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Review

Multi-Channel and Omni-Channel Retailing in the Scientific Literature: A Text Mining Approach

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Abstract: Electronic commerce appeared as a new way of managing businesses in the digital era. However, it has also been accelerated by the recent pandemic situation. Retailers had to find new strategies of reaching customers in the online environment. Thus, concepts such as multi-channel and omni-channel retailing have gained the attention of both retailers and researchers in this field. This paper aims at using a text-mining approach in order to reveal the researchers focus on this theme in a period that also precedes and covers the COVID-19 pandemic. The research methodology follows five steps that are necessary in order to obtain a relevant collection of documents that will further provide the content to be analyzed. These steps refer to: (1) Creating the database of documents for analysis purposes; (2) identifying geographic areas for separating the collection's documents; (3) framing a thematic dictionary of descriptors; (4) exploring the text using text mining approach; and (5) correspondence analysis. The discussion of the main findings is constructed starting with the geographic and the temporal distribution of documents and the design of a thematic dictionary of descriptors. Then, exploring the content of the documents provides information on the frequency of descriptors and reveals clusters of descriptors along with a link analysis. All of them are presented separately on geographic regions. Finally, the correspondence analysis of descriptors versus years provides the proximity maps and reveals the preferred topics and less approached themes. Among the main findings, one can highlight: (1) The greatest contributor in terms of documents related to the theme of interest is the United States; (2) a higher number of connections (and stronger) among descriptors for America as compared to the other two regions; (3) some categories of descriptors are specific to a particular year, which means that there are different themes under the researchers lens depending on the period; (4) the most frequently used descriptors are included in the following categories from the dictionary: Online retail environment and Consumer behavior, regardless of the region. In the end of this paper, research limitations and guidelines for future research are elaborated.

Keywords: electronic commerce; multi-channel retail; omni-channel retail; online retailing; online shopping

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1. Introduction

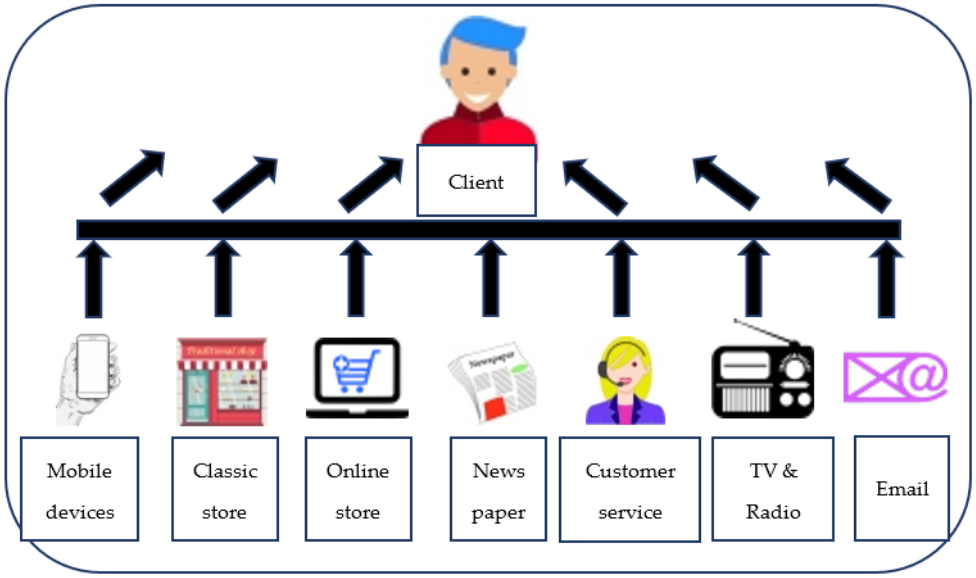
The retail industry is the third largest industry in the world, after the financial industry and real estate [1]. It has been severely affected by the COVID-19 pandemic, with serious impact on the economy and on the consumers' lifestyle and shopping experiences. Face to face purchasing activities in store were limited, so online shopping has rapidly been embraced by customers complying with restrictions and seeking to remain healthy. At the same time, digital technologies burst to support remote working as well as for online purchasing. The digital transformation occurred at first as a response for informational advances and rapid data processing needs; afterwards it appeared as a call and response to the businesses need for new types of operations (necessary to deal out with stock issues, social distance aspects, contactless services and others) [2,3]. Old businesses had to choose between permanently closing or finding a new business model based on electronic commerce or e-commerce. This led to online shopping and online retailing as two concepts

boosting from a paradigm generated by the COVID-19 pandemic. They both refer to a form of electronic commerce. E-commerce accounted for around 12.2% in the global retail sales before the pandemic situation and is expected to double until 2024 [4]. As a consequence of this rare phenomena in the economy, the role, determinants and success factors for the rapid growth of SMEs in e-commerce are discussed in the literature [5–8]. Further, the retail environment itself changed a lot, intensifying retailers' efforts to reach customers, by choosing a channel strategy. There are so many challenges encountered when trying to build a successful and sustainable channel strategy [9–12]. In the literature, one can distinguish between single channel, multi-channel and omni-channel retailing. All three concepts will be further defined and explained. Multi-channel and omni-channel retailing represent the focus of our paper. To understand how the research related to them evolved before and during the pandemic, we aim to develop an exploratory study to find differences and similarities across the world. The main aim of the paper is to map the scientific production related to the multi-channel and omni-channel concepts in order to discover some connections between them, as well as possible patterns and tendencies of the researchers in this scientific area. In order to analyze the coverage of this theme in the scientific literature, a text-mining approach has been adopted, which will imply information extraction from unstructured text, natural language processing, semantic clustering and visualization of the results.

The paper is structured as follows: The next section represents a review of the literature in order to discover what is known to be related to the topic. The third section ("Methodology") presents the main phases of the research design. In the fourth section ("Results and discussion") we will present the main findings of the research, while the last section ("Conclusions") provides a brief summary of the results, main limitations of the research and direction for future research.

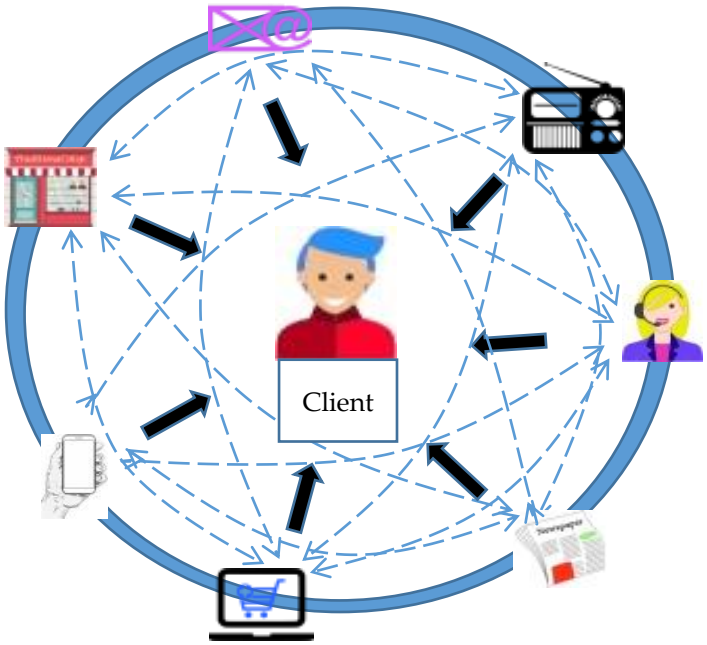
2. Literature Review

As multi-channel and omni-channel represent the main points of interest in our paper, we will further try to highlight some defining features and use the following suggestive figure (Figure 1) to compare them.



