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Resistance to technological innovation and brand equity in the banking sector

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Abstract. *Consolidating strategies in the banking sector to reduce the impact of resistance barriers to technological innovation can bring brands closer to older people, thus reinforcing the brand value of banking institutions; therefore, the objective of this research was to identify the incidence of resistance barriers to technological innovation on the dimensions of brand equity in the banking sector by elderly people. For this purpose, a descriptive correlational study was developed with 502 elderly people living in the city of Bogotá, Colombia, aged between 60 and 80 years old. Data collection was carried out using a questionnaire applied in person, which was adjusted and validated based on the information obtained. The questionnaire assessed brand equity components of brand image and awareness, brand associations, perceived quality and performance, and brand loyalty, and included items to assess psychological and functional barriers. A confirmatory factor analysis and structural equation modelling were developed for the different barriers of resistance to technology and for the dimensions of brand equity, identifying that the different types of resistance to innovation affect only the dimensions of brand awareness and brand importance. The results lead to the conclusion that elderly people experience different barriers to using the technological applications of their banking products and that the design of these applications must consider them in order to achieve or maintain brand recognition in this segment, as well as to achieve true financial inclusion for elderly people.*

Keywords: technology resistance, psychological barriers, usability, brand equity, seniors, banking sector.

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Introduction

The older adult market segment has grown dramatically in the world, by virtue of changes in the socio-demographic structure associated with declining birth rates and increasing life expectancy in most countries. A study by the World Bank (2022) indicates that between 1950 and 1980 the percentage of elderly people in the total population remained around 8%, by the year 2000 it had risen to 10%; and from the projected trends of global demographic ageing, it is estimated that by 2030 this percentage will reach 16.6% and by 2050 it will reach 21.4%.

Based on the above demographic dynamics, the older adult has become an important segment for organizations; moreover, recognizing that a large part of these consumers have a certain economic freedom, making them a potential market for brands, which must transform their functional, emotional, and symbolic aspects, particularly when they wish to approach this segment and develop a strategic communication, based on brand value, which describes the associations, image, importance, awareness and relevance of the brand for consumers (Torres-Zamudio et al., 2021; Aaker, 1991).

Aging is a human characteristic, associated with a permanent process in which changes gradually occur in people's natural capacities, with the consolidation of material and symbolic acquisitions, obtained from life experiences (Losada-Baltar et al., 2020). Bernal & De la Fuente (2014) state that ageing is an individual systematic process, which differentiates chronological age from biological, psychological, social and functional age, which are individually associated with ageing. Thus, ageing is a reality that does not necessarily imply being subject to pathologies, dependencies, or labor unproductiveness; however, as time goes by, physical and physiological, psychological and cognitive, psychomotor, and socioaffective changes manifest themselves in people (Molina et al., 2011).

As for physical and physiological changes, these are evidenced by the deterioration of the nervous system, which results in a gradual decrease in the speed of movement and reflexes, increasing the possibility of presenting pathologies that affect the cardiovascular, respiratory, digestive, musculoskeletal and urinary systems, with a weakening of the immune system and in some cases with sensory deficits (De Jaeger, 2018).

Similarly, it is possible that the psychomotor changes of ageing generate symptoms of destructuring in the body schema and difficulties in recognizing one's own body, problems of balance and orientation, causing a decrease in the ability to move and involution of physical qualities – coordination, flexibility, strength, speed and endurance (Molina et al., 2011). Older adults decrease their locomotor capacity, thus initiating a progressive deterioration of their physical, psychological, and social functionality; therefore, at 60 years of age, 15% of individuals present gait disturbances, 35% at 70 years of age, and it increases to about 50% in those over 85 years of age (Rendón-Torres et al., 2021).

The value that the brand has obtained in its consumer market is related to various functional, emotional, and symbolic aspects, being these transcendentals when organizations, from the current competitive environments, wish to develop a high market orientation (López-Rodríguez et al., 2021; Graciola et al., 2020; Foroudi, 2019; Sürücü et al., 2019). In this context, the development of a positive relationship between the older adult segment and brands, especially in the banking sector, is essential to achieve the positioning of new brands, maintaining the value of traditional brands and achieving true financial inclusion (López-Rodríguez & López-Ordoñez, 2022).

In contrast, few academic studies related to branding in the older adult segment are observed, as evidenced in the review conducted by Jia et al. (2018), who developed a quantitative and holistic overview of 728 articles in consumer psychology from 1960 to 2016, and identified that most studies are directed towards younger generations, so it is necessary to address in greater depth the issues of consumption and technological adoption of elderly people in different countries. This points to the need to study more extensively the relationships between brands, technological innovations, and the ageing processes of elderly people, given that this involves cognitive changes in memory and numeracy, as well as difficulties in mastering technological platforms, so that in the digital age, brands can unintentionally generate various barriers for the elderly user to establish appropriate relationships with their banking products (Chaouali & Souiden, 2019).

A person's self-image is an important mechanism for predicting their consumption behaviors, particularly with respect to their age; hence, if people perceive themselves as elderly, they exhibit more caution, cognitive rigidity, rejection of innovations, search routines, low self-esteem, anxiety towards technology and risk aversion (Parida et al., 2016). In contrast, cognitively younger elders show higher levels of self-confidence, innovativeness, adventurousness, well-being, creativity, commitment to change, and technological innovations (Chen & Chan, 2014). In this regard, it is relevant for organizations to identify the genesis of technological innovation failures associated with consumer resistance, which for Laukkanen (2016) are divided into two main groups: functional and psychological barriers.

Considering that the interaction of elderly people with technology is fundamental to achieve adequate financial inclusion and the development of permanent links with brands from an omnichannel vision, investigating the resistance of elderly people to the use of technology is a fundamental challenge for the achievement of development objectives in the world. To this end, it is important to understand the relationships between the physical, psychological, cognitive, and socioaffective changes that occur with older consumers, hence the relevance of empirically analysing the behavior of functional and psychological barriers in this particular population (Chaouali & Souiden, 2019), which will allow us to determine how their patterns of behavior in the use of mobile and web applications of financial products are subject to these barriers, which influence the brand equity in the banking sector.

