that demands unfolding strategic skills (Toudert, 2016; Tirado-Morueta *et al.*, 2017; van Deursen and van Dijk, 2009).

## Access to productive use of Internet

This last stage closes the conceptual structure of the digital divide embodying various pragmatic finalities into the users' individual practices. In this sense, once the users pass the previous stages of the digital divide, both time and frequency of use and sort of online activities become decisive to access benefits and advantages (Blank and Groselj, 2014; Hargittai and Hinnant, 2008; van Deursen *et al.*, 2015b). In spite of the scarce research engaged in these aspects, Zhao *et al.* (2010) showed, in the educative sphere, that time and frequency of use become decisive in the productive use of Internet when the place of consultation is considered (house, school, cybercafés). Analyzing the use of Internet by the German population, van Deursen and van Dijk (2014) noticed that those with a low education level spent more free time in social media and leisure activities. In the same order of ideas, the impact of the parents' increasing education was conclusive in school performance induced by Chinese student's online activities (Zhao *et al.*, 2010).

These findings reflect, according to van Deursen and van Dijk (2015), the persistence of social differences that in the past characterized other sorts of technology uses; moreover, Zhao *et al*. (2010) stressed the prevalence of urban-rural disparities in school performance by means of online activities. In the context of these considerations, time and frequency of use are essential to acquire tacit and super tacit knowledge which, once combined with the right online activities, become a link of better use of the web's resources (Malecki, 2016).

The same activities are relevant indicators themselves, owing to this, they are conceptually systematized and ordered in function of its potential incidence in professional or school performance or in other aspects of the users' lives (Tirado-Morueta, 2017; van Deursen and van Dijk, 2015; Zhao *et al.*, 2010).

## Hypotheses of the research model

The present research retakes three main hypotheses of the Multifaceted Model of Internet Access, proposed by van Deursen and van Dijk (2015), to analyze the moderating effect of the locality size on these causal relationships. The set of such hypotheses is supported on the successive stages in the Internet appropriation of van Dijk (2005), based on the conceptualization of the access divides and their relations with one another (Ghobadi and Ghobadi, 2015). In the context of such conceptual

scaffolding, having material access to Internet and access points were deemed influential on the development of the users skills (Toudert, 2016; Tirado-Morueta, 2017; van Deursen and van Dijk, 2015; Zhao *et al.*, 2010). In like manner, the availability of material access to Internet was considered with a positive and significant impact on the productive access to Internet (Toudert, 2016; van Deursen and van Dijk, 2009 and 2015), which was significantly benefited from the increasing impact of the users' skills (Toudert, 2016; van Deursen and van Dijk, 2015).

On the basis of the previous explorations, we put forward the following hypotheses:

H1: the increase in material access to Internet positively and significantly impacts on Internet access skills.

H2: the broadening of material access to Internet positively and significantly influences on the productive access to Internet.

H3: the increasing availability of skills to access Internet generates a positive and significant impact on access to the productive use of Internet.

By considering there is not sufficient direct evidence yet to validate the mediation of the demographic size in the causal relations of the research model, the study proposed approaching this aspect. Supported on the crossed verification of previous works by Agarwal *et al.* (2005), Billón *et al.* (2008), Shleife (2010) and Goolsbee and Klenow (2002), the mediation of the demographic size would be more likely to be concluding, being characterized by significant differences of relations H1, H2 and H3.

## Methodology and data

### *Instrument and sampling*

This research resorted to data from the "Encuesta Nacional sobre Disponibilidad y Uso de las Tecnologías de la Información en los Hogares (ENDUTIH-2015)" [National Survey on Availability and Use of Information Technologies at the Households], applied by Instituto Nacional de Estadística y Geografía, Inegi [National Institute of Statistics and Geography] from June 8th to July 31st, 2015 (Inegi, 2016a). The survey was applied to 90,030 households and 292,055 people older than 6 years of age were interviewed, distributed over the 32 States of the Mexican Republic to accomplish an estimation at a proportion of 1%, a 90-percent confidence level, a maximum relative error of 10.48% and a no-response rate of 15% (Inegi, 2016a).

