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ACCESS TO ICT SERVICES IN HOUSES AT THE BASE OF THE PYRAMID IN VENEZUELA

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ABSTRACT

Objective: The article analyzes whether or not there is an association between the different levels of the BoP and their area of residence with the variables of access to ICT services in a region of Venezuela.

Theoretical Framework: The literature review addresses the concepts of access to Information and Communication Technology services, as well as the concept of BoP population.

Method: The data analyzed comes from 1,398 households in the Táchira region (Venezuela), which were segmented by poverty conditions, resulting in 675 in the BoP. To establish the association between variables, the Mann Whitney U test was used; The magnitude of the association has been determined using Cramér's V coefficients.

Results and Discussion: The results show that access to landline telephone and cable TV services present a moderate association, with respect to socioeconomic levels; while in cell phone service, television ownership and internet service, the association is low. Little interest was evident on the part of public and private organizations in the internet services sector in serving this market segment, as they did not include it in their marketing strategies.

Research Implications: These results allow companies in the ICT services sector that have the BoP as a target market to make a distinction in their marketing strategies between the levels of the BoP, since heterogeneity is evident.

Originality/Value: The study uses an innovative method of classifying socioeconomic levels that facilitates comparison with other regions by not using income level as the only variable.

Keywords: Base of the Pyramid, Socioeconomic Level, ICT Services, Low Income, Táchira.

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ACESSO A SERVIÇOS TIC NAS CASAS DA BASE DA PIRÂMIDE NA VENEZUELA

RESUMO

Objetivo: O artigo analisa se existe ou não associação entre os diferentes níveis da BoP e sua área de residência com as variáveis de acesso aos serviços de TIC em uma região da Venezuela.

Referencial Teórico: A revisão da literatura aborda os conceitos de acesso aos serviços de Tecnologia da Informação e Comunicação, bem como o conceito de população da BoP.

Método: Os dados analisados são provenientes de 1.398 domicílios da região de Táchira (Venezuela), que foram segmentados por condições de pobreza, resultando em 675 no BoP. Para estabelecer a associação entre as variáveis foi utilizado o teste U de Mann Whitney; A magnitude da associação foi determinada utilizando os coeficientes V de Cramér.

Resultados e Discussão: Os resultados mostram que o acesso aos serviços de telefone fixo e TV a cabo apresentam associação moderada, no que diz respeito aos níveis socioeconômicos; enquanto no serviço de telefonia celular, propriedade de televisão e serviço de internet a associação é baixa. Foi evidente pouco interesse por parte das organizações públicas e privadas do sector de serviços de Internet em servir este segmento de mercado, uma vez que não o incluíram nas suas estratégias de marketing.

Implicações da Pesquisa: Estes resultados permitem que as empresas do setor de serviços de TIC que têm o BoP como mercado-alvo façam uma distinção nas suas estratégias de marketing entre os níveis do BoP, uma vez que a heterogeneidade é evidente.

Originalidade/Valor: O estudo utiliza um método inovador de classificação dos níveis socioeconômicos que facilita a comparação com outras regiões ao não utilizar o nível de renda como única variável.

Palavras-chave: Base da Pirâmide, Nível Socioeconômico, Serviços TIC, Baixa Renda, Táchira.

ACCESO A SERVICIOS TIC EN VIVIENDAS DE LA BASE DE LA PIRÁMIDE EN VENEZUELA

RESUMEN

Objetivo: El artículo analiza si existe o no asociación entre los diferentes niveles de la BoP y su zona de residencia con las variables de acceso a los servicios TIC en una región de Venezuela.

Marco Teórico: La revisión de la literatura aborda los conceptos de acceso a servicios de Tecnología de Información y Comunicación, así como el concepto de población de la BdP.

Método: Los datos analizados provienen de 1.398 viviendas de la región Táchira (Venezuela), las cuales fueron segmentados por condiciones de pobreza, resultando en 675 en la BdP. Para establecer la asociación entre variables se utilizó el test U de Mann Whitney; la magnitud de la asociación se ha determinado mediante los coeficientes V de Cramér.