Therefore, this research answers the following question: How do barriers of resistance to technological innovation affect the multidimensional consolidation of the brand equity of the banking sector from the perception of elderly people? The demographic growth of this population profiles older adults as a potential market for different industries and productive sectors, which must structure value propositions in line with their interests, experiences, emotions, and perceptions of the commercial world. The results of this research generate an important contribution to the literature, because it shows the importance of considering the characteristics of older adults for the design and ergonomics of applications and other technological innovations, in order to generate positive experiences in the consumption of banking services, which leads to a strengthening of brand equity for this population.

Literature review

Chaouali and Souiden (2019) show that older people have greater resistance to the use of technology, expressed in the rejection of innovations, so some models of resistance to innovation have been proposed that involve the set of functional barriers (barriers of use, value, and risk) and psychological barriers (tradition and image) that cause consumer resistance responses to applications on different devices (Laukkanen, 2016; Borraz-Mora et al., 2017). In this context, the following hypotheses are tested:

$\boldsymbol{H_1}$ Resistance barriers to technological innovation predict brand equity in the banking sector by elderly people.

$\boldsymbol{H_2}$ Barriers to technological innovation resistance is a multidimensional variable explained by: $\boldsymbol{H_{2a}}$ functional barriers and, $\boldsymbol{H_{2b}}$ psychological barriers.

Functional barriers

These include usage barriers, which refer to the effectiveness of a technological innovation in its pre-adoption, that is the ability of consumers to identify its advantages and associate them with the value proposition offered by organisations (Antioco & Kleijnen, 2010). Chaouali and Souiden (2019) state that a significant number of consumers in the banking sector do not perceive mobile banking as useful and convenient, especially elderly people, avoiding the use of their products due to the inconveniences related to the sizes of the screens and touch keyboards that mobile devices have, which is why mobile banking for some markets is not the appropriate communication platform for the consumption of banking offers, as they generate great efforts for its use from the chronological age of the consumer (Laukkanen, 2016).

Another functional barrier is that of value, which is understood as "the relationship between performance and price compared to substitutes for the product" (Antioco & Kleijnen, 2010, p. 1703). 1703), therefore, when consumers perceive that technological innovations do not offer additional value to what is currently on offer, they show resistance to their adoption, and even more so if they prevent the normal development of everyday consumption, particularly the use of mobile banking is costly, compared to offline banking or traditional ATMs (Tamilmani et al., 2021).

Next, there is the risk barrier, which from the perspective of Laukkanen (2016) refers to the degree of threat and danger associated with an innovation. For an older adult, these types of threats become one of their main barriers to the adoption of technological innovations, because they are associated with perceptions of vulnerability that their products may have in the banking sector, generating doubts in consumers regarding the performance, financial, social, and security risks that may occur when using mobile banking (Khanra et al., 2021). Given the above, the study tests the following hypotheses:

$\boldsymbol{H_3}$ Functional barriers are a multidimensional variable explained by: $\boldsymbol{H_{3a}}$ usage barriers, $\boldsymbol{H_{3b}}$ value barriers, and $\boldsymbol{H_{3c}}$ risk barriers.

$\boldsymbol{H_4}$ Functional barriers predict brand equity in the banking sector by elderly people.

Psychological barriers

The first of the psychological barriers is associated with consumer traditions, even more so when a brand adapts technological elements to its value proposition that bring about significant changes in the habitual behavior of users (Laukkanen, 2016), in this case elderly

people, for whom the adoption of new technological processes necessary for the consumption of services goes against commercial idiosyncrasies, hence Heidenreich and Handrich (2015) indicate that a large part of adult consumers are less open to technological innovations and find it difficult to change their consumption habits. This tradition barrier is highly correlated with people's cognitive age, which is why Chaouali and Souiden (2019) argue that age moderates the impact of the tradition barrier on resistance to technological innovations in the banking sector, where the barrier will be stronger for cognitively older consumers.

The second psychological barrier is that of image, which is recognized as the set of negative attitudes and perceptions that a consumer can associate with a product on the market based on its technological component of use (Laukkanen, 2016). This set of associations, similar to those proposed by Keller (1993) for the consolidation of brand equity from the image, when perceived unfavourably, can allow the development of a negative brand image, which is associated with the use of certain technology necessary for the consumption of banking products. This is why people who have a negative general image of certain types of technology attribute the same value judgement to related business offerings, a clear example being mobile banking, which causes not only resistance to the use of products but also a negative brand image (Laukkanen, 2016). In this respect, the following hypotheses are tested:

$\boldsymbol{H_5}$ Psychological barriers are a multidimensional variable explained by: $\boldsymbol{H_{5a}}$ tradition barriers, and $\boldsymbol{H_{5b}}$ image barriers.

$\boldsymbol{H_6}$ Psychological barriers predict brand equity in the banking sector by elderly people.

It is possible that chronological age influences the processes of technology use and that functional and psychological barriers to technology adoption are observed (Chaouali & Souiden, 2019); however, it is not accurate to pigeonhole elderly people into a large market, without differences in the perception of value propositions, where technological developments are included. It is necessary to identify whether these barriers actually exist and what is their real influence on the value of brands, as well as to analyze the real adoption potential of current technological applications in virtual environments by elderly people, considering that Souiden and Diagne (2009), as well as Tan and Ooi (2018) have evidenced a better adoption in the cosmetics and entertainment sector.

The interaction of users with technological platforms generates partial or total changes in the valuation and expectations towards brands, given that this psychological dimension strongly depends on the individual experience, and systematically affects the image, relationship, and purchase intention (Chaouali & Souiden, 2019); therefore, it is important to analyze the relationships between the barriers of resistance to technological innovation and what has been called brand value.

