Assortment as a clustering variable: an application to the distribution of ceramics and construction materials in Spain

Abstract
Classifying is essential for understanding the situation of the commercial distribution and analyzing its evolution. In the present paper we study the distribution of ceramics and building materials in Spain and we propose a classification based on a cluster analysis validated both internally and externally. As a result, we have obtained three clusters of distributors that present significant differences regarding their assortment, business areas, resources and results obtained.

Keywords: cluster analysis, validation, classification, commercial distribution.

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Alejandro Mollá Descals
Departamento de Comercialización e investigación de Mercados. Universitat de València.

*María Eugenia Ruiz Molina
Facultad de Economía. Avda. de los Naranjos, s/n. 46022 Valencia (Spain).
M.Eugenia.Ruiz@uv.es

Teresa Vallet Bellmunt
Departamento de Comercialización e investigación de Mercados. Universitat Jaume I.

1. Introduction

As in the rest of Europe, the distribution sector in Spain is going through a phase of reconstruction. Various authors (e.g. Seth and Randall, 1999; Dawson, 2000) have pointed out, among other determinants of the new trends in commerce, the increase in consumer mobility, the popularization of the use of e-commerce, the growing size of establishments, market concentration, domestic market saturation and changes in legislation.

Classification plays a central role in the systematic understanding and prediction of any phenomenon (Singh, 1990) and in particular it is essential for understanding and analyzing relationships in retailing (Guy, 1998), as commercial establishments are heterogeneous in various aspects, such as their location, size, and type of customers. According to Mason and Mayer (1990), the structure of the retail system can be described via different classifications that altogether help to analyze the impact of the retail commerce on the economy and serves as a tool for business managers who wish to develop strategies to increase profits. In addition, by analyzing the size, growth rate and future trends of several components of a given classification, it is possible to assess the competitive position of the establishments of a company, or a sector in a geographical area. Furthermore, a consistent and complete classification allows researchers to empirically compare and test the results obtained for different geographical, cultural and temporal contexts (Guy, 1998).

The process for the extraction of classes begins with the choice between two approaches: the deductive approach (also denominated theoretical or a priori), using the a priori grouping of companies (typologies), and the inductive approach (denominated post-hoc or empirical), which generates strategic types using computer algorithms (taxonomies). In both cases, the selection of the dimensions used to cluster companies is a crucial step in thought about business competition.

The classification of commercial establishments and its relationship with companies' strategies and the results of their activity in terms of productivity and effectiveness have traditionally interested marketing researchers (Entenberg, 1959; Bucklin, 1963; Lewis and Thomas, 1990; Conant et al., 1990; Vallet, 2000). A current of literature on distribution

has focused on merchandise as a key variable for building a classification typology of retailing. The decision about the product assortment is perhaps one of most important that must be taken by the distributor (Kahn, 1999). However, most research has focused on grocery retailing, and there are few works in other sectors of activity. This paper aims to develop a typology of companies in ceramic and construction materials distribution in Spain in order to characterize the companies as the first step in the development of further research. The rest of the paper is organized as follows. Section 2 reviews literature about the classification of the companies from the distribution sector. Section 3 describes the methodology used, and Section 4 the characteristics of the sample and the databases. Next, the results obtained are analyzed. Finally, sections 6 and 7 draws conclusions and outlines future work, respectively.

2. Review of the literature

In this section we review the main contributions of typologies and taxonomies in the distribution industry, as well as the assortment as key element in the classification of distributors.

2.1. Typologies and taxonomies in the distribution industry

Retailers have several strategic options to meet their objectives. In the literature on retail distribution several typologies are detailed, these can be classified under four groups: the adaptation of the typologies of Miles and Snow (1978) and Porter (1980) to the retail sector, growth typologies, competitive positioning typologies and retailer format typologies. In the first group, Ellis and Calantone (1994) have studied the relationship between strategic types and retailer's results, whereas Porter's types (1980) have been adapted to the positioning strategies of price leadership, differentiation and segmentation (e.g. Bamfield, 1987; Savitt, 1987; McGee, 1987; Johnson, 1987; Helms et al., 1992).