A percentage of 61.8 of the respondents was users of Internet, of which 114,334 people use it everyday (Inegi, 2016b). These frequent users of Internet are the study's target population and their answers to the questionnaire are the data involved in the assessment of the research model, displayed in figure 1.[1]

## Characterization of variables and measurement scales

The diversity in the data structure of the analyzed survey required using PLS (partial least squares) techniques to enable the incorporation of various dimensions and measurement scales (Falk and Miller, 1992). The above, in addition to avoid cumbersome adjustments that other methods would require, for instance the one based on the analysis of covariances, permits operating in the context of latent training, with data that lack normal distribution and theoretical context in construction stages (Chin, 1998).

The proposed research model includes 15 manifest variables, four of which are related to the construct: Internet access skills, as reflective indicators (see table 2). The manifest variables are incorporated into two second-order constructs: material access to Internet and access to productive use of Internet. The research model was assessed as a set in the context of four groups of localities defined by the number of inhabitants: G1 (more than 100,000), G2 (from 15,000 to 99,999), G3 (from 2,500 to 14,999), G4 (fewer than 2,500).

Measurements to characterize the dimensions of the study were made possible owing to the adaption of the survey data. Several of these analyzed dimensions were also used in other studies (Toudert, 2016; Lee, 2009; Min, 2010; Suárez *et al.*, 2016; van Deursen *et al.*, 2014; van Deursen and van Dijk, 2015). Material access to Internet was characterized as a two-dimensional second-order construct composed of material access and satisfaction in the access. Material access was expressed by two items: device used and place of access.

The item device used was measured as in van Deursen and van Dijk (2015). Satisfaction with the access was measured with the valuation of quality of telephone and Internet service, applying a 4-point Likert scale (from excellent to poor). In the president study the construct Internet access skills was characterized by the items: operational skills, formal skills, informational skills and strategic skills, which were used by van Deursen *et al*., (2014) and van Deursen *et al*., (2012). Productive access to Internet

1 Figure and tables are at the Annex, at the end of the article (Editor's note).

was approached as a three-dimension second-order construct, which were defined by van Deursen and van Dijk (2015), Tirado-Morueta *et al.* (2017) and van Deursen *et al.* (2015b).

## Result: validity and soundness of the model

Everyday users of Internet, described in table 1, are mostly in localities with more than 100,000 inhabitants (74%), they follow a gender distribution similar to that observed at national population and are between the ages of 6 and 35 years (64%). As regards schooling, they distribute homogeneously into basic, high school and university; largely, they are hired as employees or are students (see table 1). In terms of dynamic of Internet users, it is verified that if gender differences have been closing in Mexico, for the rest of structural variables and digital divide inequalities are still sometimes relevant (Toudert, 2015 and 2016).

The research model assessment was carried out taking into consideration Henseler's *et al.* (2016) recommendations, which allowed us to attain soundness conditions in the PLS validation process, which is the successive assessment of the general model, measurement model and structural model.

The general model presents a geodesic discrepancy $d_G$ and a non-weighted least squares of the goodness of fit $d_{ULS}$ below the discrepancies of the current model at a 95% level (Dijkstra and Henseler, 2015a). The importance of these discrepancies was assessed by means of the approximate criterion of the model fit measured by the standardized root mean square residual (SRMR), producing a value of 0.04, which is below the accepted limit value, 0.08, which indicates a suitable fit of the research model (Hu and Bentler, 1999).

The assessment of the measurement model displays load values of items of reflective constructs presented in table 2, with figures over the admission rule of 0.7 (Nunnally and Bernstein, 1994). This together with the consistency of internal reliability which shows values over the recommended, 0.07, for Dijkstra-Henseler rho indicator (ρA), verifying the soundness of the reflective constructs (Dijkstra and Henseler, 2015b). As regards formative constructs, both weights and signs are suitable, significant and defined by a variance inflation factor (VIF) that allows discarding the inconveniences of multicollinearity (Henseler *et al.*, 2016).