Brand equity

Aaker (1996) defined brand equity as a set of four categories of brand assets linked to the name or symbol that can add or subtract the value provided by a product to a company or its customers. These categories are brand awareness, perceived quality, brand associations, and brand loyalty. From brand awareness, consumers have the ability to identify and remember

a brand in the market, i.e., its prominence in the consumer's mind (Aaker, 1996), being a concept widely addressed in empirical research processes around branding for its impact on brand equity (Sürücü et al., 2019; Foroudi, 2019; Graciola et al., 2020).

From Keller's (1993) perspective, brand equity is a managerial proposition that is associated with brand building and is evidenced when consumers have a high level of awareness and knowledge of the brand by identifying strong, favorable, and unique brand associations in their memory. Brand equity emerges and is managed from two fundamental components: brand awareness and brand image (Keller, 1993).

Regarding perceived quality as a brand equity construct, Aaker (1991) describes it as the perception held by consumers associated with the quality or level of superiority of an offer in the market compared to the intention with which it was acquired. Brand associations are represented by all the thoughts that consumers have related to the brand, among which feelings, perceptions, images, experiences, and beliefs stand out (Aaker, 1991), including also the brand personality, as the set of human characteristics that consumers associate with the brand (Aaker, 1997).

Loyalty and brand liking reflect the link between a customer and the brand, which can range from commitment (attitudinal loyalty) to the observation of repeated purchase behavior of the same brand (behavioral loyalty) (Buil et al., 2013). It is relevant to highlight that, given the current competitive scenario in most sectors, it is not only relevant to sustain the value proposition from the differentiation of products that support the performance of the brand; it is necessary to develop an adequate relationship between consumers and organizations in the long term (Kotler & Keller, 2006), which really strengthens the importance and image of the brand in the market, by relating it to the products it supports.

In view of the above, the study tests the following hypotheses:

$\boldsymbol{H_7}$ Resistance barriers to technological innovation predict brand awareness in the banking sector by elderly people.

$\boldsymbol{H_8}$ Barriers of resistance to technological innovation predict brand associations in the banking sector by elderly people.

$\boldsymbol{H_9}$ Resistance barriers to technological innovation predict brand loyalty and brand liking in the banking sector by elderly people.

$\boldsymbol{H_{10}}$ Resistance barriers to technological innovation predict brand salience in the banking sector by elderly people.

$\boldsymbol{H_{11}}$ Resistance barriers to technological innovation predict brand performance in the banking sector by elderly people.

$\boldsymbol{H_{12}}$ Resistance barriers to technological innovation predict perceived brand quality in the banking sector by elderly people.

Based on the above aspects, the objective of this research was to identify the relationship between resistance towards technological applications by elderly people and the value of brands in the banking sector in Colombia, analyzing the influence of functional and psychological barriers on the dimensions of brand equity. The proposed research model which embodies the general hypothesis is visualized in Figure 1.

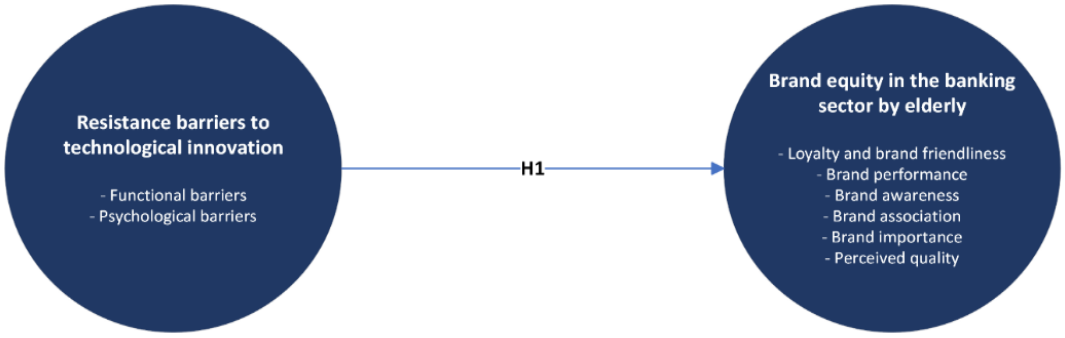


Figure 1. Research model

Source: Authors' own research.

Research methodology

Participants

The study included 502 elderly people living in the city of Bogotá, Colombia, aged between 60 and 80 years (M = 67.9; SD = 6.01), and who had at least one banking product, with monthly income associated with their salaries, pensions, independent activities, or with some type of family financial support. 50.8% were male and 49.2% were female. A one-stage cluster sampling was carried out, setting the sample size based on available demographic data (DANE, 2021), with a reliability level of 95% and a margin of error of 5%. The fieldwork was carried out through semistructured interviews conducted in person in shopping centers in the city of Bogotá and in areas surrounding the banks, between May and June 2023.

Instrument

In order to fulfil the purposes of the study, a questionnaire was constructed and applied with three components. The first included seven sociodemographic questions, in the second, a measurement of the dimensions of brand equity was developed, with 19 items, for banking brands in the segment of elderly people from the scale proposed by López-Rodríguez and Sandoval-Escobar (2023), in which a Cronbach's Alpha of α=0.919 was observed, these results being reported by the authors of the original scale. The third component, with 19 items, was related to the barriers of resistance to technological innovation in elderly people from the scale proposed by Chaouali and Souiden (2019) which is divided into two groups: functional barriers (use, value and risk) and psychological barriers (traditions and image), subscales that have a Cronbach's Alpha of α=0.85, these results being reported by the authors of the original scale. The instrument items were measured on a five-point Likert scale, where 1 is "strongly disagree" and 5 is "strongly agree". The applied instrument obtained a Cronbach's Alpha of α=0.939 for the technological innovation resistance barriers, particularly the functional barriers obtained an α=0.911, and the psychological barriers obtained an α=0.894. On the other hand, for the brand equity dimensions, an α=0.950 is reported.

