

Omnichannel diagnosis for micro, small and medium-sized companies, sectorial study

Diagnóstico omnicanal para micro, pequeñas y medianas empresas, estudio sectorial

Diagnóstico do omnicanal nas micro, pequenas e médias empresas, estudo setorial

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ABSTRACT | The study aims to explain the omnichannel characteristics and behaviors of micro, small and medium-sized enterprises (MSMEs) in the food sector in Antioquia, Colombia. It evaluates the conditions necessary to achieve an omnichannel classification based on three dimensions: marketing models, multichannel options, and supply chain with digital technologies. An explanatory methodology using empirical data from surveys of 140 MSMEs was applied, and cluster analysis was used to group the companies. The results show relatively low overall omnichannel behavior, with medium enterprises outperforming small and micro enterprises. Enhanced digital technologies and integrated platforms can significantly improve omnichannel conditions, leading to better profitability and customer retention. The findings emphasize the importance of digital integration and the need for further research into the technological and methodological aspects of omnichannel implementation.

KEYWORDS: technological change, retail and wholesale trade, cluster analysis

JEL classification: O3, L81, C38

HOW TO CITE

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RESUMEN | Este estudio explica las características y comportamientos omnicanal de las micro, pequeñas y medianas empresas (MIPYMES) del sector alimentario en Antioquia, Colombia. Evalúa las condiciones necesarias para alcanzar una clasificación omnicanal basada en tres dimensiones: modelos de marketing, opciones multicanal y cadena de suministro con tecnologías digitales. Se empleó una metodología explicativa utilizando datos empíricos de encuestas administradas a 140 MIPYMES, y se utilizó el análisis de conglomerados para agrupar a las empresas. Los resultados muestran un comportamiento omnicanal general relativamente bajo, con las empresas medianas superando a las pequeñas y a las microempresas. Las tecnologías digitales mejoradas y las plataformas integradas pueden mejorar significativamente las condiciones omnicanal, lo que conduce a una mejor rentabilidad y retención de clientes. Los hallazgos enfatizan la importancia de la integración digital y la necesidad de más investigación sobre los aspectos tecnológicos y metodológicos de la implementación omnicanal.

PALABRAS CLAVE: cambio tecnológico, comercio minorista y mayorista, análisis clúster

CLASIFICACIÓN JEL: O3, L81, C38

RESUMO | O estudo tem como objetivo explicar as características e comportamentos omnicanal de micro, pequenas e médias empresas (MPMEs) do setor de alimentos em Antioquia, Colômbia. Avalia as condições necessárias para alcançar a classificação omnicanal em três dimensões: modelos de marketing, opções multicanal e cadeia de suprimentos com tecnologias digitais. Foi aplicada uma metodologia explicativa utilizando dados empíricos de pesquisas realizadas com 140 MPMEs, e foi usada a análise de cluster para agrupar as empresas. Os resultados mostram um comportamento omnicanal geral relativamente baixo, com as médias empresas superando as pequenas e microempresas. As tecnologias digitais aprimoradas e plataformas integradas podem melhorar significativamente as condições omnicanal, levando a uma melhor lucratividade e retenção de clientes. Os achados enfatizam a importância da integração digital e a necessidade de mais pesquisas sobre os aspectos tecnológicos e metodológicos da implementação omnicanal.

PALAVRAS-CHAVE: Mudança tecnológica, Comércio varejista e atacadista, Análise de Cluster

Classificação JEL: O3, L81, C38

INTRODUCTION

Omnichannel retailing has revolutionized the retail industry by integrating various touchpoints to provide a seamless and enhanced customer experience. The shift from multichannel to omnichannel retailing is a common factor in which companies use multiple channels simultaneously to engage with customers throughout the purchase process (Hübner et al., 2022). This transition makes omnichannel strategies an essential part of modern business practices, especially in retail, and enables companies to effectively meet the evolving demands of consumers. Omnichannel retailing equalizes prices, offers unique features in specific channels, and coordinates marketing efforts across all touchpoints to increase customer satisfaction, loyalty, and sales. The COVID-19 pandemic has accelerated the adoption of digital channels and highlighted the critical importance of omnichannel strategies to address current and future challenges in the retail environment.

In this area, technology plays an important role, as digitalization is a part of it. Technological change related to Industry 4.0 is transforming the economy and lifestyle and explaining the impact of these dimensions, for example on healthcare services and products (Aceto et al., 2020). Digitalization has changed the way numerous products are purchased in all aspects of the e-commerce field (Matarazzo et al., 2021), while Qi and colleagues (2023) show that Industry 4.0 develops a high level of technology and achieves sustainable manufacturing operations. For example, the analysis of large amounts of data helps in the implementation of omnichannel actions and enables operations and communication with customers.

Kotler and colleagues (2021) highlight the importance of digitalization in marketing, such as linking customer interactions in the online and offline channels into a cohesive system that ensures a smooth customer experience when switching between channels. This emphasizes the need to make information accessible to consumers at every stage of their decision-making process. The omnichannel approach involves integrating distribution channels with sales and promotional information with the main objective of providing a seamless and satisfying customer experience, managing different channels for customers' search, purchase and consumption habits, improving the customer experience and increasing sales (Kotler et al., 2021; Roldán-Sepúlveda et al., 2022).