Resultados y Discusión: Los resultados muestran que el acceso a los servicios de telefonía fija y TV cable presentan asociación moderada, respecto a los niveles socioeconómicos; mientras que en el Servicio de telefonía celular, tenencia de televisor y servicio de internet, la asociación es baja. Se evidenció poco interés por parte de las organizaciones públicas y privadas del sector de servicios de internet en atender este segmento de mercado, al no incluirlo en sus estrategias de marketing.

Implicaciones de la investigación: Estos resultados permiten a empresas del sector de servicios TIC que tienen la BdP como mercado objetivo hagan una distinción en sus estrategias de marketing entre los niveles de la BdP, ya que se evidencia heterogeneidad.

Originalidad/Valor: El estudio utiliza un método innovador de clasificación de niveles socioeconómicos que facilita la comparación con otras regiones al no utilizar el nivel de ingresos como única variable.

Palabras clave: Base de la Pirámide, Nivel Socioeconómico, Servicios TIC, Bajos Ingresos, Táchira.

1 INTRODUCTION

The BoP researchers propose a vision of the problem of poverty from a market perspective, where they can provide the productive sector with new market opportunities, with the potential to improve these social problems and at the same time be economically profitable for public or private organizations (Pineda, 2015), taking the concept of business society beyond philanthropy, where companies innovate in their business model with sustainability strategies that improve human and environmental conditions while generating profitability in their businesses (Gates, 2008; Hartman *et al*., 2008; Werhane *et al*., 2010), because as Ricart & Rodríguez (200) 06), "Making money at the bottom of the pyramid is not only possible, but a reality; it is a market in which great possibilities for responsible and sustainable growth are concentrated" (p. 91).

The heterogeneity of developing economies poses challenges in terms of understanding people's needs (Thakur, 2015), because they present sociocultural realities, which impact their lifestyle, expectations and consumption habits (Banerjee & Duflo, 2007; Castro & Di Blasi, 2011; Craig & Douglas, 2011; the above underpins the importance of taking as a basis the behavior of consumers of the BdP when developing marketing strategies that fit their needs (Alur & Schoormans, 2013; Rovetta *et al*., 2023; Chikw3; eche & Fletcher, 2010; Farooq & Maqbool, 2024; Nakata & Antalis, 2015; Seelos & Mair, 2007;

Based on the need described in the previous paragraph, the BoP researchers propose a vision of the problem of poverty from a market perspective, where they can provide the productive sector with new market opportunities, with the potential to improve these social problems and at the same time be economically profitable for public or private organizations (Pineda, 2015), taking the concept of business society beyond philanthropy, where companies innovate in their business model with sustainability strategies that improve human and environmental conditions while generating profitability in their businesses (Gates, 2008; Hartman *et al*., 2008; Werhane *et al*., 2010) because, as Ricart & Rodríguez (2006) affirm, "Making money at the bottom of the pyramid is not only possible, but a reality; it is a market in which great possibilities for responsible and sustainable growth are concentrated" (p. 91).

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Based on the need described in the previous paragraph, the article analyzes whether or not there is an association between the different levels of the BoP with the variables of access to ICT services in a region of Venezuela.