Secondly, by applying the model proposed by Ansoff (1965) to the retail distribution, growth routes have generated basic consolidation strategies, geographical market development, development of new trading formats and diversification (Knee and Walters, 1985; Robinson and

Clarke-Hill, 1990; Pellegrini, 1994; Filser, 1987; Savitt, 1987; McGee, 1987; Omura, 1986; Burstiner, 1990; Dawson, 1991; Levy and Weitz, 1992; Gosh, 1990; Lewison, 1994; Cox and Brittain, 1994; Pellegrini, 1994; Tordjman, 1991; Muñiz, 1995; Casares et al., 1987).

Regarding retail positioning strategies, Berry and Barnes (1987) explore customers' motivations for visiting a store, proposing four generic retail positioning strategies: value retailers, time-efficient retailers, high-contact retailers and sensory retailers.

Finally, Mason and Mayer (1990) distinguish different classifications of commercial formats, i.e. descriptive classifications, which specify the different dimensions of the retail structure mostly offered by official statistics, and strategic classifications, which help the retailer to develop differential marketing by using the elements of the marketing mix that are more difficult to find in official statistics. Descriptive classifications include classifications by property or relationship with other organizations (Davidson et al., 1988; Rosenbloom, 1980; Berman and Evans, 1992; Levy and Weitz, 1992; Lewison, 1994) such as vertical integration (Díez, 2005; Svensson, 2008); geographical location (Davies, 1974; Potter, 1981; Dawson and Sparks, 1986; Guy, 1998; Shaw and Cresswell, 2002; Thurstain-Goodwin and Gong, 2005) and by size of retailer (Rosenbloom, 1980; Dunne et al., 1992; Puelles, 2004). Strategic classifications gather the classification of formats according to the contact with the consumer and the customer shopping purpose. In the former group there is a distinction between sale with establishment and sale without establishment (Mason and Mayer, 1990; Davidson, Sweeney and Stampfl, 1988; Bolen, 1988; Rosenbloom, 1980; Gosh, 1990; Berman and Evans, 1992; Levy and Weitz, 1992; Dunne et al., 1992; Lewison, 1994). The latter group is the result of the distinction between shopping trips to cover routine needs (convenience shopping) and those made occasionally and mainly for personal satisfaction (comparison shopping).

Even if it is usual the classification by retailer size, this type of classification involves the arbitrary use of borders. In addition, in the so-called "small distributor" group, there is a wide variety of retailers. For that reason, the classification based on the size of the store would have to be com-

pleted with its characterization based on the type of products that it sells (Guy, 1998).

As opposed to typologies, the second method of classification of strategies covers the post-hoc approaches (TAXONOMIES). The post-hoc or empirical approaches are those in which the strategic types have arisen from the empirical data. The different types of strategies appear after the data treatment and statistical analysis.

The empirical study of the competitive strategies has been analyzed from various disciplines. Economic sciences have looked for a unit of analysis between the industry and the company to explain the competitive forces, denominated strategic group (Marion, 1998; Harrigan, 1985; Hawes and Crittenden, 1984; Flavian, 1995, 1998; Muñiz, 1995, 1996a, 1996b; Bello and Muñiz, 1998; García and Rodríguez, 1994, 1996; Vázquez, 1992; Ruiz and Iglesias, 1997). The identification and analysis of the groups depend on key strategic dimensions chosen by the researcher, and most of the time, based on the secondary data available.

In addition, studies in psychology also use intermediate levels of aggregation of companies that they call cognitive taxonomies (Porac, Thomas and Emme, 1987). The identification and analysis of the groups obtained depends on company managers' perceptions of its competitive environment, and managers propose the key measurement dimensions of the strategy.