The convergent validity of the research model was assessed with average variance extracted (AVE), with values over 0.5 that identify such factors, exhibiting more than a half of their indicators' variance (Fornell and Larcker,

1981). Discriminant validity was assessed with the heterotrait-monotrait ratio of correlations (HTMT), which in table 3 shows values below one and that indicate a relevant discrimination between factors (Hensler *et al.*, 2015).

The assessment of the structural model reveals $R^2$ values largely superior to 10% of the variance, explained by the fluctuation of exogenous variables, which is considered an acceptable rate in preliminary research stages (Falk and Miller, 1992). Likewise, the endogenous latent variables express a satisfactory predictive power of the model, which expresses in the case of the highest $R^2$ value almost the totality of the variance explained by the construct: access to productive use of Internet (see table 2).

The hypotheses' significance level of the research model was ascertained using a 5000-resample bootstrapping; the three relations assessed H1, H2, H3 and their total effects were all concluding with $P<0.001$ (see table 4). Likewise, the relation between the second-order constructs: material access to Internet and access to the productive use of Internet and their total effects were significant ($P<0.001$). The same significance level was also noticed in the case of the indirect effect calculated for the three first-order constructs with the rest of latent variables of the research model with $P < 0.01$ and $P < 0.001$.

The assessment of the moderating effect that generates the size of residence localities was carried out by means of multi-group analysis, applying Henseler's (2007) test of group difference. In the results presented in table 5, the relation between material access to Internet shows significant differences ($P<0.10$) for the comparison between groups G1-G4, G2-G4 and G3-G4, being G2-G4 the comparison that shows the starkest differences.

For the relation between material access to Internet and access to productive use of Internet differences are significant ($P<0.10$) only for G1-G2; while for the relation between access skills and productive access to Internet the comparisons G2-G3 and G2-G4 show significant differences ($P<0.10$) with a stronger effect in G2-G3.

## Discussion

Considering that hierarchical components were used for the first time in an Internet access multifaceted model, the research results verify the multidimensionality of the high level of abstraction of the second-order concepts used. For the second-order construct: material access to Internet, the dimensions material access and satisfaction with the access showed a significant and positive influence, with a stronger effect on the former (0.7117).

This way, it is important to remember that the dimension of material access was on its own the latent variable that characterized the same concept as in Tirado-Morueta *et al.* (2017) and van Deursen and van Dijk (2015), who found it was concluding in a similar way. However, adding, in the present case, a new dimension focused on the satisfaction of the user with voice and data services offered better definition and an incidence as high (0.5757).

The same seems to be taken from the second-order construct: access to productive use of the Internet. In fact, the dimension involved in commercial transactions and activities (07174) had an impact on productive use of Internet almost three times more important than dimensions: productive uses (0.293) and experience of use (0.2412).

Seemingly, this indicates that in the context of frequent Mexican users, what is more relevant in the use of Internet is online shopping and payments. This behavior was closely associated to high-status users, who are more prone to engage in online commercial activities (Hargittai and Hinnant, 2008; Madden and Lee, 2003). Albeit, van Deursen *et al.* (2015b) disclosed that in the context of German population, these activities follow evolving characteristics, in which at first young males, with a low educational level and sufficient income prevail.

Taken as a set, these findings seem to indicate an involvement in commercial activities and incidental transactions in the productive use of Internet, which may be considered contextual and temporary. But this is not the case of the dimensions of productive use and experience in use that were found in other works with a performance similar to the present study (van Deursen and van Dijk, 2015; van Deursen *et al.*, 2015b).

From a different perspective, knowingly that the multifaceted model of Internet access was devised to keep track of the digital divide among the general population (van Deursen and van Dijk, 2015), in this article it is verified that its nomological and structural validity to study frequent users of Internet. As a matter of fact, all the causal relations of the research model (H1, H2 and H3) were highly significant, verifying that the frequent use of Internet does not allow skipping, in all of the cases, the successive barriers of accessibility, skills and productive use of the web. From a clarifying standpoint, this sort of explanations, of which, the most relevant, will be discussed.