Procedure and data analysis

A confirmatory factor analysis (CFA) was used to develop the objectives of the study and was complemented by structural equation modelling (SEM). The CFA was developed for the barriers to resistance to technological innovation and then for the brand equity dimensions,

the Diagonally Weighted Least Squares (DWLS) method was used due to the ordinal nature of the items present in the measurement scale (Chen et al., 2015). The model fit was assessed with Chi-square test ($\chi 2$), the root mean squared error of approximation (RMSEA) index and the standardised root mean squared residual (SRMR) index, where values below 0.05 determine a good fit, and between 0.05 and 0.08 an acceptable fit (Li, 2016). The Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) were also considered, with values above 0.95 indicating a good fit (Li, 2016).

The Omega Coefficient (ω) and the Alpha Coefficient (α) were reviewed to assess the internal consistency of the scale, which are determined to be adequate if they are greater than 0.80 (Hayes & Coutts, 2020). The average variance extracted (AVE) was calculated, which is the average amount of variation that a latent construct can explain in the observed variables to which it is theoretically related, an indicator that should be greater than 0.50 (Dos Santos & Cirillo, 2023). Finally, the Kaiser Meyer Olkin (KMO) test is presented for each item, which allows us to analyze the adequacy of the sample to support the relevance of the factor analysis performed, noting that values close to 1.0 indicate that a factor analysis can be useful with the data it possesses (Chen et al., 2015).

Subsequently, a SEM was developed using the Bootstraping technique, with the purpose of testing the general hypothesis that is embodied in the research model proposed in Figure 1. For the validity and reliability of the model, not only the standardized loadings of Cronbach's Alpha coefficients were analyzed, but also the composite reliability (rho_c) and the average variance extracted (AVE) (Hair et al., 2021). Likewise, a collinearity analysis, a Heterotrait-Monotrait Ratio test (HTMT), and the CVPAT test, which assesses how PLS-SEM results predict future results, were run, allowing to evaluate the ability of a model to make accurate predictions on unseen data, which is achieved through k-fold cross-validation (Liengaard et al., 2021). The following indicators were considered: indicator-averages prediction benchmark (IA), and the linear model prediction benchmark (LM) to identify the predictive validity of the model (Liengaard et al., 2021; Sharma et al., 2022).

Results

Highlighting some descriptive elements of the participating population, 74.3% belong to the lower middle socioeconomic level (in Colombia strata 2 and 3), while 21.7% of the sample was located in the middle and upper middle strata, percentages that closely represent the sociodemographic distribution of elderly people in the country. In terms of occupation, 31.3% are pensioners, while 26.7% are self-employed and 13.1% still receive a salary. Regarding education, 31% have a secondary education, 12.5% have a technical degree, 15.9% are technologists, 17.7% have a university education and 8.8% have no education. Regarding health condition, 12.2% consider it to be excellent, 57.2% believe it to be good, and 28.3% evaluate it as fair.

Confirmatory factor analysis (CFA)

Table 1 presents the overall goodness-of-fit report of the CFA for each instrument, which allows us to assess how well the proposed model fits the observed data, as well as to understand the underlying structure of the dataset in which the barriers to technological innovation resistance and brand equity dimensions are included, finding favorable results for both instruments. Overall, the results show that the observed test factors confirm the

theoretical factor structure with which the instrument was designed (López-Rodríguez & Sandoval-Escobar, 2023; Chaouali & Souiden, 2019).

Table 1. General adjustment report

CFA adjustments	**Resistance barriers to technological innovation**	**Dimensions of brand equity**
Chi-square test (χ2) Baseline model	15038.287	15720.496
Chi-square test (χ2) Factor model	111.666	126.057
Comparative Fit Index (CFI)	1.000	1.000
Tucker-Lewis Index (TLI)	1.000	1.001
Root mean square error of approximation (RMSEA)	0.000	0.000
RMSEA 90% CI lower bound	0.000	0.000
RMSEA 90% CI upper bound	0.021	0.016
Standardized root mean square residual (SRMR)	0.042	0.044

Source: Authors' own research.

The scale used for the factor analysis of barriers to technological innovation resistance had an overall average variance extracted (AVE) of 0.509, an OMEGA Coefficient (ω) of 0.944, and an Alpha Coefficient (α) of 0.945. In Table 2, these same indicators are presented independently for the functional barriers, as well as for the psychological barriers, and for each of their total scale items, the unstandardized factor loadings, the Kaiser-Meyer-Olkin test (KMO) and the standard error, finding satisfactory results for each subscale.

Table 2. Coefficients, mean variance extracted and item description for barriers to technological innovation resistance

Resistance barriers	**OMEGA (ω)**	**Alpha (α)**	**AVE**	**Items**	**Factor loadings**	**KMO**	**p**	**Std. error**
Functional barriers	0.924	0.923	0.524					
UB	0.853	0.847	0.593	UB1	0.738	0.957	< 0.001	0.037
				UB4	0.896	0.944	<0.001	0.041
				UB5	1.052	0.929	<0.001	0.050
				UB6	1.008	0.942	< 0.001	0.048
VB	0.811	0.811	0.589	VB1	0.951	0.940	< 0.001	0.074
				VB2	0.923	0.940	< 0.001	0.071
				VB3	0.886	0.957	< 0.001	0.072
RB	0.880	0.880	0.647	RB1	0.967	0.928	< 0.001	0.038
				RB2	0.899	0.926	< 0.001	0.034
				RB3	0.942	0.939	< 0.001	0.036
				RB4	0.872	0.950	< 0.001	0.035
Psychological barriers	0.877	0.894	0.595					
TB	0.833	0.831	0.624	TB1	0.823	0.932	< 0.001	0.037
				TB2	0.895	0.908	< 0.001	0.038
				TB3	0.909	0.900	< 0.001	0.040
IB	0.913	0.914	0.779	IB1	1.002	0.953	< 0.001	0.046
				IB2	1.052	0.929	< 0.001	0.047
				IB3	1.120	0.904	< 0.001	0.049

Source: Authors' own research.