Also, studies in business administration and marketing try to find generic types of strategies through the inductive method. The results of these works are generic taxonomies and positioning taxonomies. Generic taxonomies are characterized by the study of several sectors, and based on big samples and manager perceptions, they look for generic marketing strategies. Conant et al. (1993) and Vallet and Mollá (2002) have developed this concept in the retailing sector. The positioning taxonomies are based on the customer perception of the image of the retailer, and depending on this, competitive positioning retail strategies are defined (Hernandez et al., 1995; Vázquez, 1992, 1989; Ring, 1979; Oppewal and Timmermans, 1997; Davies and Brooks, 1989).

2.2. Assortment as a classification variable

The definition of the assortment constitutes one of the retailer's main decisions and makes it possible to define the commercial differentiation, together with customer service, promotion and price policy (Balderston, 1956). In addition, merchandise is the factor that most often appears in the studies of retail image (Lindquist, 1974; Gil et al., 1995). The factors that determine assortment are multiple (Vázquez, 1989:52) and from their interaction a favorable image appears: retailer mission, market demand, higher or lower numbers of different types of customer, the commercial area, sales area and capital available for fixed investments and stock.

However, the merchandise can be the same (brands of manufacturer in grocery distribution, for example) and does not differentiate establishments. What is important is the way and the context in which the merchandise is displayed, rather than the merchandise itself (Davies and Brooks, 1989:219). An important part of the retailer strategy is the development of own brands, which constitutes an additional form of differentiation from competitors, to obtain reputation, to create customer loyalty toward the store and to build a corporative image (Vázquez, 1989:56).

It is also necessary to consider the differences of approach between the producer and the retailer, regarding the composition of the product portfolio. Whereas the producer aims at defined segments of market, the retailer copes with a set of consumers belonging to the different segments of producers. The producer has a product portfolio on which it stamps a brand image, which adapts to one or several segments, with competition at international level, and portfolio management is carried out through the marketing mix. By contrast, the distributor has a product portfolio (assortment) coming from different companies, on which he stamps a standard image, adapted to a geographical area of attraction, with competition at local level and managed through retailing-mix actions.

Thus, there is need to refine the definition of the typology of retailers depending on their product assortment. Considering Bucklin's (1963) definition of retailer or product assortment as a mix of market goods together with a series of services in order to reduce costs between economic

agents in the subsequent levels of the distribution channel, we describe below some typologies based on the assortment.

First, distributors can be classified according to the variety of their assortment. The variety refers to the number of different product lines, and the assortment is the choice of products within a line. Variety can be defined as wide (multiple product lines) or narrow (few lines), and assortment can be characterized as deep (many products in a line) or superficial (few products in a line). Following these options, the typology of Tordjman (1991) distinguishes four distributor strategies based on the breadth or depth of the assortment: defensive strategy, with a broad, shallow assortment; offensive strategy, with a narrow, deep assortment; push strategy, with a narrow, shallow assortment, and pull strategy, with a broad, deep assortment. It is important to distinguish between this assortment-based definition of defensive strategy from the strategy based on maximizing royalty or customer retention (Berné et al., 2005).

In a second classification, it is possible to distinguish between non-specialized distribution, multi-product specialized distribution and single-product specialized distribution (Vallet and Mollá, 2006).

On the other hand, among the specialized retailers Vallet and Mollá (2006) distinguish four great categories based on his assortment: specialized store, which displays a limited line, a narrow, deep assortment; single line store (of specialties, superspecialist, or niche specialist), which is characterized by a very narrow and very deep assortment, by a specialized line or part of the line; large specialized surface, which offers a narrow, very deep assortment and large store size (between 5,000 and 10,000 m^2); and factory stores, which offer a narrow, semi-deep assortment.

Also, taking into account that managerial decisions regarding assortment can aim at different objectives and, consequently, generate diverse retailer formats, Balderston (1956) proposes a typology with eight types of different distributors, i.e., conventional, specialty shop, volume-oriented distributor, bargain-oriented distributor, distributor specialized in new purchase combinations, distributor specialized in sporadic buyers, distributor with technical services and status symbol distributor.