(**a**)

Figure 1. *Cont.*



(**b**)

Figure 1. Types of retailing channels: (**a**) Multichannel retail system; (**b**) omni-channel retail system. Source: Authors' own conception, based on [13,14].

Multichannel retailing means a multitude of channels through which a customer is attracted to buy a certain product or service, and equally, a seller manages to capitalize on the same product or service by selling it on the market. In general, these channels, which form the multichannel domain, are made up of traditional stores, websites specialized in the sale of products, email and social media platforms, and others. The main feature of multichannel retailing is that these channels are acting independently, without interfering with one another. This gives some simplicity to this type of retailing and ease of monitoring.

Regarding the other concept, omni-channel retailing implies a combined action of all channels within a single platform. Within this platform, each channel "sees" what the other channels are doing and can adjust its policy and strategy accordingly. Omni-channel retail implies a unified vision of the process of capitalizing on the market of a product or service, having a higher complexity than the other form represented by multichannel. In this way, a synergistic effect of all the channels that contribute to the valorization of the product or service on the market is obtained. Unlike multichannel retail, this form requires cooperation between the online and offline environments. Moreover, this form of retail manifestation was initially named (around 2010) "bricks and clicks" retail [15], representing exactly that symbiosis between the traditional store (with classic walls) and the online store (existing in the virtual environment), and was specific mainly to young people who have this ability of using multiple channels for shopping [16]. What is very important to emphasize is that omni-channel enables cross-channel purchase for a customer. From this perspective, cross-channel represents the experience of a customer who can use different channels in order to buy a product (e.g., a customer discover a product on a TV commercial and then goes to the shop to make the purchase).

Analyzing the previous figure, we can observe that, in the case of the multichannel retail system, the channels act independently of each other, with the ultimate goal of getting the consumer (customer) to purchase a certain product or service. However, the omni-channel retail system involves the combined action of all channels in order to achieve the same objective. For this purpose, the channels communicate and cooperate with each other, which involves a higher level of complexity compared to the multichannel system.

In relation to these two concepts, researchers developed studies to treat a variety of topics. Table 1 manages to present the most representative papers according to the Web of Science database (these papers managed to gather the highest number of citations since their publication). The search that returned these papers is the same as the one used in the first step of the present analysis. The search required a specific query, which will be detailed in the next section and a specific filtering related to language (only English written documents were kept) and to the type of documents (only articles and review articles were selected).

Table 1. Highly cited papers on topics related to channel strategy.

Authors	Number of Citations	Topic
Abhishek, Jerath & Zhang (2016) [17]	319	The paper compares two ways e-tailers (online retailers) have to allow manufacturers' access to their customers (agency selling versus conventional selling).
Brynjolfsson, Hu & Simester (2011) [18]	295	The authors analyze data from a multichannel retailer in order to compare internet and traditional channels in terms of sales distribution.
Rigby (2011) [19]	266	The authors designed the Random Forest prediction model for the Indian online shopping market.
Ofek, Katona & Sarvary (2011) [15]	253	The paper discusses differences regarding pricing strategies and physical store assistance levels when using dual channel strategy.
Cao & Li (2015) [20]	241	This is an analysis on the impact of channel integration on a firm sales growth using a novel framework proposed by authors.
Weathers, Sharma & Wood (2007) [21]	238	The authors examine three online retailer communication practices and reveal on consumer perceptions of product performance uncertainty.
Avery et al. (2012) [22]	236	The analysis focuses on the effects appeared when introducing a new retail store channel to the existing direct channels.
Blázquez (2014) [23]	180	Focusing on fashion industry, the paper deals with multichannel shopping experiences and their influence on consumers' perceptions and motivations.
Melis et al. (2015) [24]	159	The study investigates the drivers supporting the online shopping for groceries and changes that may affects them when customers gain experience.
Zhang et al. (2018) [25]	125	The authors connect channel integration strategy to client empowerment and use a specific framework to confirm the positive link between them.
Yan, Zhao & Liu (2018) [26]	122	The analysis focuses on the implications of introducing the marketplace channel and its effects on e-tailers and manufacturers.
Tang & Xing (2001) [27]	117	The study envisages two categories of retailers (traditional online retailers and pure Internet retailers) in order to study their pricing behaviour.
Li et al. (2018) [28]	112	Dealing with the customers reaction on cross-channel integration, the authors demonstrates the role of uncertainty, identity attractiveness, and switching costs in shaping this reaction.
Melacini et al. (2018) [29]	106	The paper applies a systematic literature review methodology in order to highlight specific features related to e-fulfilment and distribution associated with choosing omni-channel retailing
Ancarani & Shankar (2004) [30]	103	The study envisages three categories of retailers: pure-play Internet, bricks-and-mortar (traditional), and bricks-and-clicks (multichannel) retailers, in order to study their pricing behaviour.
Bock et al. (2012) [31]	100	Considering different product types and the multi-channel retailing context, the authors try to reveal what influences the online trust.