The relationships between the barriers of use (0.89), value (0.94), risk (0.85), traditions (0.77) and image (0.87) with the first order variable, i.e. with the barriers of resistance to technological innovation, are well adjusted. This is confirmed in Table 3.

Table 3. Second-order factor loadings for barriers to technological innovation resistance

Indicator	Estimator	Std. Error	z-value	p	95% Confidence interval		Std. Est.
					Lower	Upper	
UB	1.988	0.226	8.817	< 0.001	1.546	2.430	0.893
VB	2.695	0.628	4.295	< 0.001	1.465	3.925	0.938
RB	1.614	0.130	12.421	< 0.001	1.360	1.869	0.850
TB	1.213	0.090	13.446	< 0.001	1.037	1.390	0.772
IB	1.791	0.179	10.022	< 0.001	1.440	2.141	0.873

Source: Authors' own research.

The scale used for the factor analysis of the brand equity dimensions showed an overall average variance extracted (AVE) of 0.506, an OMEGA Coefficient (ω) of 0.950, and a similar figure for the Alpha Coefficient (α). Table 4 presents the indicators for the factorial support of the brand equity dimensions, which were satisfactory.

Table 4. Coefficients, mean variance extracted and item description for brand equity

Brand equity	OMEGA (ω)	Alpha (α)	AVE	Items	Factor loadings	KMO	p	Std. Error
LBF	0.903	0.903	0.702	LBF1	0.803	0.934	< 0.001	0.022
				LBF2	0.857	0.925	< 0.001	0.022
				LBF3	0.872	0.964	< 0.001	0.024
				LBF4	0.935	0.961	< 0.001	0.024
BP	0.828	0.827	0.616	BP1	0.822	0.937	< 0.001	0.027
				BP2	0.829	0.947	< 0.001	0.028
				BP3	0.858	0.970	< 0.001	0.029
BA	0.871	0.876	0.701	BA1	0.766	0.929	< 0.001	0.025
				BA2	0.731	0.911	< 0.001	0.026
				BA3	0.842	0.938	< 0.001	0.027
BAS	0.826	0.821	0.613	BAS1	0.753	0.946	< 0.001	0.025
				BAS2	0.820	0.962	< 0.001	0.027
				BAS3	0.665	0.952	< 0.001	0.023
BI	0.793	0.794	0.562	BI1	0.704	0.931	< 0.001	0.024
				BI2	0.673	0.922	< 0.001	0.023
				BI3	0.703	0.948	< 0.001	0.024
PQ	0.850	0.854	0.657	PQ1	0.819	0.939	< 0.001	0.027
				PQ2	0.812	0.897	< 0.001	0.027
				PQ3	0.799	0.921	< 0.001	0.026

Source: Authors' own research.

Structural equation modelling (SEM)

Regarding the development of the validity and reliability analysis of the model, Table 6 shows the Cronbach's Alpha, Composite Reliability (rho_c), and Average variance extracted (AVE) for each of the intervening variables. It is pertinent to highlight that, in terms of Cronbach's Alpha, the value barriers have a lower indicator than expected (α=0.690);

nevertheless, the Composite Reliability reports a higher value for this same variable than stipulated by Hair et al. (2021), guaranteeing the reliability of the model, not only for this but for all the other variables. On the other hand, the average extracted variance values show figures above 0.50, which guarantees adequate indicators of validity and reliability in the following results (Hair et al., 2021).

Table 6. Validity and reliability analysis of the model

Variable	**Cronbach's Alpha (α)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
Brand equity	0.950	0.955	0.531
Brand association	0.827	0.897	0.743
Brand awareness	0.877	0.924	0.802
Brand performance	0.828	0.897	0.744
Brand importance	0.800	0.883	0.716
Loyalty and brand friendliness	0.906	0.934	0.780
Perceived quality	0.855	0.912	0.775
Resistance barriers	0.940	0.947	0.516
Functional barrires	0.910	0.926	0.534
Use barriers	0.847	0.898	0.687
Value barriers	0.690	0.828	0.621
Risk barriers	0.880	0.917	0.735
Phychological barriers	0.894	0.919	0.655
Image barriers	0.914	0.946	0.853
Tradition barriers	0.832	0.899	0.749

Source: Authors' own research.

To run the predictive analysis of the model, the cross-validated predictive ability test (CVPAT) was developed through PLS-Predict, determining the CVPAT values to observe whether there is predictive accuracy of all endogenous constructs simultaneously (Sharma et al., 2022). For this analysis, the Hierarchical Component Models (HCM) test is run using SMART-PLS. This type of test is effective because it reduces the number of relationships in the structural model and provides a more accurate understanding of how each dimension acts on the first-order variable (Hair et al., 2021). The information in Table 7 reflects the comparison between the indicator-averages prediction benchmark (IA), with the linear model prediction benchmark (LM), concluding that the proposed model has high predictive validity (Liengaard et al., 2021; Sharma et al., 2022).

To test the hypotheses, the repeated indicator technique proposed by Ringle et al. (2012) is used to support or reject the hypotheses according to the significance levels when t is greater than 1.960 (*t >1.960)*.

Table 7. Predictive model analysis

	IA			**LM**			**Conclusion**
	Average loss difference	*t value*	*p value* <0.05	Average loss difference	*t value*	*p value* <0.05	
Total model	-0.377	18.791	0.00	0.357	4.624	0.00	High predictive power

Source: Authors' own research.

In terms of hypothesis testing, it is pertinent to indicate that the results begin by determining whether barriers to resistance to technological innovation predict brand equity in the banking sector by elderly people, this being the general hypothesis of the research (H_1). In this regard, the data visualized in Figure 2, although showing the existence of an inversely proportional correlation between these two variables, reject this hypothesis (H_1 *β=-0.175; t=1.662;* R^2= 0.031).