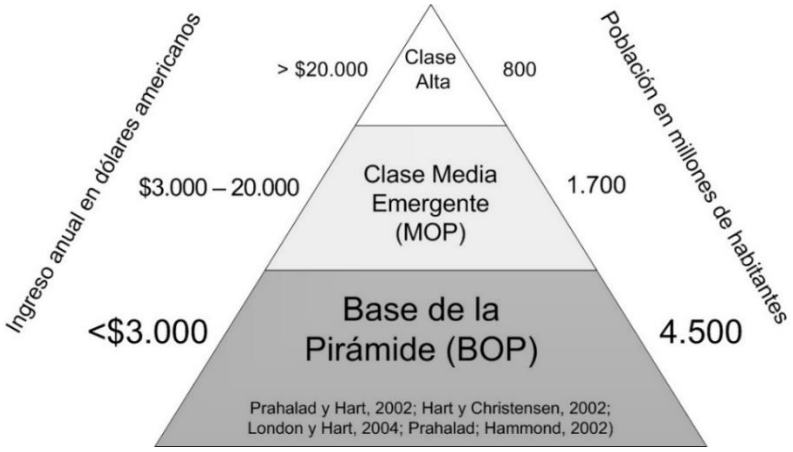
2 THEORETICAL FRAMEWORK

2.1 ACCESS TO ICT IN THE PYRAMID BASE POPULATION (BOP)

The BoP is the population living in low-income developing countries (Praceus, 2013). The number of people worldwide, ranked by their income level, has a pyramid-like distribution, where there are few rich at the top and a large area at its base, which is the representation of the poor (See Figure 1). This group comprises 4.5 billion people worldwide, who must meet their needs with less than US$250 per month. (Prahalad, 2005; Prahalad & Hart, 2002; Prahalad, 2010). Balance of payments conditions worsen depending on their geographical location (Thakur, 2015), as their low purchasing power is compounded by physical isolation caused by inefficient investment in infrastructure, making it difficult to access essential products and services. (Bird *et al*. 2002; Contreras *et al*. 2016).

Figure 1

Population pyramid by income level



Source: Authors

The population at the base of the pyramid varies between regions and countries (Thakur, 2015). It has characteristics such as cultural complexity and difficulty accessing products and services, especially in rural areas physically isolated due to inefficient infrastructure investment (Engizek & Yaşin, 2018; Bird *et al*., 2002; Contreras *et al*., 2016). In the case of Latin America, the BOP represents 9.1% of the world's population, with an expenditure of more than $600 billion (Guesalaga & Marshall, 2008).

In developing economies like Venezuela, one reason for low internet access is digital inequality that inhibits socioeconomically disadvantaged people from exploring digital opportunities. Digital inequality refers to inequality in access to information and communication technologies (DiMaggio *et al*., 2004). The digital divide is seen as one of the most significant issues in the current era, as access to resources has become a crucial component of social engagement in the information-based sector. When talking about digital inequality, it is important to mention the pyramid base (BOP), being a segment that meets its basic needs such as food, water, sanitation, education, insurance, finance and health care through transactions in an informal market economy (Prahalad & Hammond, 2002; Goyal *et al*., 2014; Teixeira & Teixeira, 2022). The digital divide identifies economically disadvantaged people as the most vulnerable to the negative effects of inability to find information online (Hersberger, 2013). Therefore, the adoption and use of Internet services by the bottom of the pyramid have important implications for digital equality. Therefore, it would be important to analyze whether or not there is an association between the different levels of the BoP with the variables of access to ICT services in the Táchira region of Venezuela.

3 METHODOLOGY

3.1 STUDY REGION

The Táchira region (Venezuela), according to the National Institute of Statistics of Venezuela (INE) has a population of 1,168,908 inhabitants, representing 4.29% of the national population, is made up of 5 subregions (See Figure 2).

Figure 2

Geographical distribution region study

Source: Garcia et al., 2016

3.2 SAMPLE

The sample is calculated from the households distributed in the five subregions of the State of Táchira. Sample size was calculated using the stratified multistage probabilistic method with systematic random selection. Below is the formula used to calculate the sample:

$$n = \frac{Z_{\frac{\alpha}{2}}^2 PQN}{\varepsilon^2(N-1)+Z^2PQ} \qquad (1)$$

The final sample size was 1,398 houses, after adjustment by design. Table 1 shows the sample for each study subregion.

Table 1

Sample distributed by Subregion

Subregion	Number of Houses	Sample n_0	Design-adjusted effective sample n
Metropolitan	125,968	532	560
Mountain	16,167	68	147
Border	69,432	294	382
North	15,185	64	150
South	25,657	108	159
Total Táchira	**252,409**	**1,066**	**1,398**

Source: Authors.