These technologies pose new challenges and opportunities for businesses and require further academic research (Kotler et al., 2021). Omnichannel strategies pose specific challenges for MSMEs serving both business-to-business (B2B) and consumer-to-consumer (B2C) customers. B2B sales involve transactions with other businesses that often require customized solutions, bulk orders, and long-term relationships. In contrast, B2C sales target consumer customers and focus

on personalized experiences, emotional engagement, and immediate purchase decisions. These dual demands result in different customer needs, complex supply chain management, consistent branding and messaging, and different marketing strategies. To address these challenges, MSMEs must develop a clear omnichannel strategy that effectively balances B2B and B2C sales and ensures consistent brand image and messaging across all channels (Fujimura & Ishino, 2020).

Internet connectivity requires effort and planning for the optimal integration of retail and information with consumers for an omnichannel strategy through the exchange of information in offline and online sales channels (Matarazzo et al., 2021; Hänninen et al., 2021). However, in the Colombian case, according to FAEDPYME (2021), digitalization state still has a long way to go to implement it and that the size of the company and the sector, as well as the professional training of its managers, have a greater influence on it.

Omnichannel strategy transformed communication from traditional services and products to technological challenges and application scenarios (Aceto et al., 2020) by connecting physical and virtual systems with internet platforms that unify information to achieve efficiency, improve collaboration and quality (Bagheri et al., 2015), highlighting the fact that customer information and interactions play an important role in business operations, which require the storage of large amounts of non-traditional data and analytics.

Omnichannel approach can improve competitive positioning strategies such as total customer solutions and system locks from the delta model by combining digital technologies with retail and providing platforms for customer interactions, data control, service, satisfaction and efficiency (Hoehle et al., 2018). Nevertheless, the Covid-19 pandemic accelerated omnichannel growth between 2020 and 2021 (Cocco & De-Juan-Vigaray, 2022), offering contactless channels to meet shopping needs, avoid human interaction, automate businesses, and ensure compatibility and trust in a contactless society (Wang et al., 2021). This approach has become a crucial solution for companies to adapt to the changing consumer landscape and remain competitive in the market.

Not only marketing and digitalization, but also inventory and supply chain distribution are considered important for omnichannel classification in companies by different authors. For example, Roldán-Sepúlveda and colleagues (2022) propose a conceptualization of three dimensions: digital marketing with customer engagement in channels, supply chain and digital systems; and web or app platforms for storing information; in contrast, the objective of this study is to explain the omnichannel characteristics and behaviors of food companies, focusing specifically on micro, small and medium enterprises (MSMEs) in Antioquia, Colombia. It defines the

conditions that these companies need to achieve an omnichannel classification and a measure for a sample of this type of companies, identifying key dimensions and observable variables related to successful omnichannel strategies.

LITERATURE REVIEW

This section explains the dimensional aspects of the omnichannel strategy, taking into account the conditions of micro, small and medium-sized enterprises and analyzing marketing models, multichannel options and supply chain digitalization.

Marketing strategies generate high competitiveness, as Moreno-Gómez et al. (2023) have confirmed in Colombian companies. Synergies through Internet technologies and communication require digitalization, which highlights the importance of offline and online marketing (Kotler et al., 2021). Analysis of customer behavior is crucial for marketing decisions, with big data analysis increasing benefits in decision-making processes (Hautakangas, 2022).

Companies need servers and storage capacity for big data analytics to build powerful omnichannel experiences, store data and meet demands and profitability (Werenowska, 2020). However, there are still gaps in the literature regarding new touchpoints, channels and predicting omnichannel customer behavior (Gerea et al., 2021). Marketing 5.0 trends should also be considered (Kotler et al., 2021).

On the other hand, multichannel is another condition that omnichannel must meet, since the channels must have information provided by the retailer so that the consumer can have data from the store about their products and inventory, both present and digital. Therefore, with the definition of the omnichannel strategy mentioned above (Liu et al., 2020), it is necessary that multichannel information is provided on different platforms, which is not the same as omnichannel, but is a necessary requirement. For this reason, multichannel is another dimension that should be described here.

For an effective omnichannel strategy, multichannel information must be available across platforms (Liu et al., 2020). Integrating supply chain management with inventory data is necessary and requires data storage, communication and digitalization (Hänninen et al., 2021) to solve problems such as inventory depletion, price discrepancies and queues while improving experiences, management and decision making (Hoehle et al., 2018).

Marketing models

Omnichannel marketing models typically use websites, social media, digital advertising, and e-shopping (Zhang et al., 2022). Consumers access information through multiple channels, allowing for flexible experiences. In times of crisis,

rational purchasing decisions require organizations to adapt to new demands (Belyakov et al., 2020). Omnichannel empowers customers through digital experiences (Alonso-Garcia et al., 2021; Gao et al., 2021; Mishra et al., 2021).