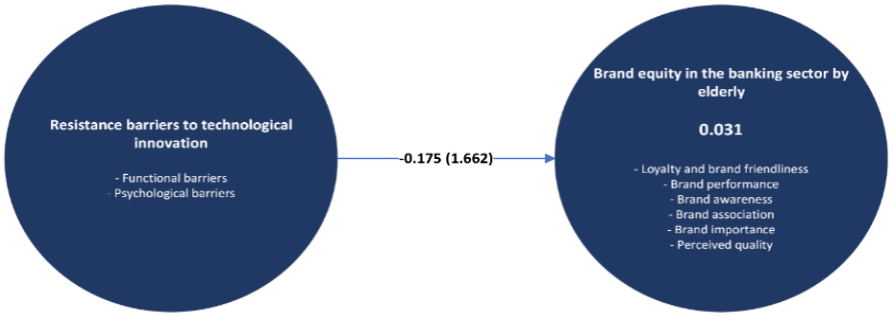


Figure 2. Model results

Source: Authors' own research.

To provide a deeper interpretation of the results, not only barriers to technological innovation resistance but also brand equity in the banking sector for elderly people were analyzed as multidimensional variables. Figure 3 provides a general description of the multidimensional behavior of the barriers to resistance to technological innovation. This construct consists of functional and psychological barriers (Chaouali & Souiden, 2019).

Initially, results of this analysis provide evidence supporting H_2 that barriers to technological innovation resistance are a multidimensional variable explained by: H_{2a} functional barriers (*t=49.046; t >1.960*) and H_{2b} psychological barriers (*t=30.876; t >1.960*). Similarly, results support H_3 r that functional barriers are a multidimensional variable explained initially by use barriers (H_{3a} *t=26.012; t >1.960*), by risk barriers (H_{3c} *t=23.635; t >1.960*), and then by value barriers (H_{3b} *t=11.329; t >1.960*). It should be noted that these functional barriers do not predict brand equity in the banking sector by elderly people as shown in H_4 (*t=0.607; t >1.960*).

Regarding psychological barriers, H_5 shows that this, as a multidimensional variable, is most strongly explained by tradition barriers (H_{5a} *t=50.340; t >1.960*), and secondly by image barriers (H_{5b} *t=39.983; t >1.960*); however, psychological barriers do not predict brand equity in the banking sector by elderly people, this being verified inH_6 (*t=1.062; t >1.960*).

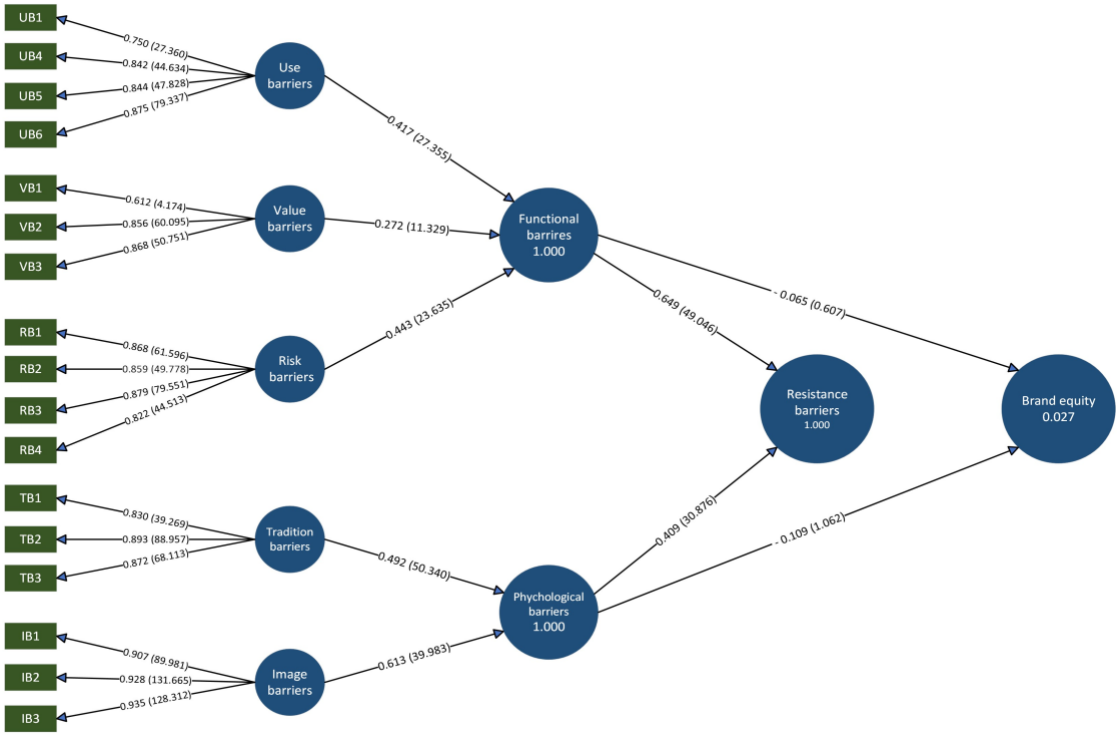


Figure 3. Multidimensional model for hypothesis testing on barriers to resistance to technological innovation

Source: Authors' own research.

With the aim of testing the proposed hypotheses between barriers to technological innovation resistance and brand equity dimensions, Figure 4 depicts these results in a multidimensional way. Results provide evidence supporting H_7 where barriers of resistance to technological innovation predict brand awareness in the banking sector by elderly people (*t=3.553; t >1.960*); however, la H_8 which posits that these barriers predict brand associations in the banking sector by elderly people, is rejected (*t=1.529; t >1.960*).

Barriers of resistance to technological innovation do not predict brand loyalty and brand liking in the banking sector by elderly people, hence H_9 is rejected (*t=1.292; t >1.960*); the H_{10} is accepted, as these barriers predict brand importance in the banking sector by elderly people (t=2.138; t >1.960). (*t=2.138; t >1.960*).