3.3 BoP LEVEL CLASSIFICATION

People belonging to the same social class have similar incomes, occupations, and tastes (Coleman, 1983). The one-dimensional income method for classifying households by socioeconomic level, despite being the traditional one, presents limitations that skew the analysis, due to measurement errors such as under-registration and non-declaration of income information by the respondent (Camelo, 1998; Donza, 2011; Feres, 1998; Llach & Montoya, 1999; Roca & Peña, 2001). In addition, it is difficult to calculate income per period when there is informality in employment (Gómez, 2014; Minujin & Bang, 2002); It is also a method that does not allow comparison with regions of other countries, due to the volatility in macroeconomic indicators and exchange rate policies (Vélez & Moreno, 1994).

The method for classifying households is through a global synthetic index using scales to segment them by poverty conditions. To arrive at the index, an Optimal Quantitative Evaluation is carried out on a set of variables associated with the living conditions in each household (Loaiza *et al*., 2007). To obtain the coefficients of score of the conditions of the houses is used the technique of analysis of main components for categorical variables. (Carmadiel *et al*., 2000).

To quantify categorical variables, category codes are replaced by optimal numerical values, in order to determine existing relationships. The quantitative evaluation process is carried out by an optimal scaling of alternative least squares (Carmadiel *et al*., 2000; Vélez &

Moreno, 1994). Then, the technique of classification of k-mean groups is applied to group households with similar characteristics.

4 RESULTS AND DISCUSSIONS

4.1 CLASSIFICATION OF DWELLINGS OF THE BDP

4.1.1 Variables associated with living conditions

To construct the synthetic index of poverty, the following variables associated with living conditions were taken into account: 1. Structural characteristics of the home; 2. Access to services at home; 3. Possession of household goods; 4. Asset Holding; and 5. Socioeconomic characteristics (Camardiel *et al*., 2000; Vyas & Kumaranayake, 2006).

4.1.2 Optimal scaling of variables

Numerical values are assigned to the categories of each variable to analyze the scale with the optimal scaling technique, the transformations of each variable are represented with a vector passing through the origin.

4.1.3 Allocation of scoring coefficients to qualitative variables by dwelling

CATegorical Principal Component Analysis (CATPCA) is applied to obtain in numerical value the coefficients of possession or deficiency score assigned to each of the houses (Kolenikov & Angeles, 2009; Vyas & Kumaranayake, 2006; Khudri & Chowdhury, 2013; Van der Burg *et al*., 1988). The optimal scaling level of the variables is ordinal, so that the transformed values represent ordered categories (Carmadiel *et al*., 2000; Vélez & Moreno, 1994). It is defined that the number of components to be extracted is one, as in the studies of Filmer & Pritchett (2001) and Van der Burg *et al*. (1988), where the first component explains between 12% and 26%.

Table 2 presents the model estimation data, where the total percentage of explained variance of 25.64%, that is, is the total of information retained or explained by the two dimensions of the model, where the variables of dimension 1 contribute 15.372% and dimension 2 retains 10.271%. The Cronbach's alpha coefficient of both dimensions is positive,

which allows us to observe an accumulation of information above the model average in other studies.

Table 2

Estimating the model of the optimal scaling method

Dimension	Cronbach's alpha	Variance posted for	
		Total (self-value)	Variance %
1	0.738	3,382	15,372
2	0.584	2,260	10,271
Total	,862[a]	5,641	25,643