Table 1. *Cont.*

Authors	Number of Citations	Topic
Wang, Li & Cheng (2016) [32]	91	The analysis explains there is a gap between the online and offline channels' operating costs which affects the retailer's choice on channel selection.
Mishra, Singh & Koles (2021) [33]	82	The literature review in this paper concentrates on consumer behaviour in omni-channel retailing, creating a holistic radiography of this theme in the scientific field.
Darke et al. (2016) [34]	81	The analysis presents insights on the online trust as influenced by psychological distance.
Bernon, Cullen & Gorst (2016) [35]	81	The paper concerns retail returns management process and addresses the emergent managerial implications of omni-channel retail returns.
Ha & Stoel (2012) [36]	81	The paper deals with e-shopping dimensions and factors and discuss their influence on the customers intention and satisfaction as shopping outcomes.
Carlson, O'Cass & Ahrholdt (2015) [37]	76	This paper focuses on customer perceived online channel value and how clients perceptions affect satisfaction and channel loyalty.
Jin, Li & Cheng (2018) [38]	74	The analysis discusses the buy-online-pick-up-in-store method and designs a theoretical model for the case of a physical retailer.
Huang, Lu & Ba (2016) [39]	72	The paper discusses web versus mobile shopping and the consumers shift from one to another.
Zhang (2009) [40]	71	The author brings into attention the pricing strategy adoption for traditional retailers choosing a multi-channel strategy.
Frasquet, Mollá & Ruiz (2015) [41]	69	Channel choice is brought into attention and presented as unique for each stage of the shopping process (search, purchase and post-sales activities).
Anderson, Chatterjee & Lakshmanan (2003) [42]	68	The authors identify possible spatial impacts of e-retailing development and try to put into question the substitution between e-retail and traditional retail.
Cai & Lo (2020) [43]	66	The analysis consists in a systematic literature review on omni-channel management.
Badrinarayanan et al. (2012) [44]	60	The authors aim to develop and validate a framework for investigating purchase intentions in online stores of multi-channel retailers.
Basak et al. (2017) [45]	59	The authors analyze the effect of showrooming on the online and traditional retailers sales.
Lewis, Whysall & Foster (2014) [46]	58	The paper identifies obstacles faced by retailers when moving to multi-channel retailing and designs a framework in this regard.
Wagner, Schramm-Klein & Steinmann (2020) [47]	57	This research paper combines the results of an online survey and an experimental study to substantiate salient features of online retailing.
Jocevski et al. (2019) [48]	57	The research paper links omni-channel strategies to digitalization in a business model context.
Galipoglu et al. (2018) [49]	56	The analysis focuses on the scientific literature on logistics and supply chain management in omni-channel strategies.
Xu & Jackson (2019) [50]	49	The authors discuss the omni-channel features that influence clients' perception.

Source: authors based on Web of Science.

3. Methodology

This type of research implies establishing a rigorous framework, constructed in a logical manner, so that it eases achieving the objective. In this regard, following similar recent research [51,52], the next five steps are used to design the methodology:

Step 1. Creating the database of documents for analysis purposes

This first step requires selecting the database that will generate a collection of documents having treated the theme of multichannel and omni-channel retailing as related to electronic commerce and online shopping. We chose the Web of Science database over others that we could have used for a variety of reasons (it contains great amount of quality papers written by top reputed scholars in the field [52,53]; it is one of the most well-known database for indexing documents and among the most widely used by researchers [54]; it provides access to thousands of journals from around the world and from prestigious international publishers [54]).

Using the search engine of the Web of Science database, the next query was used by the authors in order to obtain relevant documents (TS represents the syntax for "topic search" in Web of Science database):

> (TS = "multichannel* retail*" or TS = "multi-channel* retail*" or TS = "omnichannel* retail*" or TS = "omni-channel* retail*") AND (TS = "e-commerce" or TS = "electronic commerce" or TS = "mobile commerce" or TS = "online shopping" or TS="online market" or TS = "electronic market" or TS = "online retailing")

After the search was performed and refined, 177 documents were identified. The refinements refer to keeping in the collection of only documents written in English and only two specific types of documents: Articles and review articles (as there is a difficulty in obtaining papers from conference proceedings and book chapters). However, downloading all of them was not possible (some of them were not relevant for the research theme). Thus, in the end, the bibliographic information was only retrieved for 174 documents.

Step 2. Identifying geographic areas for separating the collection's documents

This step starts with separating documents in accordance with a geographic area (Asia, Australia, Europe, America and Africa) as a result of the corresponding author's affiliation. In this way, the next phases of the analysis will reflect specific aspects depending on the documents' distribution on different regions. A temporal spread of the documents separated on regions can be emphasized here in order to reveal each period's focus of the researchers in this field.

Step 3. Framing a thematic dictionary of descriptors

In order to design the thematic dictionary, a content analysis software (QDA miner [55]) will be used. This software facilitates the text analysis and also helps to obtain variate graphical elements, which enables visual understanding of the descriptors. A descriptor is a keyword found either in the title, abstract, or among keywords within the text. The most important things for a word (or a group of words) to become a descriptor is its significance related to the topic and its frequency (e.g., descriptors such as "online retail environment", "omni-channel retail" or "multi-channel retail" are very important for the analyzed topic; also, descriptors like "theoretical models and studies", "place" or "price" have a very high frequency, namely 534, 468 and 761, respectively). After a panel discussion between all the authors, the descriptors are manually grouped and so the thematic categories of descriptors appear (e.g., descriptors like "product", "price", "promotion and distribution" or "place" has been manually assigned to the "marketing mix" thematic category). In this way, we can create a thematic keyword's map, which can cover the whole topic with several categories of descriptors and with many descriptors inside each of them [56].

Step 4. Exploring the text (text mining approach)

This step comprises three sub phases, which are briefly described below. The choice of presenting them as sub phases of a single step is the authors' choice based on:

- ✓ Presenting descriptors' frequency of occurrence. This refers to the absolute and relative values of the frequency of occurrence for each category of descriptors included in the dictionary, along with the number of documents containing them;
- ✓ Grouping descriptors on clusters. This sub phase pays attention to arranging in groups, descriptors which are found in the same context or in similar ones. The clusters are graphically represented with different colors.
- ✓ Link analysis. This refers to highlighting connections among descriptors and finding the strength of those links, by using the Jaccard coefficient.

Step 5. Correspondence analysis

Correspondence analysis (CA) is an investigation tool to find out and visualize the potential relationship between two different categories (if there are many categories, then we are talking about multiple correspondence analyses). In a specific scientific topic, CA can be only used when we can identify two dimensions of the same phenomena/processes/variable (e.g., product and location for purchase in market research or disease and treatment in healthcare area) [57].

A correspondence analysis uses a table (with just 2 dimensions), and in each cell there is the frequency that indicates how variable 1 (from the columns) distribute variable 2 (from the lines). This method is very useful for visualization of the table (known as the contingency table) using a suggestive map, in which the position of all points and the distance between them have a specific interpretation [58]. Hence, correspondence analysis is a very powerful tool to analyze the connection/relationship between two variables, especially in social science.

From a text mining perspective, the correspondence analysis is a method used to find similarities or differences for descriptors and plotting them in a proximity map along with some characteristics (years or journals). This is a common method used in review articles treating a wide range of themes [59–62].

4. Results and Discussion

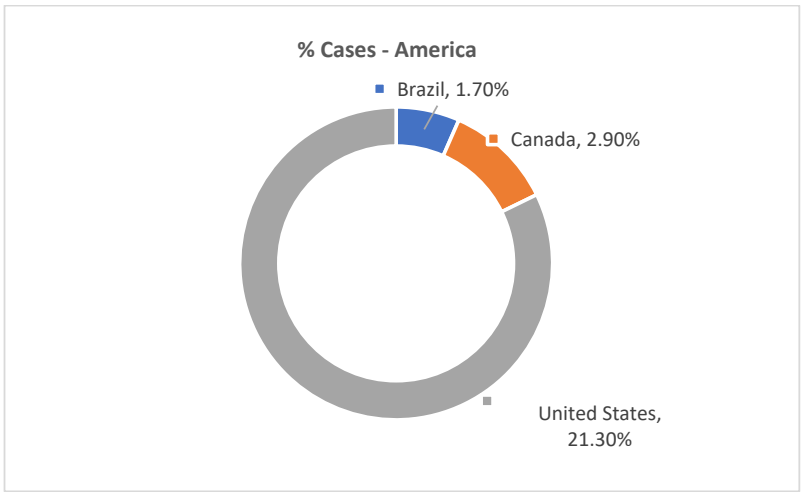
According to the methodological steps, after selecting all documents, as explained in the previous section, and taking into account the affiliation of the corresponding author, the 174 documents are divided into geographic areas. For South Africa, only one article was reported, so we chose not to include it in a separate region. Australia was aligned to Asia as it reported only four documents. Figure 2 comprises three geographic areas and the documents' distribution on each country included in those areas.