H_{11} must be rejected because barriers to resistance to technological innovation do not predict brand performance in the banking sector by elderly people (*t=0.568; t >1.960*), and H_{12} is rejected because these barriers do not predict perceived brand quality in the banking sector by elderly people (*t=1.024; t >1.960*).

From the results found, it is found that brand equity in the banking sector by elderly people is a multidimensional variable explained initially by brand associations (*t=41.510; t >1.960*), then by brand loyalty and brand liking (*t=37.807; t >1.960*), followed by brand performance (*t=37.807; t >1.960*), perceived brand quality (*t=30.870; t >1.960*). Brand importance (*t=28.110; t >1.960*) and brand awareness (*t=26.989; t >1.960*) represent the variables with the least explanation in the model.

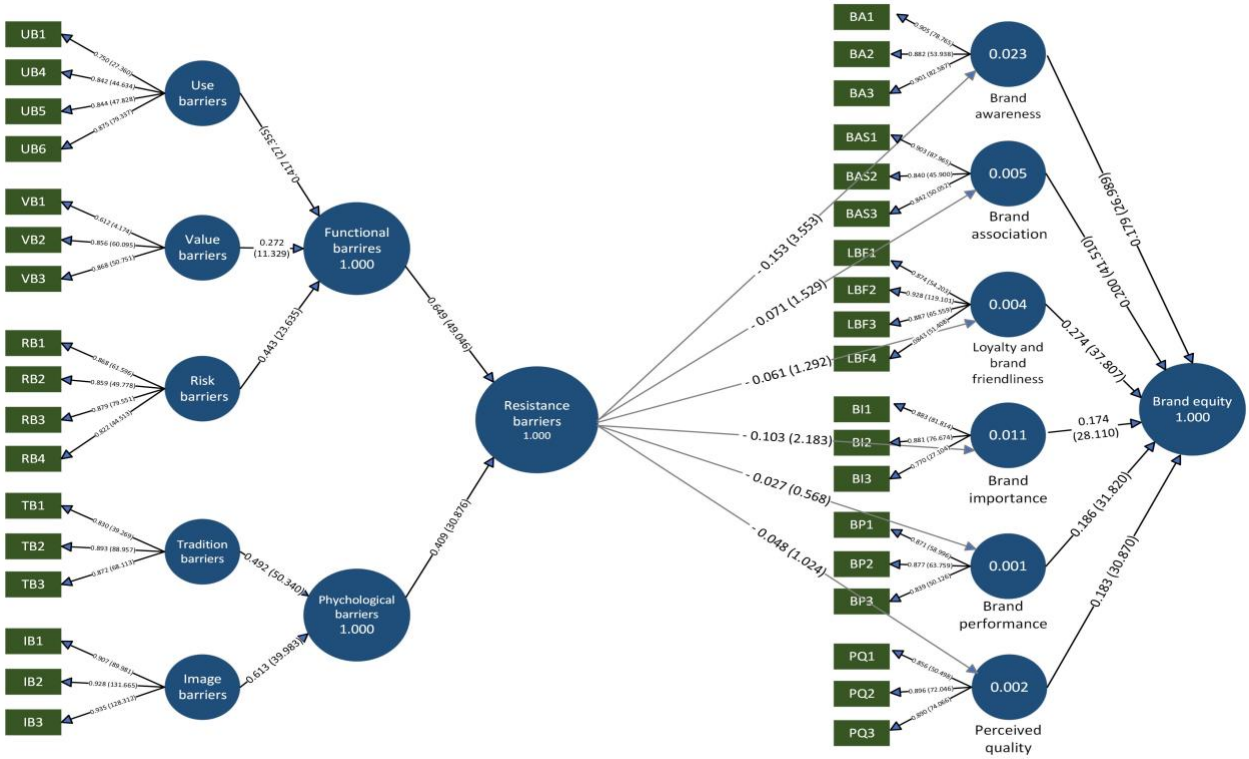


Figure 4. Multidimensional model for hypothesis testing between technological innovation resistance barriers and brand equity dimensions

Source: Authors' own research.

Discussion

Compared to some studies such as Ameme & Wireko (2016), Baklouti & Boukamcha, (2023), Laukkanen (2016), and Laukkanen et al. (2007), in which the resistance to innovation among older consumers in the banking sector and their satisfaction from different theoretical positions are explored in depth, the possibility to investigate the influence of barriers of resistance to technological innovation on brand equity in the banking sector is novel, and provides knowledge, not only for institutions but also for academia.

By addressing the specific concerns and barriers of older adults, banks can strengthen the trust of this market segment in their brands. Therefore, the development of this study allows us to understand why banking brands that understand and care about the needs of older adults have a positive impact on brand equity and its multidimensionality, led by brand awareness, perceived quality, associations, importance, and brand loyalty (Aaker, 1996; Keller, 1993).

The findings of this study allow us to determine the existing relationships between the barriers of resistance to technological innovation and the dimensions of brand equity of brands in the banking sector by elderly people, analyzing their predictability, and considering the multidimensional characteristics of these two components, so it was appropriate to analyze them in two phases: initially from a confirmatory factor analysis, and secondly through a structural equation model.

In the first part, the barriers of resistance to technological innovation proposed by Chaouali and Souiden (2019) had a good fit and support in their factor loadings, both

for functional and psychological barriers; however, some usage barriers had to be excluded (observed variables UB2 and UB3); the other variables were not modified with respect to the scale applied. Regarding the brand equity dimensions, the confirmatory factor analysis showed satisfactory results at the psychometric level for each of these dimensions.

Secondly, from the partial least squares structural equation model, the multidimensionality of the barriers to resistance to technological innovation is confirmed, which is made up in the first instance by functional barriers and, secondly, by psychological barriers. As for the dimensions of brand equity as a multidimensional component, it is observed that it is initially made up of brand associations, followed by brand loyalty and brand sympathy; thirdly, brand performance, perceived quality, brand importance, and lastly brand awareness.