Previous studies reported that people with a low schooling level use Internet over long periods in their free time; users who characterize largely by a low socioeconomic level commonly use the web superficially (van Deursen and van Dijk, 2013; van Dijk, 2005). By comparison, DiMaggio *et*

*al.* (2004) demonstrated that users with a high socioeconomic status use Internet more productively, verifying to a certain extent what Hargittai and Hinnant (2008) noticed: the most educated commonly use Internet in activities that allow them to increase their capital.

In this sense, it is considered that these factors that hinder the harnessing of Internet in other contexts are susceptible to generate similar influence on the variety of uses in Mexico. As information only, it is worth mentioning that over 2015, about a half of the frequent users of Internet in Mexico had a schooling that reached at its highest, up to secondary (see table 1).

In addition to the factors above, other aspects with similarities to evidence found in the knowledge gaps were identified by its influence on the gaps of Internet use (Hargittai and Hinnant, 2008; van Deursen and van Dijk, 2015). Gender and age are factors that favor use gaps in virtue of the online activities chosen by them.

As an example, productive use, such as find information on heath and trade would be of interest to middle-aged men, compared with a use concentrated in entertainment and communication, which is generally related to women and youths (Madden and Lee, 2003; van Deursen and van Dijk, 2013). From this standpoint, in the case of witnessing a closing of the man/woman digital divide in Mexico, it is important to underscore that slightly more than 60% of the frequent users of Internet are younger than 35 years of age, which would be in favor of developing less productive online activities (see table 1).

Another aspect that seems to influence on the variation of the uses is the limitations of the various technological platforms to access the web. Compared with the use of computers, Pearse and Rice (2013) noticed that smartphones reduce the access to online activities beneficial for Armenian users. A similar impact would be expected in Mexico, since 87% of the frequent users of Internet use their smartphone as the main means to access the web (Inegi, 2016a).

As regards the influence of living in cities with different demographic sizes, significant differences were identified between the each of the first groups of localities and the last group with fewer than 2500 inhabitants as regards material access and Internet access skills. These last localities of lighter demographic weight are generally typical of rural areas, which in the Mexican characterize by their dispersion and sometimes isolation (Toudert, 2015).

In these peripheral spaces, both access to Internet and the conditions to develop the necessary skills are different in comparison with urban-influenced

regions (Malecki, 2003; Shleife, 2010). In fact, the differences in the offer of Internet service, demographic structure, schooling conditions, occupation and job position, among others are decisive aspects on the segmentation of the web use in urban and rural areas (Agarwal *et al.*, 2005; Chen, 2013; Pick *et al.*, 2015).

Taking these elements into consideration as explanatory elements, it is important to stress that living in a rural area does not mean, in all cases, as Shleife (2010) mentions for a case in Germany, a significant difference in the use of Internet as compared with urban areas; albeit, in a case in China, Zhao *et al.* (2010) found such difference significant and proportional to the development of the localities. These findings, which seemingly are related to development levels, demand to deepen into comparative research to clarify, among other things, the influence of access to Internet in the display of skills, especially in the various contexts of the territorial configurations of the rural areas.

Between groups of localities, differences in the impact of material access to Internet on access skills and productive use of the Internet involve for the first impact the groups of localities G1-G4, G2-G4 and G3-G4. These findings are synonym to differenced impact, not linear, of the demographic size on the causal relations of the research model. Out of all the causal relations analyzed, only some display a concluding impact located between groups G1, G2, and G3 specifically with G4. Within this causal relation (H1), the group of localities with the lowest population is characterized by significant differences with the rest of groups with larger populations.

These results seem to indicate, for groups G1, G2, and G3, a comparable impact different in the case of G4, owing to the lack of devices and services that enable both access to Internet and the development of skills to use it. From this standpoint, in Mexico G4 seems to define a demographic threshold for Internet access and development of skills for its use. As regards the incidence of the material access to Internet on the productive use of the web (H2), the reduction in the demographic size of the localities in group G2 produces significant differences with G1 and these seem to be linked to a relevant change in the harnessing conditions in G2.