Implementing a strategy that coordinates information services and material processes simultaneously can increase customer loyalty by tracking advertising, products, prices, and orders (Hsia et al., 2020; Ivanov & Sokolov, 2020). This approach requires an adaptable, dynamic, and fast system in which digital marketing plays a crucial role (Blut et al., 2018). Customer interaction is particularly important in the food sector due to the short lifespan of products (Wang et al., 2021; Wu & Chien, 2021). Technology can give companies a competitive advantage (Kumar et al., 2021), but more research is needed to understand the omnichannel customer experience (Gerea et al., 2021).

Multichannel options

Digital information should be shared company-wide as part of an omnichannel strategy (Hübner et al., 2022). High-quality digital information and matching physical products are crucial to avoid customer loss (Wu & Chien, 2021). MSMEs need adequate resources and technologies for successful digital transformation, which requires unified platforms for customer interaction, data management and traceability (Arkhipova et al., 2021).

Designing distribution channel operations is crucial to benefit from e-commerce, but it also creates competition between manufacturers and retailers, requiring an improvement in the capabilities of both. Tahirov and Glock (2022) suggest that MSMEs need to focus on multichannel distribution systems, virtual products, and digitalization of sales channels. Digitalization can meet customer demands and improve business modalities, customer satisfaction, efficiency, and effectiveness, but requires significant investments in technology and resources (Kovaleva & Kanke, 2021). However, digital adoption is not universal among MSMEs, and rural areas often have fewer digital sales resources and prefer face-to-face channels (Reuschke & Mason, 2022). The potential for digital home-based businesses to expand their market is there, but the literature has exaggerated the growth of digital sales, especially in Latin American countries, with most studies coming from North America or Europe (Hübner et al., 2022; Mehta et al., 2020).

Supply chain with digitalization

Digitalization is transforming the supply chain into a strategic decision-making process that enables companies to achieve their goals using technology. The digital supply chain (DSC) uses a digital methodology to increase resource potential and existing capabilities, improve business performance, and promote a digital culture, processes, products, and services. Ibrahim and Wang (2019) identify distribution,

product, customer service, online engagement, and store experience as critical factors in the DSC. Big data is an innovation that increases supply chain capabilities. However, technological knowledge gaps and skills deficits remain a challenge.

Inventory and supply chain management in an omnichannel strategy can be improved through technology applications such as virtual augmented and social networks (Cai & Lo, 2020). Optimal planning of operations, including administrative requirements, customer order management, inventory planning and optimization, demand forecasting, and store and route locations, is required for offline and online sales (Hübner et al., 2022). Despite gaps in the literature, the interplay of digitalization and inventory management helps ensure product availability across all channels and reduce the risk of stockouts or excess inventory (Jocevski et al., 2019; Zhang et al., 2022). By providing customer demand and market trends, inventory needs can be predicted and met in a timely manner, improving e-commerce and social marketing (Li, 2023).

Comparing studies on omnichannel strategies

International level

Globally, the adoption of omnichannel strategies has been widely studied, especially in developed countries with advanced digital infrastructure. Aceto and colleagues (2020) discuss the role of Industry 4.0 technologies such as big data and IoT in enhancing omnichannel retail through high levels of technological integration and sustainable manufacturing operations. Qi and colleagues (2023) elaborate on the role of big data analytics in implementing intelligent Industrial Internet of Things (IIoT) systems in sustainable manufacturing operations and emphasize the need for high levels of technological integration.

Regional Level (Latin America)

In Latin America, studies have highlighted the digital divide and the slower pace of technological adoption compared to North America and Europe. Matarazzo and colleagues (2021) examine how digital transformation impacts customer value creation in Latin American MSMEs and find that while digital technologies offer significant potential, their implementation is often hampered by infrastructural and economic challenges. Reuschke and Mason (2022) found that digital distribution resources are lower in rural areas and prefer face-to-face channels. Moreno-Gómez and colleagues (2023) confirm that marketing innovation and digital communication significantly impact the competitiveness of Colombian SMEs and highlight the importance of digital integration and marketing models.

National level (Colombia)

At the national level, the adoption of digital and omnichannel strategies in Colombian companies has been studied, but comprehensive industry-specific

studies remain limited. Roldán-Sepúlveda and colleagues (2022) provide a conceptual review of omnichannel strategies, highlighting the potential for competitive advantage but noting the significant gap in implementation, and Valencia-Cárdenas and colleagues (2023) provide a customer perspective with strong evidence of lack of strategies and lack of trust in omnichannel information sharing. The FAEDPYME (2021) report highlights the slow digitalization process among Colombian MSMEs, influenced by factors such as company size and management competence, reflecting the need for further digital integration and resource allocation.

Recent comparative studies

Recent studies highlight the rapid development and critical importance of omnichannel strategies at global, regional and national levels. Big data analytics in IIoT systems are critical for sustainable manufacturing and digital platforms (Qi et al., 2023). Marketing innovations and digital communication significantly increase the competitiveness of Colombian SMEs (Moreno-Gómez et al., 2023). However, challenges to digital transformation persist in rural areas of Latin America due to technological and economic barriers (Reuschke & Mason, 2022). The slow digitalization process of Colombian MSMEs requires further digital integration and resource allocation to improve omnichannel capabilities (FAEDPYME, 2021).