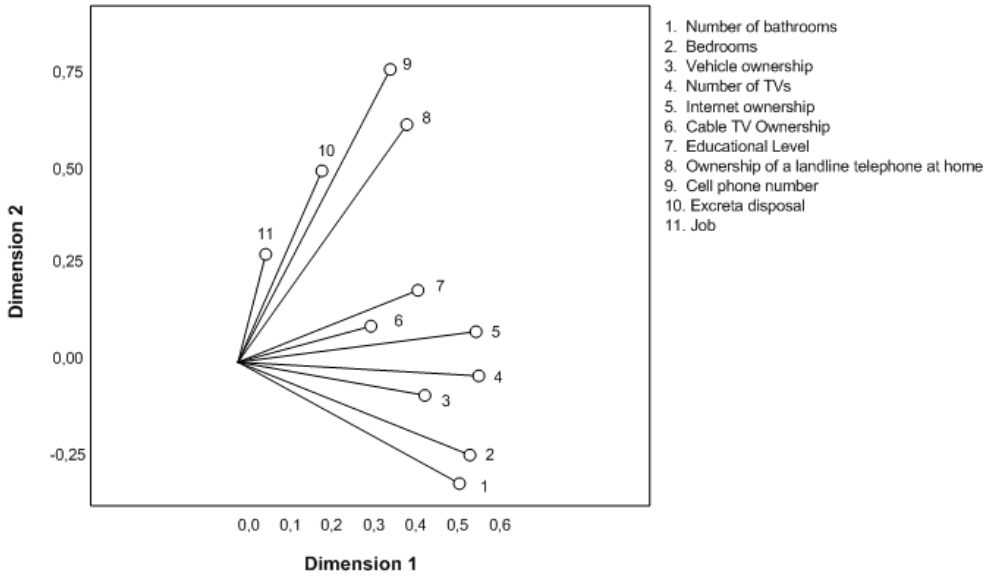
a. Cronbach's alpha total is used in the total eigenvalue.

Source: Authors

Once the consistency of the optimal scaling model has been proven, we proceed to determine the two main dimensions or components, which are new variables, in this case two, that allow reducing the dimensionality of all the variables. When analyzing Figure 3 it can be inferred that dimension 2 represents variables of property ownership, while dimension 1 represents variables of structural conditions and access to household services.

Figure 3

Variable saturation graph by dimension



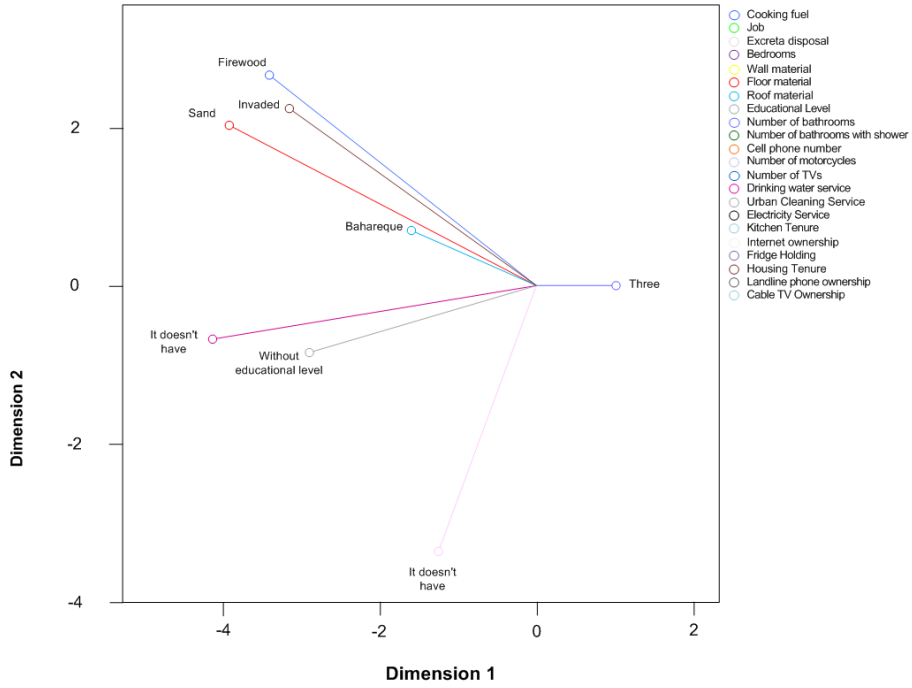
Source: Authors

Figure 4 shows possible associations or patterns of relationships in a plane that quantifies the categories of the variables. Distant categories involve different response patterns, while nearby categories involve the same combination of responses. Variables represented with

a line imply association; perpendicular lines represent independence. On the left side of the plane, clearly differentiated relationship patterns between absence of services such as cooking fuel, electricity, urban toilet, excreta disposal, also precarious conditions in the structure of the house, as well as low level of education are evident; while on the other side of dimension 1 patterns of association between the possession of goods, better conditions in the formation of education and access to basic essential services are presented.