This seems to indicate marginalization in education and employment, proper to the structuring logic of G2 localities, as these conditions stop influencing other groups with localities with fewer inhabitants. Demographic size seems to make room for the proportion of inhabitants who have the services and devices to access Internet, but who do not use them in a productive manner. This is to say, localities in G2 seem to concentrate, more

than in any other group, deficiencies related to conditions of use that are not subject *sensu strictu* to the linear evolution of population.

The same logic seems to affect the differences in the impact of skills to access Internet on the productive use of the web (H3) between G2 and G3 and, G2 and G4. For this causal relation, differences seem to follow a demographic-size phased effect, which is limited at its lowest level by G2. This means that if G4 becomes a threshold for accessibility in Mexico, G2 is another threshold for the development of skills that enable a productive use of the Internet.

## Conclusion

The complexity to approach the digital divide and its various approximations impose a continual epistemological exploration of the suppositions that intend to participate in the construction of a theory. In the context of this endeavor, the present study satisfactorily validated the use of superior-order elements in the multistage modeling of the digital divide. Such constructs were strengthened resorting to new dimensions such as user satisfaction and experience of use, which allowed accomplishing a timely nomological planning of the research model. In this case, the availability of material access to Internet and satisfaction with the service had a deep impact in accessibility; while, commercial use was markedly defining the productive use of the web.

Taking into account that the multistage model of Internet access was proposed for the analysis of the accessibility and harnessing of Internet of the general population, its application in the context of frequent users in Mexico also showed significant validity for all the hypotheses proposed. This way, the frequent use of Internet does not seem to become use and harnessing skills in all of the cases. These aspects seem to vary in function of the users' socioeconomic characteristics and those of the platforms chosen to access the web.

From the standpoint of the size of the localities where frequent users live, significant differences were found in the incidence of material access to Internet on the skills to access the web between the three groups with the largest population and the last that comprises rural or peripheral localities under 2500 inhabitants. These differences seem to reflect the structural variations that characterize *vis a vis* urban and metropolitan localities of the peripheral spaces.

In like manner, other differences between locality-size groups that are apparently supported by the levels of integration and organic positioning

inherent to the urban and metropolitan systems. In this sense, the differences detected between material access to Internet and access to productive use of the web, on the one side, and on the other, between access skills and access to productive use, are illustrative of the systemic impact that crosses the territorial distribution beyond the variation in the demographic size of the localities.

It is important to underscore that among the findings of the present research there two thresholds, one for accessibility in localities with fewer than 2500 inhabitants, and another for the influence of skills on the productive use of the web in localities from 15000 to 99000.

As a set, these results seem to indicate the need to carry on researching on the final appropriation of Internet, paying attention to the different future contexts of territorial integration.

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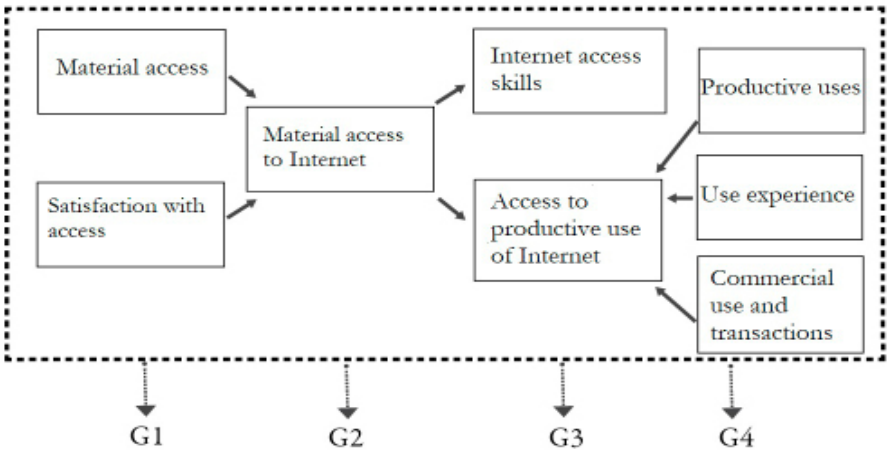
## Annex

Figure 1

**Research model proposal**




Source: own elaboration.