Although the distributor can pursue different objectives simultaneously, there is generally a predominant objective that conditions the choice of assortment regardless of short-term marginal considerations, as it affects both the present and future store image.

In summary, various criteria have been used by different authors to classify commercial stores. Some are totally inclusive, whereas others are not. Some involve classifying the stores in generic categories that must be defined according to merchandise assortment, type of owner, size and inner design, or a combination of these. For the purpose of analyzing the distribution structure at national or local level, a classification based on the types of products offered seems to be the most appropriate (Guy, 1998). A second dimension could be the size of the store or the form of ownership.

3. Research method

This study is inductive, as it aims at building a taxonomy of distributors of ceramics and construction materials in Spain considering the empirical evidence.

We have used secondary data, belonging to the database of the National Association of Distributors of Ceramics and Construction Materials (ANDI-MAC) and applied a cluster analysis considering the key variables of assortment in the different product families. First, the hierarchical method has been used to delimit the number of conglomerates. Next, as it is not expected that groups are included in other groups, a K-Means non-hierarchical clustering method is selected. Nevertheless, this method requires a number of a priori clusters for the initial analysis, as well as centroids, which are provided by the hierarchical analysis previously carried out (Punj and Stewart, 1983).

In order to consider the issues relating to the validity of the results, a three-step procedure is followed.

The first step consists of selecting the optimal number of clusters for the analysis through interactive techniques and internal validation of the solution obtained (Ellis and Calantone, 1994).

For the internal validation of the alternative solutions, we developed a confirmatory cluster analysis, we applied a discriminant analysis and we

compared the results of a cluster analysis for two alternative sub-samples. First, an additional non-hierarchical analysis was performed. In this case, a centroid is set randomly to begin with. If the results are robust, it is expected that the final solution does not differ substantially from the previous one. Secondly, the assignment group obtained from the cluster analysis is compared with the one obtained from the discriminant analysis. The chance-adjusted kappa concordance coefficient is calculated for the two solutions for the second sub-sample. The optimal number of clusters is calculated maximizing kappa, assuring its internal validity and replicability. Once the number of clusters has been determined, the data are classified and a K-Means analysis is performed with the optimal number of groups. This is the last solution of the clustering process. Thirdly, we divided our data in two random samples for internal validation, following Punj and Stewart (1983). The first data set constitutes the sample that was used to generate the possible alternative clustering solutions. The second data set is used to select between alternative clustering solutions based on stability and replicability. It is basically a comparison of the clusters assigned through the crossed validation of the second data set.

The second phase of the cluster analysis consists of validating the groups comparing the average values of clusters through other measures. In this way, we try to determine whether the subjects belonging to each group behave in a different way concerning variables that have not been included in the analysis, as it is expected that the differences between clusters involve different behaviors in several variables. In particular, after defining the clusters, their external validity is verified through studying whether the clusters obtained present significant differences regarding their activities complementary to commerce and various measures of resources (volume of assets, number of employees, own brands, total number of product families, number of warehouses, total store area, average sales area of the store, number of vehicles), of results (turnover, profitability, productivity, market share) and others (customer credit, supplier credit). The null hypothesis of equality in the different variables between the clusters is tested using one-way ANOVA. Finally, in the third phase, the distinguishing features of the clusters are identified, both regarding the group-

ing variable (product assortment) and the variables for their characterization (resources, results and others).

4. Sample and databases

As literature pays little attention to the study of the distribution of durable goods, we have centered our analysis on the sector of distribution of ceramic and construction material in Spain.

The database of companies from the sector is obtained from the secondary information available. Two sources were used to locate the companies in the sector: the database of companies associated with ANDIMAC and the companies included in the Alimarket database of economic information as retailers or wholesale suppliers of ceramics and construction materials.

The two databases were purged of duplicate data, companies exclusively specializing in the distribution of electrical components, metals, etc. Once filtered, the final sample consisted of 950 distributors of construction material whose NACE (National Classification of Economic Activities) and/or IAE (Tax on Economic Activities) codes are related to the wholesale of construction material.