Figure 4

Category Point Chart



Source: Authors

4.1.4 Socio-Economic Level Index (INSE)

The INSE results from the linear combination of the vectors that define each of the categories within each variable. The index values range from 0 to 100, where the lower limit represents the condition of the most intense poverty and the upper limit the best condition without poverty (Carmadiel et al., 2000). The scale factor *fe* is calculated from Equation 2.

$$fe = \frac{100}{\sum_j \max\left(\hat{Y}_{jk}\right)} \qquad (2)$$

Finally, the INSE is calculated based on Equation 3.

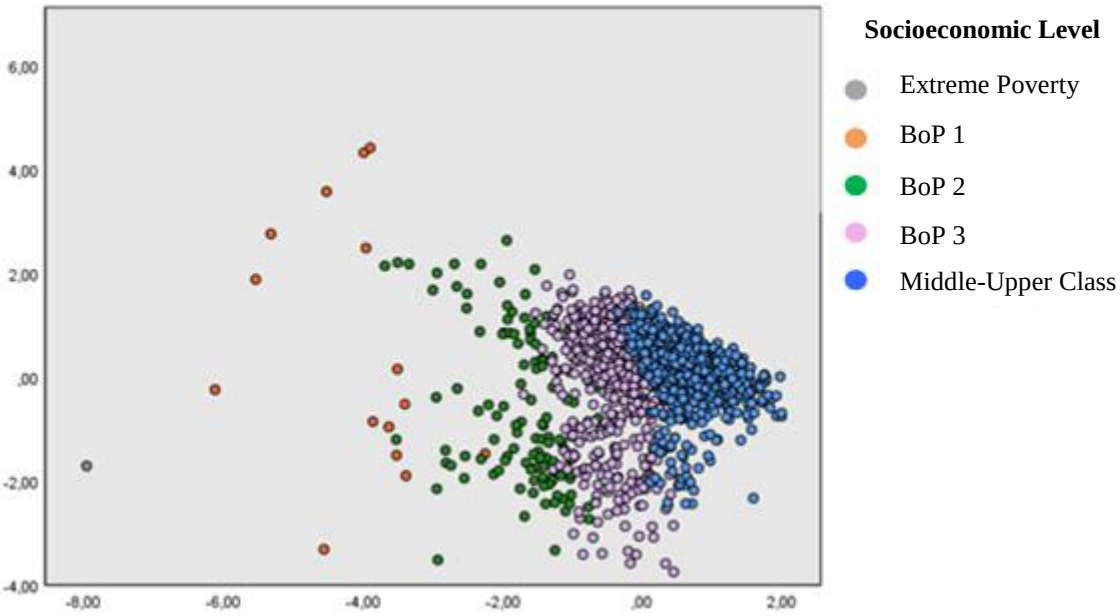
$$INSE = fe \sum_{j} \max\left(\hat{Y}_{jk}\right) \quad (3)$$

4.1.5 Housing classification by socioeconomic level

After applying the k-mean cluster technique with k=5, five levels are obtained: the first represents extreme poverty, the BdP is grouped into level two, three and four; as proposed by Guesalaga & Marshall (2008); Hammon et al. (2007) in their studies, and the fifth level groups middle and upper class housing (See Figure 5).

Figure 5

Housing by socioeconomic level



Source: Authors

The INSE ranges obtained for each socioeconomic level of the households in the study region are presented in Table 3.

Table 3

Homes by socioeconomic level in Táchira

INSE range	Socioeconomic Level	Frequency	Percentage	Cumulative percentage
Between 0 and 30,244	Extreme Poverty	1	0.07%	0.07%
Between 30,245 and 66,716	BoP 1	15	1.07%	1.14%
Between 66,717 and 78,242	BoP 2	123	8.80%	9.94%