By processing and implementing big data, retailers can improve customer satisfaction, increase sales, build stronger customer relationships, and optimize inventory. This is not the only action or activity to share information, but it has ultimately proven to improve the omnichannel experience (Werenowska, 2020). In addition, the storage, processing, and analysis of big data brings the food industry to a higher level of competition, as it is a resource linked to the omnichannel strategy to transform environments and develop retail with all kinds of information. Big data is also an important tool for the food industry, allowing customer selection through restaurants in mobile applications (Chakraborty et al., 2023).

In this way, big data is critical for implementing omnichannel strategies as it provides insights into consumer behavior, preferences, and trends for personalized experiences and data-driven decisions (Li, 2023). It supports inventory design, minimizes costs, improves quality control, and provides inventory information on product availability, which increases inventory flow, meets changing demand, and improves the consumer experience. In the food industry, companies are implementing strategies based on technology and marketing models to improve brand awareness, e-commerce, and social marketing, optimize customer service, and use data from physical and online channels for technical analytics (Chakraborty et al., 2023). This approach reduces waste and conserves resources.

METHODOLOGY

This study used an explanatory research methodology based on empirical data collection through a survey tool to measure the omnichannel degree of micro, small and medium enterprises (MSMEs) in the food sector, as shown in table 1. Based on the literature review and the study of research articles such as in Valencia-Cárdenas and colleagues (2023), it is useful to divide the evaluation criteria into three mandatory conditions: marketing models, multichannel and supply chain with digitalization, which allows analyzing their conditions and activities for adopting and fulfilling omnichannel.

Successful adoption of an omnichannel strategy requires three conditions: personalized marketing models using customer databases, multichannel options for online and offline customer interactions, and supply chain digitalization for better inventory management and efficient delivery. Measuring the adoption and compliance with these conditions can accurately evaluate the omnichannel strategy of food MSMEs and provide a detailed overview of areas for improvement. This helps companies make informed decisions to improve their strategy and ultimately increase profitability and customer loyalty.

According to previous statements, in this work we basically divided the omnichannel conditions into three parts: marketing models, multichannel, and supply chain with digitalization, all in a digital integration form. The evaluation is a numerical assignment with a maximum of five and a total of 60 fulfilled conditions according to the literature analysis (table 1).

The final operation consisted of a rule of three, a transformation on the variable scale, converting the maximum 60 points into percentages; i.e. the maximum value achieved is 100%, for the Omnichannel score, to describe the results and explain the relationship with other variables.

DIMENSION	AUTHORS	CONDITION	SCORE
MARKETING MODELS			
Webpage and application.	Blut et al. (2018), Jocevski et al. (2019), Gereá et al. (2021).	A sailing webpage or marketplace integrated into a retail store customer information management system. This must be used to store a database. The platform, digital information and database must be complete.	5
Customer databases storage.	Alexandrova & Kochieva (2021).		
Product information: digital marketing.	Blut et al. (2018), Cocco & De-Juan-Vigaray, (2022).		
Customer satisfaction measurement and empowerment.	Alexandrova & Kochieva (2021).	Measures to ensure customer satisfaction. Surveys on customer satisfaction and the sales experience.	5
MULTICHANNEL			
Physical stores and virtual stores.	Derhami et al. (2021).	There must be one physical and at least one virtual sales channel, integrated.	5
Display all products in all channels.	Jocevski et al. (2019), Liu et al. (2020).	At least 75% of products must be featured across all channels shared on platforms and in physical stores..	5
Allow storage of orders and inventories to every channel.	Derhami et al. (2021).	Inventory, orders, in the digital platform for customers, shared.	5
SUPPLY CHAIN WITH DIGITALIZATION			
Warranties after-sales.	Zhang et al. (2022).	After customer devolution, order fulfillment, with the information integrated in platforms.	5
Order fulfillment.	Gao et al. (2021).		
Packaging and shipping information.	Hoehle et al. (2018).	Internal information for packaging and shipping companies.	5
Visual delivery time.	Liu et al. (2020).		
Shipping information in platforms.	Jocevski et al. (2019), Liu et al. (2020).	Tracking orders and deliveries for customers and companies.	5
Demands registers storage in one system.	Derhami et al. (2021), Zhang et al. (2022).	Storage of all customers' requests or orders in one system, in all channels and must be integrated, centralized and not fragmented..	5
Visualization of multi-channel inventories and central management, automatically updated.	Derhami et al. (2021).	Internal inventory information for all sailing channels.	5
Diversity in deliveries (last mile, buy and collect, buy and consume).	Jocevski et al. (2019.)	Several delivery options that the customer chooses during departure.	5
Real-time delivery logistics.	Hoehle et al. (2018).		
TOTAL PUNCTUATION			60

Table 1. Omnichannel conditions that must be fulfilled, and scores

Source: Own elaboration.