As one can observe, the United States holds the greatest share in terms of published documents on omni-channel and multichannel in the online environment. China comes next with a share of 14.9% and then the United Kingdom with 8.6%, followed by India and Germany, each of them with 6.3%. These means that only five countries gather more than half of the scientific research published on the concerned theme (around 57.4% of the collection's documents). As a region, Europe accounts for 38.8% of the published documents, followed by Asia with 34.3%.

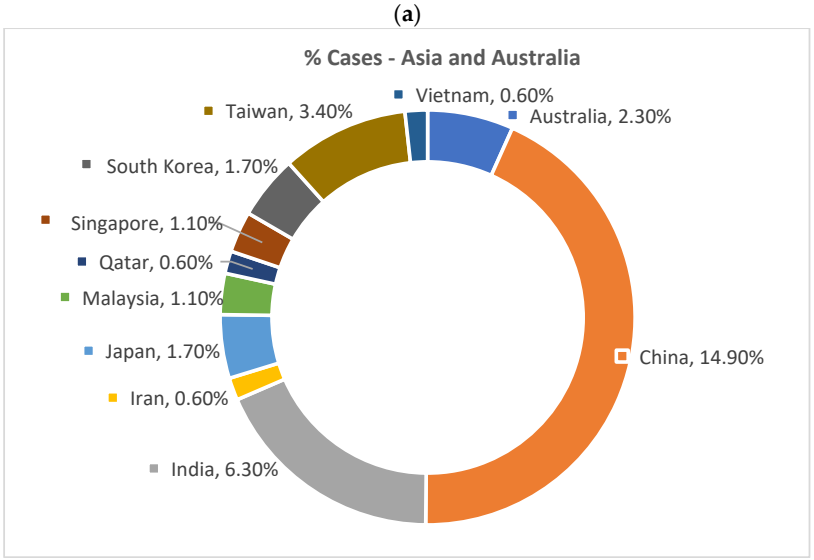
After separating documents into regions, we managed to arrange them on a time axis in order to highlight the temporal distribution. The diagram in Figure 3 shows a ten-year period from 2001 to 2011 with little focus on the theme of interest. However, around 2012, there is a remarkable effort from researchers, belonging mainly to the America region. The research documents begin to spread on the diagram from all three regions, increasing gradually from one period to another.

To move on in our analysis, the categories of descriptors from the dictionary will be further presented. The keywords included in each descriptor category were obtained after studying the list of frequencies generated by QDA Miner for words extracted from each document's content. Thus, different keywords were retained and thematically grouped on descriptors. Then, two or more descriptors joined one of the seven categories of descriptors: Client, Economic features, Market, Marketing mix, Research and Analysis, Types of chan-

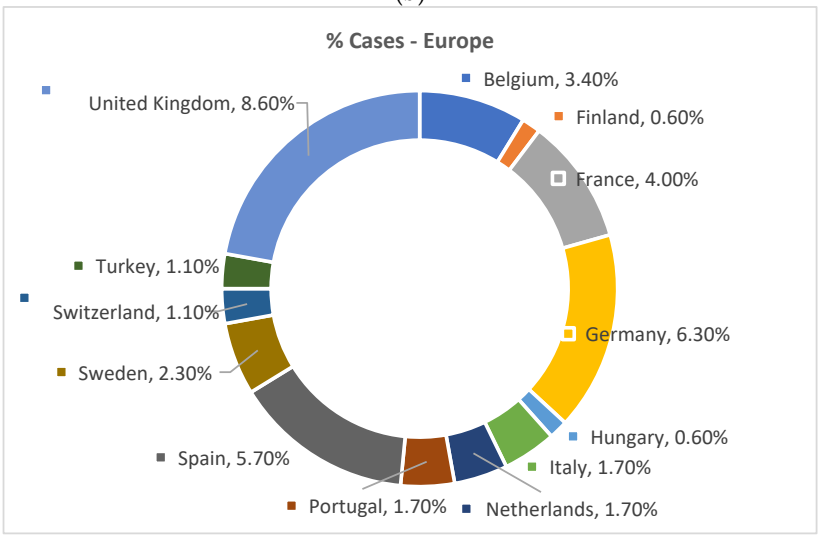
nels retailing, and Types of retail environment. Thus, the dictionary contains 22 descriptors grouped into seven categories.



(**a**)



(**b**)



(**c**)

Figure 2. The geographic distribution of documents: (**a**) Region America; (**b**) Region Asia and Australia; (**c**) Region Europe. Source: Authors based on the Web of Science.