Once the sample of companies has been defined, some indicators were analyzed in order to allow a first characterization of the sector, e.g. geographic location, type of activity, product category, number of employees, volume of assets and turnover, registered own brands, profitability, productivity, and average number of days of customer and supplier credit. All this information was mainly obtained from the database of business information SABI (Iberian Accounting Analysis System)[1]. From the Alimarket database, in addition we obtained information about number of warehouses, warehouse area and number of vehicles.

Market share, number of product families and average store area are calculated from the available information.

The distributors of ceramic and construction material present some peculiarities that distinguish them from companies belonging to other sectors. In order to describe the companies of the sample, we first analyze their type of activity following the NACE and IAE code. Table 1 shows the statistics obtained for the companies from the sample.

(1) S.A.B.I. is an Informa database that contains the annual reports of the most important Spanish and Portuguese companies since 1990. This information is obtained from different official sources, i.e. Trade Register, BORME (Official Bulletin of the Trade Register) and specialised business press.

Table 1. Activity

	NO. COMPANIES	%
Panel 1.A: Activity by main NACE code		
Wholesale (NACE: 5143, 5144, 5145, 5146, 5147, 5152, 5153, 5154, 5156, 5161, 5162, 5165, 5170)	662	69,68%
Retail (NACE: 5210, 5211, 5212, 5240, 5244, 5245, 5246, 5248)	68	7,16%
Trade intermediation (NACE: 5100, 5110, 5111, 5113)	27	2,84%
Production (NACE: 2523, 2612, 2622, 2640, 2661, 2663, 2666, 2810, 2811, 2840)	22	2,32%
Construction (NACE: 4500, 4520, 4521, 4531, 4533, 4534, 4541, 4543, 4545)	21	2,21%
Transportation (NACE: 6000, 6010, 6024, 6100, 6110)	15	1,58%
Other activities	13	1,37%
NACE not found	122	12,84%
Panel 1.B: Activity through participation in the distribution channel		
Specialists (only wholesale of construction material: IAE: 6174)	114	12,00
Wholesale of several products (IAE: 6153, 6154, 6156, 6157, 6159, 6161, 6162, 6163, 6164, 6165, 6166, 6170, 6173, 6175, 6179)	124	13,05
Retailer (IAE: 6500, 6530, 6531, 6532, 6533, 6534, 6535, 6539, 6542, 6545)	178	18,74
Trade intermediaries (IAE: 6310, 6330, 6340, 6350, 6390)	25	2,63
Wholesale and retail	67	7,05
Wholesale and trade intermediary	20	2,11
Retail and trade intermediary	21	2,21
Wholesale, retail and trade intermediary	5	0,53
Other IAE codes	274	28,84
IAE not found	122	12,84
Panel 1.C: Additional trading activities by IAE		
Only trade (wholesale, retail and trade intermediary)[2]	583	79,00
Transportation (IAE: 7220, 7221)	101	13,69
Construction (IAE: 5000, 5010, 5011, 5012, 5013, 5022, 5023, 5024, 5090)	73	9,89
Manufacturer of construction mat. (IAE: 2410, 2420, 2423, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2463, 2465, 2470, 2475, 2476, 2479, 3100, 3120, 3121, 3142, 3143, 3166, 3200, 3220, 3224, 3251)	64	8,67
Estate agency (IAE: 8330, 8331, 8332, 8340; 8600, 8610, 8612, 8620)	45	6,10
Installation (IAE: 5040, 5041, 5042, 5043, 5045)	17	2,30

Source: Own elaboration.

(2) See Table 1.C for further details about the IAE description in each category of distributor (wholesale supplier, retailer and trade intermediary).

As shown in Panel A of table 1, for the companies in the sample the wholesale trade is the main activity declared by more than half of the companies, followed by the retail trade. In particular, of the 950 companies of the total sample, 69.68% are wholesalers. This percentage is 79.95% if we consider only the companies for which we have information about their NACE codes. For the total sample, only 7.16% of the companies are defined as retailers. The other companies, i.e. 10.32%, are trade intermediaries, manufacturers, producers, constructors and carriers. In these cases it could be hypothesized that these companies have diversified their activity and have passed from being simple carriers or constructors to distributing construction materials.