Survey

As supported by the Colombian Statistics Office (Dane, 2021), a total of 5,780,623 establishments were reported, but related to food preparation, 376,072 establishments were found in Colombia (Dane, 2023). Then, for Antioquia (Colombian department) we found 12.13% of participation of this type of micro-enterprises (Dane, 2021), for 45618, then we estimated this total population at 46,000 companies in this sector, which led us to take a random sample in different and representative locations from Medellin (the capital of Antioquia) and nearby localities in the surrounding area.

Where:

n = sample size.

N = population size (46.000).

Z = 1.96 a 95% confidence level.

P = probability of success 0.2 (20%)

Q = 1-p

e = standard error of 6.7% = 0.067

$$n = \frac{N*(z^2)*P*Q}{(N-1)*e^2+(z^2)(P*Q)} = \frac{46000(1.96^2)(0.2*0.8)}{(46000)0.073^2+(1.96^2)(0.2*0.8)} = 137 \quad (1)$$

A total of 137 surveys should be collected, but we obtained 140 MSME's using equation (1).

Statistical methods

Cluster analysis uses quantitative variables to group similar data points based on their distance from selected centers. The goal is to create groups with high similarity within each group and low similarity between the groups. This method helps to identify a representative point for each group. In this work, we use the PAM method or Partitioning Around Medoids, which calculates differences between observations using Euclidean distance. The optimization process minimizes the sum of differences between the medoid and other members of the cluster while renewing the number of elements per group (Kaufman & Rousseeuw, 1990). The PAM method has been shown to find appropriate aggregations and is more robust to outliers than other clustering techniques such as K-Means (Orsi, 2017). One measure to evaluate clustering quality is the silhouette, which should be positive or close to one for a good classification. A negative value indicates misclassification (Shutaywi & Kachouie, 2021).

It is also important to estimate the Kaiser-Meyer-Olkin (KMO) test, which is used to assess whether the data are appropriate or consistent and indicate a correct association for finding classifications or factors. KMO values range from

0 to 1, and a value of 0.9 indicates that the variables in the data are well suited for factor analysis (Frías-Navarro & Pascual Soler, 2012).

RESULTS

This method will reflect the results of the surveys conducted in 140 micro, small and medium enterprises and the values are percentages measuring the omnichannel level for the transformed punctuation.

The instrument used has a mix of quantitative variables, then to check the reliability we performed a KMO test and then used the Jasp software, the main quantitative variables used for this are shown in table 2.

These results, with most KMO values above 80% and increased consistency, allow us to present validation and consistency of the links between the variables used. This shows that the observed variables are not only suitable for clustering, but also for estimating correlations to inform on associations between them.

Variables	Abbreviation	MSA
Overall MSA		0.855
Omnichannel score	Score	0.913
Optimization with digitalization	OPTIME	0.81
Current inventory level	INVENTORY	0.713
Number of sale omnichannel strategies	OMNIACTIONSALES	0.912
Online channel	ONLINESALE	0.838
Presential actions	ACPRESENCIAL	0.841
Current profitability	ACTUALPROFIT	0.777
Current perception of digital client retention	RETENONLINE	0.834
Number of web platforms	WEBPLATFORMS	0.906
Number of supply omnichannel actions	OMNIACTIONSSUPPLY	0.864

Table 2. Kaiser-Meyer-Olkin test

Source: Own elaboration.

Descriptive statistics

The initial statistics help to understand the variables used to describe the omnichannel conditions for the 140 companies. In table 3, we can see that the omnichannel score is 16 on average, which means that the omnichannel strategy conditions are met, at a very low general level in the department of Antioquia. The mean score is lower for micro companies (13%), followed by small (18.5%) and medium (27.5%), which means that omnichannel conditions are better for companies with greater size and assets, which means more opportunities to transform current models into omnichannel and improve the market.

		Score		
General Mean		16,10%		
Size of the company	Medium	Micro	Small	
Valid	20	100	20	
Mean	27.5%	13.3%	18.5%	

Table 3. Basic statistics means for omnichannel scores in percentages

Source: Own elaboration.

We also found a higher coefficient of variation for the general score and for micro and small businesses this means heterogeneity of behavior or deviating punctuation.

In table 4 we find mean values of the omnichannel scores with the transformed score, which are higher in categories such as ice cream, bakery and pizza and have a higher score in medium-sized MSME's. These also reflect this business category and size which is favorable for omnichannel scores.

Table 4 shows the mean values of the scores with higher omnichannel behavior, namely for medium-sized companies selling chicken (50%), ice cream (33.2%), coffee (33%) and restaurants (29.1%). In addition, we were able to calculate that about 40% use a platform (like Rappi) but the information is almost not integrated across all their channels, and only 13% of them have or store a customer database, which means that they do not have incentives or promotional strategies, but an actual omnichannel strategy.