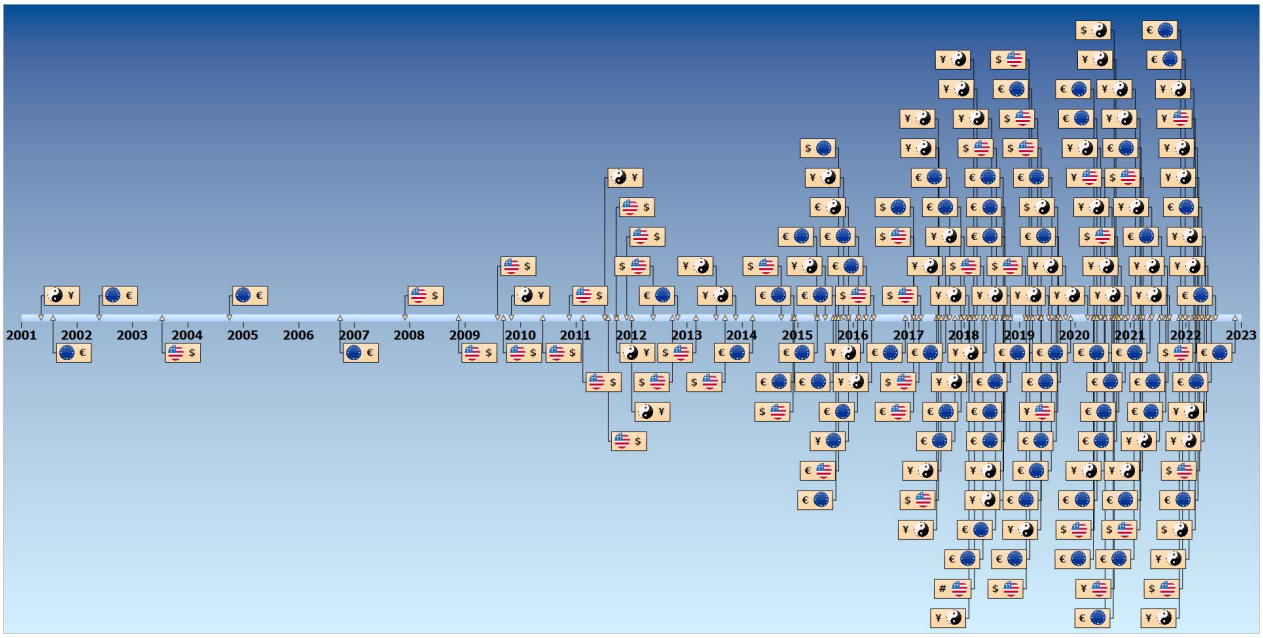


Figure 3. The temporal distribution of documents separated on regions (¥-Asia, $-America and €-Europe). Source: Authors.

After completing the third step of the methodology, we managed to frame the thematic dictionary of descriptors, which are further presented in Figure 4.

Client	• Consumer behavior (C_B) • Customer (CUST)
Economic features	• Logistics and services (Log&Ser) • Management and strategies (Mg&Str) • Marketing (Mk) • Social issues (SI)
Market	• Market features (MF) • Sales (SAL) • Supply and demand (S&D)
Marketing Mix	• Product (PROD) • Price (PRI) • Promotion & Distribution (P&D) • Place (PLA)
Research and Analysis	• Channel syntax (C_S) • Management Science (Mg_Sci) • Trends and challenges and future research (TCFR) • Theoretical model and studies (TMS)
Type of channels retail	• Omnichannel retail (O_R) • Single and dual channel (S&D_C) • Multichannel retail (M_R)
Type of retail environment	• Online retail environment (ORE) • Physical retail environment (PRE)

Figure 4. The dictionary of descriptors. Source: Authors.

For a more specific presentation, the seven categories of descriptors will refer to each of the three concerned regions, and highlight diverse aspects regarding frequency, number of cases (documents in which they are found) and the TF-IDF value, which is an abbreviation of the Term Frequency weighted by the Inverse Document Frequency (see Table 2). According to some authors [63,64], this metric is able to identify important words (in the

sense that they appear so many times in a document that they become representative for that content) and weighting them with the number of documents containing those words.

Table 2. Descriptors on regions with several characteristics.

Category of Descriptors	Descriptors	America			Europe			Asia and Australia		
		Frequency	No of Cases	TF/IDF *	Frequency	No of Cases	TF/IDF *	Frequency	No of Cases	TF/IDF *
Type of retail environment	Online retail environment (ORE)	1971	44	19.2	3095	65	60.6	3581	58	52.7
	Physical retail environment (PRE)	551	39	34.2	1123	64	29.6	1632	60	0
Marketing mix	Product (PROD)	266	39	16.5	364	54	36.4	518	51	36.6
	Price (PRI)	761	30	134	487	27	195.4	640	41	105.8
	Promotion & Distribution (P&D)	164	21	54.3	400	49	56.9	218	42	33.8
	Place (PLA)	468	43	9.2	687	61	32.4	286	53	15.4
Research and Analysis	Channel syntax (C_S)	164	26	39.1	239	42	50	525	44	70.7
	Management Science (Mg_Sci)	126	26	30	110	32	36	99	29	31.3
	Theoretical model and studies (TMS)	534	40	27.3	936	64	24.6	939	58	13.8
	Trends and challenges and future research (TCFR)	169	41	6.8	268	57	20.5	292	54	13.4
Type of channels retail	Multi-channel retail (M_R)	492	35	53.7	1230	57	94.3	689	53	37.1
	Omni-channel retail (O_R)	619	25	158	1148	49	163.4	1696	42	262.7
	Single and dual channel (S&D_C)	297	30	52.3	564	39	136.2	820	50	64.9
Market	Market features (MF)	184	24	50.2	89	30	31.6	208	28	68.8
	Supply and demand (S&D)	338	22	105	337	34	101.4	337	29	106.4
	Sales (SAL)	243	32	36	171	36	47.2	154	40	27.1
Client	Customer (CUST)	56	19	21	298	34	89.7	219	35	51.3
	Consumer behavior (C_B)	938	39	58.3	1822	62	73.1	1586	59	11.6
Economic features	Management and strategies (Mg&Str)	588	42	17.6	873	62	35	939	57	20.9
	Logistics and services (Log&Ser)	694	33	93.5	1227	61	57.9	950	53	51.2
	Marketing (Mk)	290	33	39.1	377	47	60.5	361	51	25.5
	Social issues (SI)	160	20	56.3	272	36	75.1	198	38	39.3

* Term Frequency weighted by Inverse Document Frequency. Source: Authors.

For each region, the clusters of descriptors could be identified. Figure 5 is relevant in this regard. It presents clusters of descriptors for each region, and it shows the way the content is distributed within each region. As one can observe, for America there is a large cluster, designed in green, grouping four categories of descriptors, while red, blue or purple are cluster groupings with more delimited themes. Each descriptor has a hexagonal representation and becomes a node in a cluster. Its size depends on its frequency. The distance among them reveals the tendency to occur in the same text. It can be said that the green cluster dominates the map, gathering mainly themes that refer to the following categories: Type of retail environment, Marketing mix, Type of channels retail and Economic features.

Dominant clusters also appear in the European and Asian and Australia conceptual maps (Figure 5b,c), both designed in red. However, the distances among nodes in these clusters as compared to the dominant green cluster in America, are larger.

Moving forward to the link analysis, Figure 6 facilitates understanding of the connections between clustered descriptors, separately for each region. Visually, the most powerful links are signaled in red and they appear for values over 0.1 for the Jaccard's coefficient. Each node (descriptor) is plotted given its relative co-occurrence. For instance, for the first region, America, the strongest connections appear around nodes referring to specific descriptors from the following categories: Economic features, Types of channel retail and Client. Documents containing these types of descriptors are characterized by a relatively high level of similarity.

However, all three maps are revealing nodes that could not establish a connection with a neighboring node. At the same time, there are several unilateral ties, specific to maps for Europe and America. For instance, in America, topics related to Management and strategies—Promotion and Distribution, or to Supply and Demand—Place, or to the Economic features category (Marketing—Social issues) are describing topics of discussion in several documents.