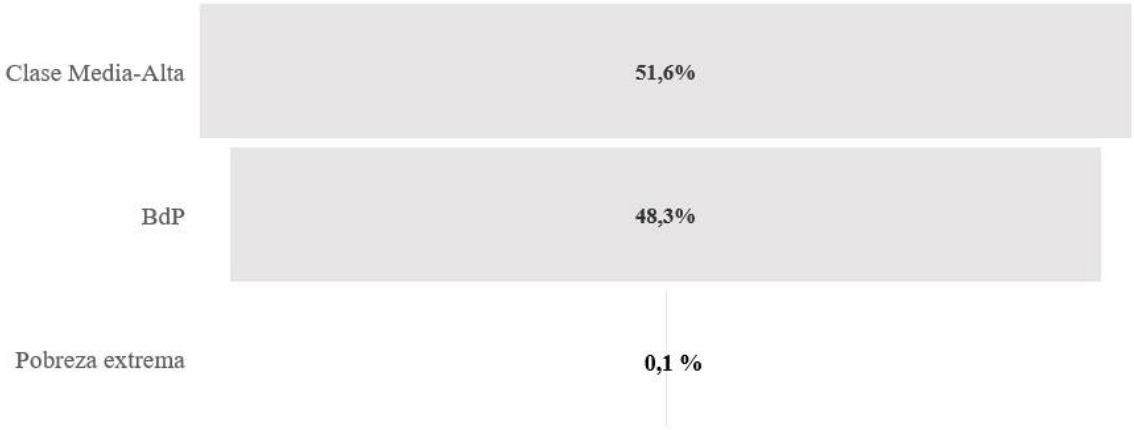
Between 78,243 and 86,020	BoP 3	537	38.41%	48.35%
Between 86,021 and 100	Middle-Upper Class	722	51.65%	100.00%
Total		**1398**	**100.00%**	

Source: Authors

Figure 6 represents the socioeconomic pyramid of the dwellings of the Táchira region, where the upper-middle class has the largest portion of the total sample with 51.6%, followed by the BdP with 48.3%.

Figure 6

Socioeconomic pyramid of housing in Táchira



Source: Authors

After applying the k-mean cluster, Table 4 presents the observations of the three internal levels of BdP, as proposed by Guesalaga & Marshall (2008); Hammon et al. (2007) in their studies.

Table 4

Distribution by housing in the BoP in Táchira (Venezuela)

INSE range	BdP level	Frequency	Percentage	Cumulative percentage
Between 30,786 and 66,701	BoP 1	15	2.22%	2.2
Between 66,702 and 78,928	BoP 2	123	18.22%	20.4
Between 78,929 and 86,549	BoP 3	537	79.56%	100.0
Total		**675**	**100%**	

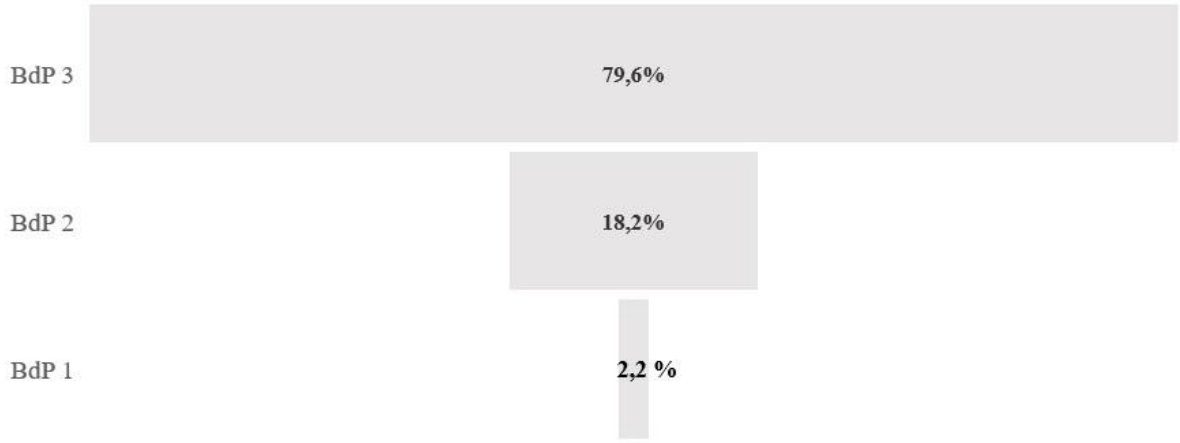
Source: Authors

Also, Figure 7 presents graphically the socioeconomic pyramid within the BoP, with

Level 3 concentrating 79.6% of the homes.