Secondly, according to their IAE codes, 77.68% of the companies in the sample declare that they are wholesalers of glass, construction material and installation accessories (IAE 6174), among other activities. Some synchronize the trade in this kind of material with another type of wholesale trade, retail commerce and/or trade intermediation. In order to explore the companies with the 6174 IAE code in more detail, we follow two criteria: their participation in the distribution channel and their participation in activities in addition to the distribution of construction materials.

First, we group the companies under 6174 code depending on whether they are exclusively wholesalers of construction material or, on the contrary, they also practice wholesale trade in another type of merchandise and/or retail trade or trade intermediation.

Panel B of table 1 shows the distribution of companies according to their participation in the distribution channel. As can be observed, nearly one third of construction material wholesalers make their work compatible with other activities apart from trade. Within commercial tasks, nearly a fifth of construction materials wholesalers also act as retailers. As opposed to these, there is a numerous group of companies selling both construction materials and other types of goods. On the other hand, as an important percentage of wholesale construction materials companies (6174 IAE code) declares that it carries out other activities apart from trade, we describe these companies according to their participation in activities additional to distribution according to other IAE codes. The

results obtained are shown in panel C of table 1. Although 79.00% of the
companies from the total sample are exclusively dedicated to trade, some
companies act as carriers, manufacturers of construction materials,
installers, constructors and/or promoters and estate agencies.

Finally, we describe the companies according to the type of product that
they commercialize. Table 2 shows the results obtained for the total sam-
ple. Thus, in table 2.A (wholesale of construction materials) we can
observe that, after the wholesale of goods related to construction, the com-
panies of the sector commercialize durable goods, followed by wood and
cork.

Regarding retailing, we can see in table 2.B that, after the sale of con-
struction material and bathroom articles and furniture, the sale of house-
hold items, hardware, and decoration items is also important.

On the other hand, the existence of distributors' registered trademarks
is important in many ranges of distribution. In the distribution sector,
although it is still an embryonic phenomenon, its importance will undoubt-
edly grow in the next few years. In this sense, from the 950 companies in
the sample, 226 companies[3] have at least one own brand. Of these com-
panies, more than a half have only one registered trademark. In particular,
the existence of own brands is a more frequent strategy at wholesale com-
panies or at companies acting as both wholesaler and retailer.

Finally, table 3 shows the distribution of companies based on the num-
ber of employees, the volume of assets and the annual income.

(3) One should interpret
the data about own
brands cautiously, as the
SABI database (which
obtains this information
from Marc@Net, the
online counseling service
about brands and
trademarks) states that
there is no information
about the company's
brands. This statement
can be interpreted in the
sense that the company
does not hold a
distributor brand, or that
this information is not
available.