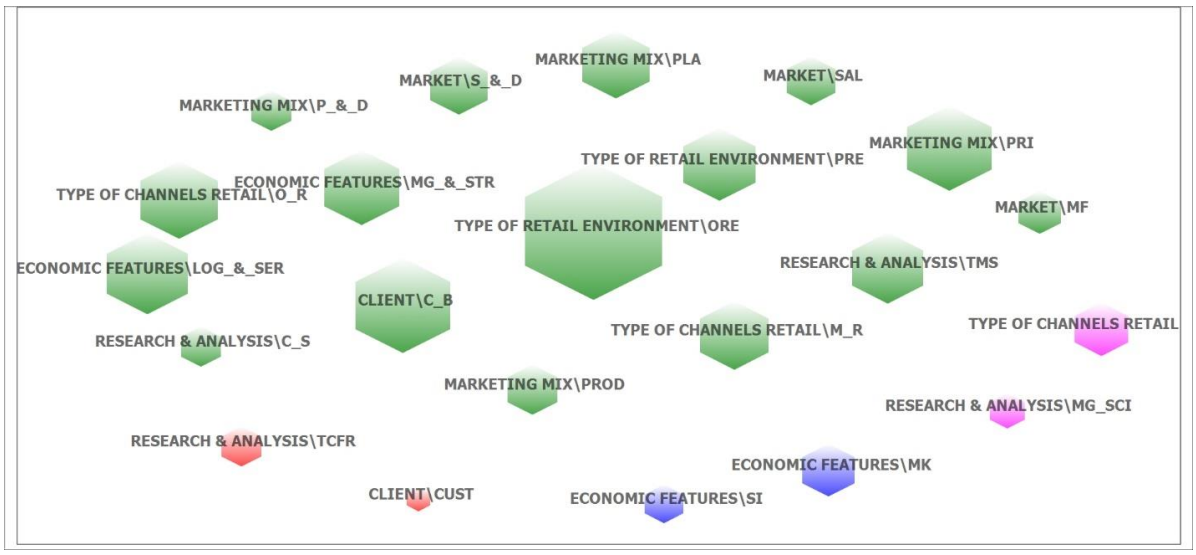
Furthermore, these network maps show that there are nodes creating closed triadic configurations, which in fact may indicate possible topics of discussion in the studied documents. As an example, for Europe, there is such a triadic configuration (which contains the strongest links of the map) plotted among the Online retail environment (ORE), Physical retail environment (PRE) and Consumer behavior (C_B).

The last part of our analysis is referring to the correspondence analysis, graphically represented in the next correspondence maps (or proximity maps), for each of the three regions. They gather information on the descriptors' categories spread along the two axes and on the proximity of a descriptor to the year of publication for documents containing it.

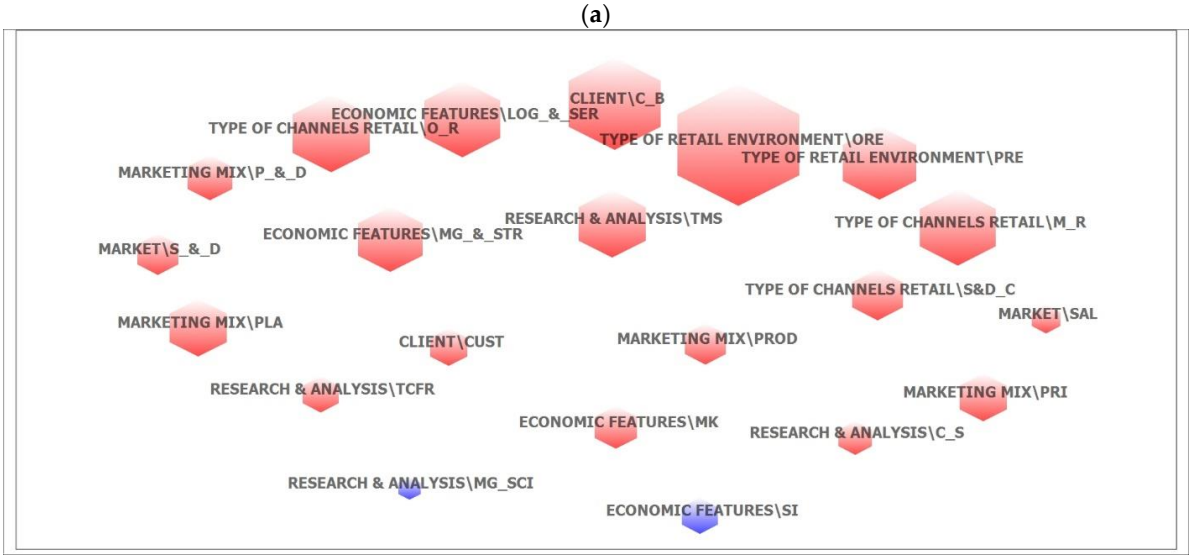
One can observe from Figure 7 that the categories of descriptors spread differently depending on each region. For instance, the first map, for America, reveals the fact that research on the Types of channels retail is specific to 2013, while categories of keywords such as Market and Research and Analysis dominate the 2017 year. Years 2008, 2009, 2011 have in their proximity descriptors from Client and Type of retail environment categories.

Maps for Europe and Asia and Australia include categories of descriptors located far from a specific year, and even farther from the center of the map. They are called highly discriminating descriptors and such an item is Client in both maps, for Europe, Asia and Australia.

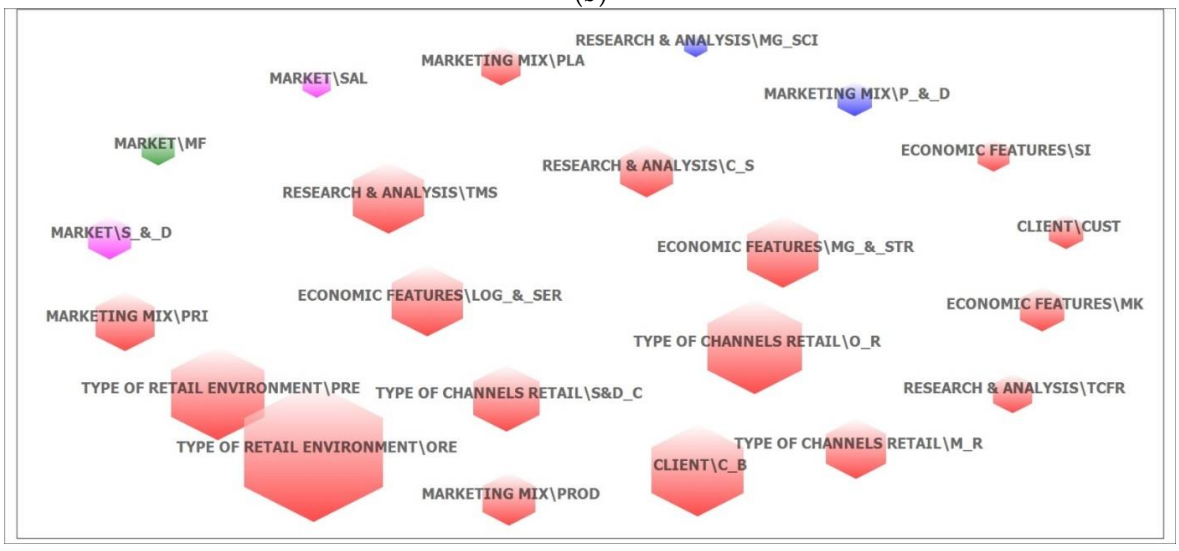
If comparing all three maps, a major discrepancy appears in the one for Europe, where several years concentrate near the center of the map. The closer they are on the plot, the more similar they seem in terms of treated themes on the research of interest.