Table 1

**Sociodemographic characteristics of the target population**

| **Gender** | **%** | **Occupation** | **%** |
|---|---|---|---|
| Men | 48.61 | Student | 30.56 |
| Women | 51.39 | Employee | 37.70 |
| **Age groups (in years)** | | Worker | 0.60 |
| 6 - 12 | 20.33 | Self-employed | 9.70 |
| 13 - 18 | 12.15 | Owner of business | 1.41 |
| 19 - 35 | 31.05 | Unpaid worker | 1.25 |
| 36 - 45 | 15.47 | Other | 18.78 |
| 46 - 55 | 11.58 | **Locality size** | |
| 56 - 64 | 5.41 | 100,000 and more inhab | 74.12 |
| 65 and older | 4.01 | From 15,000 to 99,999 | 12.40 |
| **Schooling** | | From 2,500 to 14,999 | 8.47 |
| Elementary | 23.13 | Fewer than 2,500 inhabitants | 5.00 |
| Secondary | 25.05 | **Sampling** | |
| High school | 22.84 | Total sample size | 292,055 |
| University | 24.91 | Target sample size | 114,334 |
| Postgraduate | 2.45 | | |
| Other | 1.62 | | |

Source: own elaboration.

Table 2

**Reliability of the items involved in the model**

| Constructs / variables | loads/ weights | Value T | Dijkstra-Henseler rho (ρA) | [c] VIF | [d] $R^2$ |
|---|---|---|---|---|---|
| Material access to Internet (second-order construct) | | | 0.7776 | 2.871 | |
| Material access | 0.742 [a] | 54.126 | 0.7444 | 1.1611 | |
| Device used (V1) | 0.81 | 123.6451 | | | |
| Place to access Internet (V3) | 0.846 | 158.7349 | | | |
| Satisfaction with access | 0.539 [a] | 41.737 | 0.7386 | 1.5217 | |
| Quality in telephone service (V11) | 0.9161 | 112.8639 | | | |
| Quality of Internet service (V12) | 0.8614 | 78.1426 | | | |
| Productive use of Internet (second-order construct) | | | 0.8285 | 2.076 | 0.956 |
| Use experience | 0.164 [a] | 31.014 | 0.7392 | | |
| Time using interment (V9) | 0.7853 | 69.3835 | | | |
| Daily use time (V10) | 0.7657 | 63.832 | | | |

| | | | | | |
|---|---|---|---|---|---|
| Productive uses [b] | 0.184 | 64.497 | - | 1.692 | |
| Productive activities on Internet (V8) | - | - | | | |
| Commercial use and transactions | 0.841 [a] | 157.202 | 0.8785 | 3.426 | |
| Online payment (V14) | 0.8524 | 109.0741 | | | |
| Online buying (V15) | 0.8681 | 166.1106 | | | |
| Frequencies of online purchases (V16) | 0.8607 | 155.0112 | | | |
| Frequencies of online payments (V17) | 0.8249 | 96.8825 | | | |
| Internet access skills | | | 0.9746 | 3.251 | 0.326 |
| Operative skills (V4) | 0.9869 | 680.9583 | | | |
| Formal skills (V5) | 0.9934 | 752.2058 | | | |
| Informational skills (V6) | 0.9518 | 528.2058 | | | |
| Strategic skills (V7) | 0.8365 | 180.4499 | | | |

[a] Contribution of the formative dimension
[b] formative construct with a VIF with a single item
[c] Variance inflation factor
[d] determination coefficient.

Source: own elaboration.