Category	Medium	Micro	Small	Total
Rices	16.4%	4.1%		10.2%
Coffee	33.0%	15.8%	8.2%	17.6%
Meats	28.7%	10.4%	18.2%	12.9%
Ham hotdogs sandwiches	18.9%	14.2%	28.0%	18.1%
Ice-cream	33.2%	19.4%		24.9%
Drinks and juices		14.3%		14.3%
Bakery	28.7%	16.6%	16.4%	19.4%
Pizza		17.7%	24.6%	19.3%
Chicken	50.0%	4.1%	20.5%	15.3%
Restaurant	29.1%	12.1%	13.3%	13.8%
Total	27.5%	13.3%	18.5%	16.1%

Table 4. Percentages by sector

Source: Own elaboration.

Cluster analysis

The PAM method (Jasp) found six groups of clusters presented in table 5 and finds a 73% explanation of the variability (R²). The maximum diameter found was 15.46 and the minimum distance 1.414, which shows an optimal proximity between the points, the silhouette indicator is 0.2 and has a positive value, which means that the distance between the points within each cluster is not so large and reflects a reasonable separation from one cluster to the others, that is, that we estimated good similarities in each cluster.

Cluster 3 includes 29 companies, cluster 2 28 and cluster 1 21. These 2 and 3 have higher omnichannel scores than the other clusters, which coincides with the highest scores for these strategies in marketing (4.29, 4.28), higher average scores for omnichannel campaigns in offer (1.71, 2.21), more for platform online sales (2.43, 3.35), higher means of distribution or delivery alternatives (2.39, 2.76), but also with the highest score in the perception of profitability (9.68, 8.35), optimization with digitalization strategies, appropriate inventory method, current and online customer loyalty (for online 9.68 and 7.41), especially for cluster 2, it is higher than in the other clusters.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
	Half low	Highest	High	Very low	Medium	Low
Size of the cluster	21	28	29	23	22	17
Omnichannel score	17%	23.5%	23.6%	9%	11%	5%
Number of omnichannel actions in marketing	0.76	4.29	4.28	0.22	1.05	0.12
Number of physical actions	0.76	-	0.03	0.91	0.73	0.94
Number omnichannel actions in supply	1.67	1.71	2.21	0.74	1.27	1.06
Number of web platforms for online sales	1.76	2.43	3.35	0.57	1.68	0.41
Options to distributions	1.24	2.39	2.76	0.48	0.73	0.29
Profit in physical channel	7.67	9.32	7.76	6.78	8.68	9.12
Profit in current company	7.76	9.68	8.35	7.30	8.41	9.00
Optimization with digitalization	7.81	9.43	7.21	0.44	5.18	0.29
Adequate current inventory method	8.57	9.25	8.14	5.78	7.68	9.00
Presential retention of clients	8.05	9.29	8.59	8.26	8.18	9.12
Online retention of clients	7.52	9.68	7.41	-	0.86	-

Table 5. Clusters means according to the variables used

Source: Own elaboration.

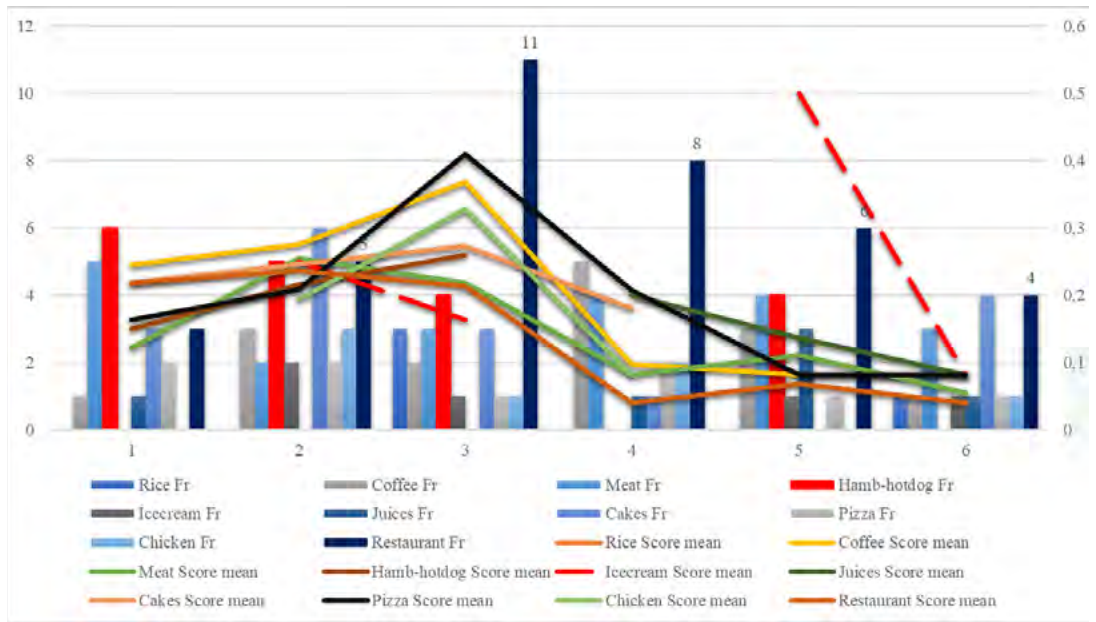


Figure 1. Statistics of omnichannel scores and percentages by cluster

Source: Own elaboration.