(**a**)



(**b**)



(**c**)

Figure 5. Clusters of descriptors by region: (**a**) America; (**b**) Europe; (**c**) Asia and Australia. Source: Authors.

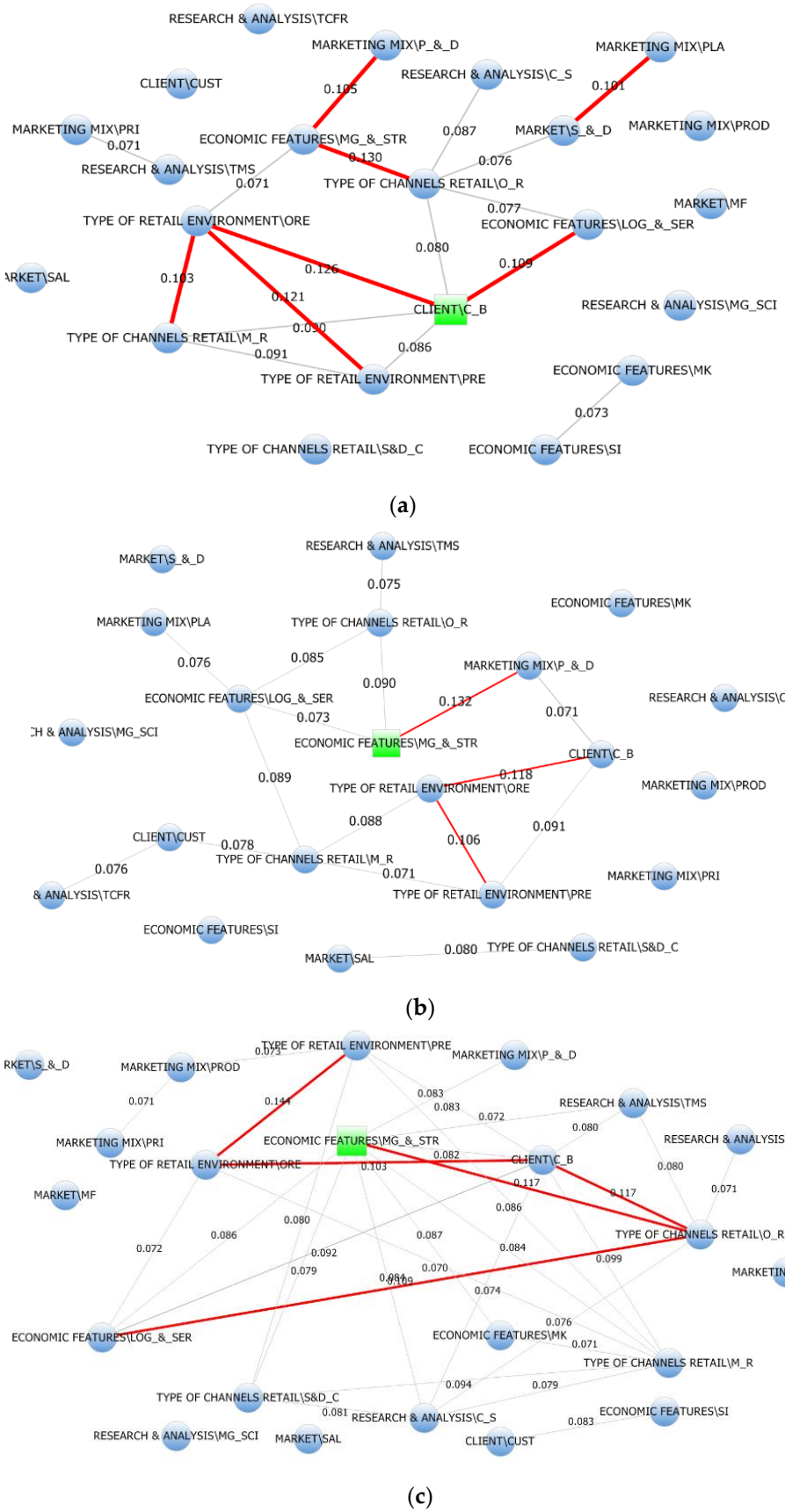
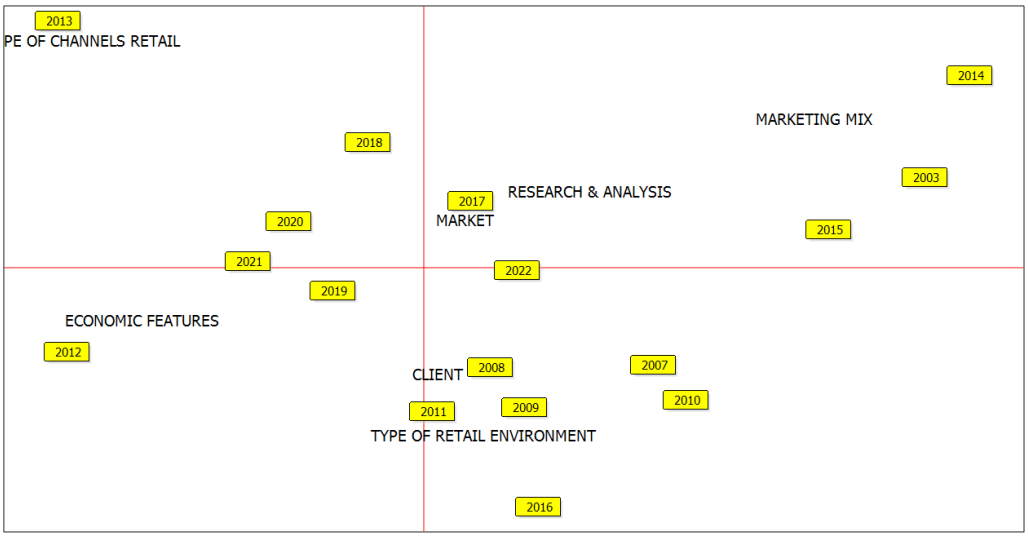
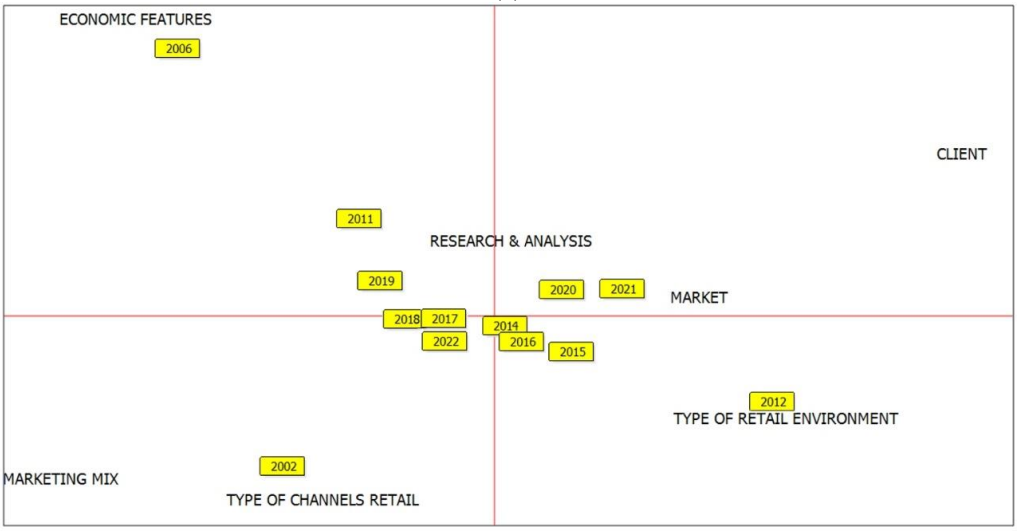