Table 3

**Convergent and discriminant validity (AVE and HTMT)**

| Constructs | AVE* | (a) | (b) | (c) | (d) | (e) | (f) | (g) |
|---|---|---|---|---|---|---|---|---|
| (a) | 0.4375 | | | | | | | |
| (b) | 0.6861 | 0.6449 | | | | | | |
| (c) | 0.7928 | 0.7101 | 0.3118 | | | | | |
| (d) | 0.9159 | 0.6117 | 0.7812 | 0.187 | | | | |
| (e) | 0.4719 | 0.6282 | 0.7576 | 0.2277 | 0.801 | | | |
| (f) | 0.6013 | 0.7387 | 0.621 | 0.2436 | 0.7078 | 0.6653 | | |
| (g) | _ | 0.5879 | 0.7605 | 0.1719 | 0.7911 | 0.7461 | 0.7063 | |
| (h) | 0.732 | 0.432 | 0.4964 | 0.1762 | 0.5412 | 0.6823 | 0.4737 | 0.467 |

*average variance extracted.

(a) material access to Internet
(b) material access
(c) satisfaction with the access
(d) Internet access skills
(e) access to productive use of Internet
(f) use experience
(g) productive uses
(h) commercial use and transactions.

Source: own elaboration.

Table 4

**Significance level of the hypotheses of the research model**

| Model hypotheses | Trajectory coefficients | T statistic (bootstrap) | Total effect | T statistics (bootstrap) |
|---|---|---|---|---|
| H1: Material access to Internet → Internet access skills | 0.5071 | 52.4953*** | 0.5071 | 52.4953*** |
| H2: Material access to Internet → Access to productive use of Internet | 0.1211 | 11.2181*** | 0.4283 | 42.4244*** |
| H3: Internet access skills → Access to productive use of Internet | 0.6057 | 65.197*** | 0.6057 | 65.197*** |
| First- and second-order relations | | | | |
| Material access → Material access to Internet | 0.7112 | 60.9418*** | 0.7112 | 60.9418*** |
| Satisfaction with access → material access to Internet | 0.5757 | 65.3276*** | 0.5757 | 65.3276*** |
| Productive activities on Internet → Access to productive use of Internet | 0.293 | 88.049*** | 0.293 | 88.0497*** |
| Use experience → Access to productive use of Internet | 0.2412 | 45.3563*** | 0.2412 | 45.3563*** |
| Commercial activities and transactions → Access to productive use of Internet | 0.7174 | 141.0657*** | 0.7174 | 141.0657*** |
| Significance of direct effects | | | Indirect effect | |
| material access → Internet access skills | | | 0.3522 | 34.0228*** |
| Material access → Access to productive use of Internet | | | 0.0021 | 3.8135** |
| Satisfaction with access → Internet access skills | | | 0.2852 | 49.3289** |
| Satisfaction with access → Access to productive use of Internet | | | 0.0017 | 3.8325** |

**P < 0.01 ***P < 0.001.

Source: own elaboration.

Table 5

**Results of the multi-group analysis test**

| Relations | Comparative | Henseler P |
|---|---|---|
| Material access to Internet → Internet access skills | | |
| | G1-G2 | 0.289434 |
| | G1-G3 | 0.307346 |
| | G1-G4 | 0.908512* |
| | G2-G3 | 0.486656 |
| | G2-G4 | 0.930562* |
| | G3-G4 | 0.917208* |
| Material access to Internet → Access to productive use of Internet | | |
| | G1-G2 | 0.952481* |
| | G1-G3 | 0.743175 |
| | G1-G4 | 0.818947 |
| | G2-G3 | 0.218699 |
| | G2-G4 | 0.404219 |
| | G3-G4 | 0.646438 |
| Internet access skills → Access to productive use of Internet | | |
| | G1-G2 | 0.000317 |
| | G1-G3 | 0.158557 |
| | G1-G4 | 0.146726 |
| | G2-G3 | 0.936919* |
| | G2-G4 | 0.912529* |
| | G3-G4 | 0.461196 |

*significance at 0.10.

Source: own elaboration.

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