Figure 7

Socio-economic pyramid of the BoP in Táchira



Source: Authors

Regarding access to Information and Communication Technologies (ICT) services, Table 5 shows how they generally exist throughout the BoP, access above 80% in fixed telephone, television and cable TV services; and a deficiency in Internet access, showing that only a quarter of homes have this service. Half of the households at BoP level 1 do not have access to mobile phones, 66.67% do not have access to cable TV, and only 6.67% have access to the Internet, however, this contrasts with access to TV where 80% of the households claim to have it. In BoP 2, access to fixed telephony, mobile telephony, TV and the internet is slightly improved, while internet access is just as low at level 1. Housing classified in BoP 3 has much better access conditions than the other levels, however, only one third said they have Internet service.

To establish the association between variables, the Mann Whitney U test has been used; with significance levels less than 0.05, rejecting the hypothesis of independence between access to ICT services and the socioeconomic level of the BoP, that is, it is inferred that there is an association between the two variables. Likewise, the value of the Cramer V, measures the association effect between the access of each ICT service and the levels of the BoP, where it was obtained as a result, that, access to fixed telephony and cable TV services have moderate association, with respect to socioeconomic levels; while in the Cell Phone Service, television ownership and internet service, the association is low with Cramer V values of 0.245, 0.278 and 0.240, respectively.

Table 5

Access to ICT Services by BoP level in Táchira

ICT Services / Access		Socioeconomic Level BOP							χ^2	*p*	V de Cramer
		BoP 1		BoP 2		BoP 3		Total			
		% by level	% by total	% by level	% by total	% by level	% by total	% by level			
☎	No	$40{,}00_{a}$	0.89	46.34_{a}	8.44	12.66_{b}	10.07	19.41	76.73	, 000	0.337
	Yes	$60{,}00_{a}$	1.33	53.66_{a}	9.78	87.34_{b}	69.48	80.59			
📱	No	$46.67_{a.b}$	1.04	58.54_{a}	10.67	28.68_{b}	22.81	34.52	40.47	, 000	0.245
	Yes	$53.33_{a.b}$	1.19	41.46_{a}	7.56	71.32_{b}	56.74	65.48			
🖥	No	$20{,}00_{a}$	0.44	11.38_{a}	2.07	0.74_{b}	0.59	3.11	52.08	, 000	0.278
	Yes	$80{,}00_{a}$	1.78	88.62_{a}	16.15	99.26_{b}	78.96	96.89			
📡	No	66.67_{a}	1.48	47.97_{a}	8.74	12.29_{b}	9.78	20.00	100.5	, 000	0.386
	Yes	33.33_{a}	0.74	52.03_{a}	9.48	87.71_{b}	69.78	80.00			
📶	No	$93.33_{a.b}$	2.07	93.50_{a}	17.04	66.85_{b}	53.19	72.30	38.86	, 000	0.240
	Yes	$6.67_{a.b}$	0.15	6.50_{a}	1.19	33.15_{b}	26.37	27.70			

Source: Authors

5 CONCLUSION

This study discussed whether access to ICT services is associated with the socio-economic status of the BoP, the results confirm that unlike other studies of the BoP in emerging countries, this segment in Venezuela is not the majority, since the upper middle class is represented by 51.6% of the total being greater than the BoP. The findings also confirm that there is an association between access to ICT services and socio-economic levels of the BoP.

access to fixed telephony and cable TV services are moderately associated with socio-economic levels; whereas in the Mobile Telephone Service, TV ownership and Internet service, the association is low.

There was little interest on the part of public and private organizations in the ICT services sector in attending this market segment, especially not including it in their marketing strategies in Internet service and cable TV. Heterogeneity was found between the internal levels of the BoP, which leads to recommend that companies in the ICT services sector that have the BoP as their target market make a distinction in their marketing strategies when they intend to reach these users.

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