Clusters 1, 4, 5 and 6, comprising 83 MSME’s, share a common characteristic: they manage predominantly face-to-face channels and almost no virtual or telephone channels for sales, without a virtual sales alternative. Moreover, in these companies, the assessment of the profitability perception of the face-to-face channel is moderately high, especially for cluster 6, but for cluster 4, the company’s current profit perception is lower than for clusters 2 and 3. We found associations related to variables such as met omnichannel conditions for marketing and sales, number of platforms, i.e. digitalization alternatives, as well as in evaluating perceptions of profitability, optimization, appropriate inventory practices and customer loyalty.

In addition, in figure 1 we can see descriptive statistics with the number of companies and also average values of omnichannel scores by cluster.

The restaurant sector has a medium level of omnichannel behavior, with pizza, coffee, and chicken products having the highest scores in cluster 3. While some sectors, such as ice-cream and restaurants, meet some omnichannel conditions, their scores are lower, perhaps due to consumer preferences for in-person channels. Clusters 2 and 3 have the highest scores, but few companies fall into these groups. Ice cream companies have higher omnichannel average scores in clusters 2 and 5. Observations by some employees included the lack of systems for database storage, as well as the lack of knowledge and resources to implement these systems, especially digitalization for omnichannel optimization.

DISCUSSION

The literature reflects the importance of channel integration, which includes aligning prices, offering unique features in specific channels, and coordinating the marketing mix across different touchpoints.

Few micro-enterprises plan for full online digital integration and often have low levels of information sharing across face-to-face and virtual channels. The regional omnichannel score is low at 16 on average, possibly due to barriers such as lack of knowledge, resources, or trust in technology that hinder the reproduction of a well-executed customer experience across multiple channels.

Despite these challenges, clusters 2 and 3 have higher omnichannel scores with 57 companies (40.7%). These companies demonstrate higher levels of optimization, profitability, and customer loyalty online, driven by more advanced digital strategies, greater use of web platforms, and improved supply chain measures. This suggests that greater digital integration leads to improved omnichannel strategies and promotes development. Although marketing models, multichannel options, and digitized supply chains are critical, more research is needed to fully exploit their potential to increase customer loyalty and understand preferences across multiple channels (Cui et al., 2021).

Omnichannel strategy is closely linked to the digitalization of medium-sized companies and scores highly, while small and micro-enterprises are far from it. Despite this, the contrast between the exponential growth of digital channels internationally and the low adoption rates of omnichannel strategies in Antioquia, Colombia, highlights a significant weakness in competing for increasingly digitally savvy customers. This situation requires more research to improve resources, integration, sharing and big data management and simplify the purchasing process for customers, as stated by FAEDPYME (2021).

Implementing an omnichannel strategy has a positive impact on the overall performance and competitiveness of MSMEs (Moreno-Gómez et al., 2023; Kotler et al., 2021). Hübner and colleagues (2022) also emphasize the importance of channel integration, price alignment, offering unique features in specific channels and coordinating the marketing mix across all touchpoints. For effective omnichannel improvement, adopting technology-driven digitalization, promoting collaboration between companies and sharing inventory information to facilitate data integration are recommended.

Recent studies emphasize the rapid development and importance of omnichannel strategies at global, regional and national levels. Qi and colleagues (2023) emphasize the role of big data analytics in IIoT systems for sustainable

manufacturing and digital platforms. In Latin America, Moreno-Gómez et al. (2023) show that marketing innovations and digital communication significantly increase the competitiveness of Colombian SMEs. However, Reuschke and Mason (2022) identify challenges for digital transformation in rural Latin America due to technological and economic barriers.

At the national level, the FAEDPYME (2021) report highlights the slow digitalization process among Colombian MSMEs and stresses the need for further digital integration and resource allocation. This echoes our findings on the low omnichannel scores among Colombian MSMEs and highlights the urgent need for targeted interventions to improve digital capabilities.

This study contributes to the literature by providing empirical evidence from a specific sector in the context of a developing country. It uses a robust empirical methodology to assess omnichannel readiness among MSMEs in the food sector and uses cluster analysis to identify distinct groups based on their omnichannel conditions in a Colombian region, the department of Antioquia. Companies with higher levels of digital integration reported better profitability and customer loyalty, offering practical insights into overcoming barriers and improving competitive position through omnichannel strategies.

While global studies emphasize advanced technological integration and accelerated adoption of omnichannel strategies, this study highlights significant challenges and lower adoption rates in developing regions such as Antioquia, Colombia. By comparing these findings with regional and national studies, it is clear that while there is awareness of the benefits of omnichannel strategies, practical implementation remains limited due to infrastructural, economic and educational barriers. This research fills a critical gap and provides valuable insights for future studies and policies to encourage omnichannel adoption among MSMEs.