From the Hierarchical Component Models (HCM) test and the comparison made between the indicator-averages prediction benchmark (IA) and the linear model prediction benchmark (LM), it is determined that the model proposed in this study has a high predictive validity, so it can be inferred that the barriers of resistance to technological innovation do not predict, as a multidimensional construct, the brand equity in the banking sector by elderly people (*H_1 β=-0.175; t=1.662;* R^2= 0.031*)*; however, it is pertinent to highlight that these barriers do adequately predict two of the brand equity dimensions, namely brand awareness (*t=3.553; t >1.960*) and brand importance (*t=2.138; t >1.960*).

Theoretical implications

The theoretical implications of the study reflect important contributions to technological innovation and branding. The empirical results support the findings of Chaouali and Souiden (2019) insofar as resistance barriers to technological innovation were also identified in terms of two constructs: functional and psychological barriers.

Functional barriers refer to obstacles or challenges that may limit or hinder the adoption and development of new technologies by elderly people in the banking sector, and are theoretically made up of usage barriers (*t=26.012; t >1.960*) related to elderly people' ability to identify their advantages and associate them with the value proposition offered by banking institutions (Antioco & Kleijnen, 2010), as well as risk barriers (*t=23.635; t >1.960*) epresenting the degree of threat and danger that elderly people associate with a technological innovation in the banking sector (Laukkanen, 2016), and by value barriers (*t=11.329; t >1.960*) present when elderly people perceive that technological innovations do not offer additional values to those they have traditionally perceived with respect to the bank's offerings (Chaouali & Souiden, 2019).

Psychological barriers refer to the emotional and cognitive obstacles that may hinder the acceptance, adoption, and adaptation to new technologies offered by the banking sector to the elderly (Chaouali & Souiden, 2019), which are theoretically shaped by the barriers of traditions (*t=50.340; t >1.960*), which are practices rooted in the culture and history of the older adult as a consumer, which may resist change and hinder the adoption of new ways of demanding products from banking systems (Laukkanen, 2016), and by image barriers (*t=39.983; t >1.960*), these being possible negative perceptions and prejudices of elderly people that may arise around a new technology due to the way it is presented, communicated and associated with certain characteristics, thus hindering the adoption and acceptance of the technology developed by the banking sector.

With respect to branding, the results of the study validate brand awareness, perceived quality, associations, and brand loyalty as dimensions of brand equity (Aaker, 1996; Keller, 1993), based on the factorial covariances for the relationship of each of them, finding satisfactory results between the estimates, the standard error, the z-value, and the significance level (p) of each relationship. The findings confirm the view of Keller et al. (2011), who assumes brand equity as a managerial proposition that is associated with brand building and is evidenced at the moment when the consumer shows a high level of awareness and knowledge of it (Sürücü et al., 2019), identifying strong, favorable and unique associations in their memory (Narteh, 2018).

Practical implications

In terms of practical implications, it is relevant for the banking sector to reduce the impact of resistance barriers to technological innovation in its "senior" segment through brand awareness and the importance of brand as dimensions of brand equity.

The results of the study show that brand awareness (*t=3.553; t >1.960*) is a dimension of brand equity influenced by barriers of resistance to technological innovation, because elderly people' recognition and recall of a bank can influence their choice of products (Sürücü et al., 2019), and their trust in the services offered, impacting their long-term loyalty (Kim et al., 2019). Banks, not only for their commercial consolidation, but also for their social responsibility practices, need to strengthen trust and credibility in the market, which is imperative in the financial sector, where security and integrity are fundamental aspects of their value proposition.

Regarding brand importance (*t=2.138; t >1.960*), the results show that brand importance for seniors in the banking sector is not only based on the management of their corporate image, but encompasses the general perception of the financial institution, which should be associated with trust, differentiation, and reputation among consumers (Swimberghe et al., 2018), so lowering resistance barriers to technological innovation is a fundamental action of brand equity in the senior segment. A strong bank brand for seniors can increase their loyalty and increase their consumer lifecycle, considering that in a competitive financial market, a strong and recognized brand can differentiate a bank from its competitors.

Limitations and directions for future research

One of the limitations of the study is the fact that it does not use mediating variables that could have explained the relationship between barriers to resistance to technological innovation as independent variables and the dimensions of brand equity as dependent variables. Therefore, the use of such mediating variables is recommended in the development of future research to go deeper into the consumer behavior of elderly people in the banking sector.

Another important limitation is the cross-sectional design of the study; therefore, a recommendation for future research would be to develop longitudinal or experimental studies, which would allow us to answer the question of the causality of the observed variables with empirical evidence.

Future lines of research include the development of a line of research on the user experience of elderly people, given that their physical and psychological characteristics are unique and not comparable with other age segments, so that the design of technological

interfaces should be based on testing applications, analyzing their ergonomics, and testing their usability, investigating their effect on the value of brands, not only in the banking sector. Likewise, for future studies it is relevant to check whether psychological and functional barriers, independently, predict different dimensions of brand equity, based on focused interventions that allow us to visualize whether use, value, risk, tradition and image have an impact on the construction of value from the usability of technological platforms according to the perceptions of users.

Conclusion

On the other hand, the segment of elderly people in Colombia and Latin America is particular and different from other countries in the world, with different educational and digital literacy indicators and diverse possibilities of developing different possibilities, so it is important to particularize the models and include sociodemographic and cultural variables in them that take into account not only the characteristics of the segment, but also the type of configuration of the banking system.

Finally, from the perspective of corporate social responsibility and the promotion of responsible consumption practices, the banking sector must critically analyze technological innovations and their relationship with its value propositions, given that the gradual growth of the population of elderly people in the world, who have particular needs and characteristics, requires an effective and ethical response that ensures that applications, websites and devices are accessible and usable for them, and in turn, become a competitive advantage for this economic activity.

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