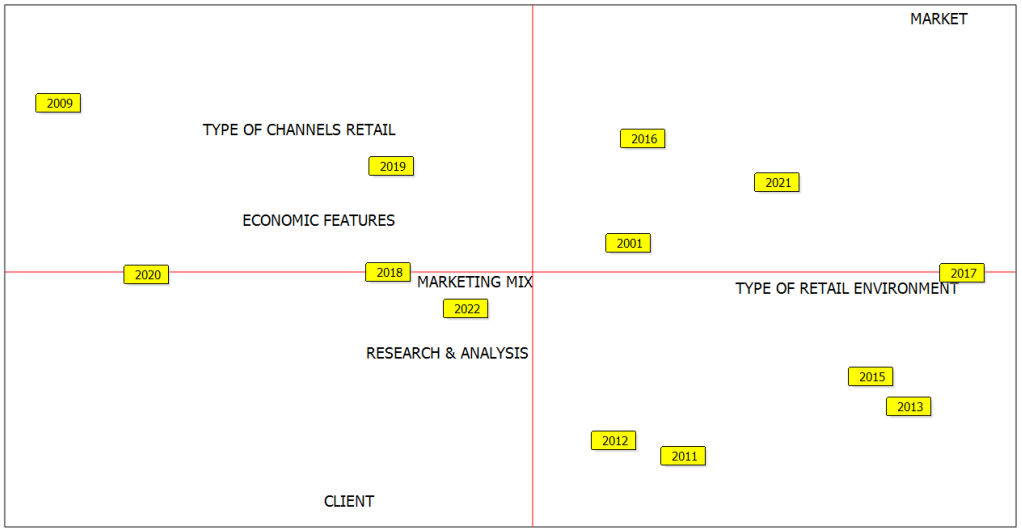
Figure 6. Link analysis of descriptors by region: (**a**) America; (**b**) Europe; (**c**) Asia and Australia. Source: authors.



(**a**)



(**b**)



(**c**)

Figure 7. Correspondence analysis (descriptors versus years) by region: (**a**) America; (**b**) Europe; (**c**) Asia and Australia. Source: authors.

5. Conclusions

This study aimed to study the main flow of the scientific literature in terms of omni-channel and multi-channel retailing in order to design the landscape of online retailing driven by both the digital transformation and pandemic related constraints.

This research adopted an approach based on text mining to analyze the coverage of the interest concepts (omni-channel and multi-channel retail) in the scientific literature. The main outputs of the research are: A dictionary of descriptors, clusters maps, network maps and proximity maps. Each of those outputs contribute to all the results' visualization and to an overview contouring on the concepts followed in this research.

The results were grouped and presented on three regions (Europe, America and Asia and Australia). Among the main findings, the following are self-evident (as visually supported by the graphical representations): (1) United States holds the greatest share in terms of published documents on omni-channel and multichannel in the online environment; (2) there is a higher number of connections (and stronger according to the eigenvalues on the network maps) between descriptors revealed for America as compared to the other two regions; (3) there is a different spread of descriptors and proximity with years of publication, which depends on each region. For instance, the category Types of channel retail is specific to 2013 for America, while Europe appears as being characteristic to 2002, and for Asia and Australia more specific to 2019; (4) the most frequently used descriptors are included in the: Online retail environment (ORE) and Consumer behavior (C_B) regardless the region.

A major benefit of this research is to better understand the relationship of interdependence between the concepts of omni-channel and multichannel, within the scientific production of researchers and experts. In the current context of the acceleration of the pace of promotion for the technical progress (which leads to a reduction of the life cycle for the vast majority of products, especially those that incorporate cutting-edge technology), it is very useful to know what type of promotion/sales channels can be used, in such a way that the consumer is determined to purchase a certain good or service as quickly as possible. From this perspective, it is very useful to understand the connections that are formed between various terms based on the resulting clusters and the fact that any change in a descriptor (e.g., "price") can generate changes both within the cluster of which this descriptor is a part, but also for other descriptors with which it has strong connections.

At the same time, observing the rapid increase in the number of articles that analyze these two concepts in recent years (evolution suggestively presented in Figure 3) we can conclude that the importance of the analyzed topic and, implicitly, its influence on the products and services on the market, will be more and more accentuated in the next period.

From another perspective, according to the authors' knowledge, it is the first study that performs a text mining analysis in this very important field of economic life. Moreover, it is for the first time that a comparative analysis is carried out between three major geographical areas (North America, Europe, Asia and Australia), regarding the scientific production for omni-channel and multichannel topic. This comparative analysis highlights the particularities of each geographical area, generated by the economic culture, the economic-social conditionality, the historical, political characteristics, etc.

The main limitation of this study is related to the source of data. More specifically it refers to using one chosen database for extracting bibliographic information and to the complexity of using two or more at the same time. Another limitation refers to the type of analyzed document (in this case we are talking about article and review). Other types of documents (that also define scientific production, namely books, book chapters, conference papers, etc.) were not taken into account (all of them can be the subject of future research). Finally, the third limitation concerns the software used (QDA Miner) that can only perform certain types of analysis and generate certain types of reports. Finally, we appreciate that all these limitations are not able to affect the validity of the results obtained.

Our research has implications for both researchers and scholars, as it offers an overview, as seen in the scientific literature, on these two concepts, of multi-channel and omni-channel retailing and creates premises for future research. The knowledge related to those

two concepts can be increased by using meta-analysis instead of a systematic review for more integrative research. Studying in depth transitions between these two forms of multi-channel and omni-channel retailing would also represent a new research topic. All in all, this theme contributes to the knowledge regarding future digital transformation of retailing from a multichannel view and opens new paths for shaping the future of multichannel retailing.

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