A critical factor for omnichannel success is ensuring that different supports are fully adapted to each device and maintaining a homogeneous design that reinforces brand image. Companies must start from their current reality and facilitate the diagnostic process to synchronize internal processes to implement omnichannel strategies, which also requires significant resources (Jocevski et al., 2019; Hänninen et al., 2021). As a result of this research, companies see optimization and better profitability through digitalization and through actions related to omnichannel conditions linked to big data actions. Data storage and big data analysis can then be not only a tool, but also an analytics-based strategy that can also improve management, as it supports decision-making processes, loyalty, forecasting and market strategies related to omnichannel actions (Chakraborty et al., 2023; Li, 2023). By leveraging big data analytics, food companies can gain

a deep understanding of their customers' needs and preferences, allowing them to create personalized offers and improve customer relationship management.

The combination of big data actions driven by the implementation of web platforms and omnichannel retail in the food industry has the potential to revolutionize the way consumers buy food by providing them with sustainable and healthy food options based on environmental and health perspectives.

These digital technologies, including mobile applications and data analytics, enable a deep understanding of customer needs and the possibility of creating personalized offers in the food service industry. Overall, the application of omnichannel strategies and big data in the food industry offers opportunities to improve the consumer experience, optimize business operations and support sustainable development.

Finally, the results obtained demonstrate the fulfillment of the objective initially proposed for this study, which was to explain the omnichannel characteristics and behaviors of food companies, focusing specifically on MSMEs in Antioquia, Colombia, by assessing the conditions required by these companies to achieve an omnichannel classification and by identifying key dimensions and observable variables related to successful omnichannel strategies..

CONCLUSIONS

This study provides an empirical analysis of the conditions required for the successful implementation of an omnichannel strategy among MSMEs in the food sector, focusing on three key aspects: marketing models, multichannel options and supply chain digitalization. The results highlight the importance of synergy, connectivity, effective communication and advanced technologies for smooth operations, improved customer loyalty, optimization, inventory management and adequate profitability.

Despite an average multichannel adoption of 47%, which includes both virtual and face-to-face sales channels, true omnichannel compliance remains limited. Only 13% of companies implement customer database storage and less than 20% use an inventory centralization system. The overall omnichannel score is on average only 16%, with mid-sized companies (27.5%) performing better than small (18.5%) and micro (13.3%).

Cluster analysis provides key insights and shows that clusters 2 and 3, comprising 57 companies (40.7%), achieve higher omnichannel scores. These clusters demonstrate superior performance on variables such as marketing

strategies, supply chain promotion, online sales platforms and distribution alternatives, leading to higher profitability perception, optimization through digitization strategies and improved customer loyalty both online and offline.

The critical role of digitalization and data intelligence in omnichannel strategies is evident as they enable important connections between organizations and customers through advanced big data analytics. This improves marketing strategies and operational efficiency, although there is still a significant gap in the expertise required for comprehensive omnichannel implementation.

A comparative analysis with recent studies highlights the rapid development and importance of omnichannel strategies at the global, regional and national levels. At the international level, the integration of big data analytics into IIoT systems and the reliance on digital leadership underscore the transformative impact of advanced technologies. At the regional level, in Latin America, marketing innovation and digital communication are critical for competitiveness, although technological and economic barriers remain, especially in rural areas. At the national level, the slow digitalization process of Colombian MSMEs requires targeted actions to improve digital capabilities and resource allocation.

While global studies highlight the benefits of advanced technological integration and accelerated omnichannel adoption, this study highlights the significant challenges and lower adoption rates in developing regions such as Antioquia, Colombia. Addressing infrastructural, economic and educational barriers is essential to realize the full potential of omnichannel strategies. This research fills a critical gap by providing detailed empirical evidence from a specific sector in the context of a developing country and offers valuable insights for future studies and policies aimed at improving omnichannel adoption among MSMEs. Companies must actively engage in digital transformation, recognize their positioning in the evolving market and adapt to new customer relationship dynamics to survive and thrive.

In terms of the study's impact, first, this study demonstrates the importance of collaboration, inventory information sharing, and digitization for a seamless customer experience. It provides businesses with insights to identify areas for improvement and prioritize investments in digital transformation, such as customer database storage and centralized inventory management systems. The study contributes to the literature by providing empirical evidence on omnichannel readiness and adoption among MSMEs in the food sector in the context of a developing country, thereby filling a critical gap in existing research. It also sheds light on the factors that influence omnichannel adoption, such as company size, digital integration, and supply chain digitization, thereby contributing to a better understanding of the drivers and barriers to adoption.

Finally, it is important to highlight the following key limitations of the study. First, while the study identifies low adoption rates and gaps in omnichannel adoption, it does not delve deeply into the specific barriers and challenges faced by these businesses. A more comprehensive study of factors such as resource constraints, technological infrastructure, digital literacy and organizational culture could provide valuable insights to overcome these barriers. The study focuses exclusively on MSMEs in the Antioquia region, without making comparisons with other regions or countries, but it could be applied to other sectors. A comparative analysis could help identify best practices, successful strategies or contextual factors that influence omnichannel adoption in different regions or settings.

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