Table 2. Product category

IAE	CONCEPT	N	%
2.A. WHOLESALE RELATED TO CONSTRUCTION MATERIALS			
6174	CONSTRUCTIÓN MATERIAL, GLASS, INSTALLATION ACCESSORIES	738	77,68
6156, 6157, 6159	DURABLE GOODS, FURNITURE AND HOME DEVICES	100	10,53
6173	WOOD AND CORK	88	9,26
6170 and 6179	INTER-INDUSTRIAL EXCEPT MINERALS AND CHEMICAL PRODUCTS	50	5,26
6153	HOME APPLIANCES, HARDWARE	38	4,00
6152	FURNITURE	15	1,58
6163	MINERALS	15	1,58
6175	WOOD AND METAL MACHINERY	12	1,26
6162	IRON AND STEEL	8	0,84
6154	RADIO-ELECTRICAL MATERIALS AND ELECTRONICS	7	0,74
6166	CHEMICAL PRODUCTS	3	0,32
6165	OIL AND LUBRICANTS	2	0,21
6164	NON-FERROUS METALS	1	0,11
2.B. RETAIL RELATED TO CONSTRUCTION MATERIALS			
6534	CONSTRUCT. MATERIALS, ART.AND BATHROOM FURNITURE	214	22,53
6533	HOUSEHOLD ART., HARDWARE, DECORATION, GIFTS OR ORNAMENTS	86	9,05
6530, 6536, 6539	OTHER HOUSEHOLD AND CONSTRUCTION ITEMS	34	3,58
6532	ELECTRIC AND NON-ELECTR. HOME DEVICES AND KITCHEN FURNITURE	34	3,58
6545	MACHINERY EXCEPT HOME DEVICES, OFFICE AND MEDICAL ITEMS	10	1,05
6531	FURNITURE (EXCEPT OFFICE FURNITURE)	8	0,84
6535	DOORS, WINDOWS, VENETIAN BLINDS, MOULDINGS, FRAMES, WOODEN PLATFORMS	5	0,53
6542	ACCESSORIES AND PARTS	2	0,21

Source: Own elaboration.

Table 3. Distribution of the total sample by number of employees, volume of assets and annual income (year 2003) and growth rates (1993-2004)

Variable	No. of companies	%	Growth rate 1993-2004
Number of employees:			49.8 %
< 5	84	11.88	
5 – 10	108	15.28	
10 – 25	312	44.13	
25 – 50	138	19.52	
> 50	65	9.19	
Volume of assets (in millions of euros):			135.3%
< 0.5	69	8.82	
0.5 – 1	90	11.51	
1 - 2.5	237	30.31	
2.5 – 5	206	26.21	
5 - 10	107	13.68	
> 10	74	9.47	
Volume of income (in millions of euros):			113.4%
< 1	96	12.31	
1 - 2.5	129	16.54	
2.5 – 5	231	29.62	
5 - 7.5	150	19.23	
7.5 – 10	57	7.31	
> 10	117	15.00	

Source: Own elaboration.

As shown in table 3, the distributions of the three variables are quite similar.

5. Analysis of results

Since the objective of the present paper is to propose a typology for classifying the distributors of ceramics and construction materials, we first apply a non-hierarchiral cluster analysis to the total sample, distinguishing three groups through the dendogram that are internally validated by a K-Means cluster analysis and a discriminant analysis.

In order to obtain more detailed information about the meaning of the differences between the elements belonging to the clusters, we perform a variance analysis considering as factor the cluster assigned and as dependent variables those used to classify the elements of the sample. The results obtained are exposed in table 4.

Table 4. Average of cluster descriptors and variance analysis

Variables	Cluster 1	Cluster 2	Cluster 3	F	Differences between groups[*]
Construction material	0.91	0.47	0.94	24.495[a]	1-2, 2-3
Inter-industrial	0.06	0.27	0.06	5.698[a]	1-2, 2-3
Electrical material	0.02	0.07	0.00	5.524[a]	1-2, 2-3
Oil and chemical products	0.01	0.07	0.00	5.262[a]	1-2, 2-3
Machinery	0.01	0.87	0.01	383.015[a]	1-2, 2-3
Hardware	0.58	0.27	0.00	403.726[a]	1-2, 1-3, 2-3
Durable goods	0.63	1.00	0.00	620.908[a]	1-2, 1-3, 2-3
Metals, iron and minerals	0.04	0.00	0.02	1.638	-
Wood and cork	0.13	0.07	0.11	0.289	-
Other products	0.08	0.00	0.03	6.698[a]	1-2, 1-3
Number of cases	207	15	608		
%	24.94	1.81	73.25		

[a, b, c] Significantly different from zero at confidence levels of 99%, 95% and 90%, respectively.
[*] In order to test the significance of the differences between the types of retailers, the Tukey post-hoc multiple comparison test is used. Only the statistically significant differences between groups at the 5% level are shown.

Clusters present significant differences in all clustering variables, except the trade in metals, iron and minerals, and wood and cork.

In order to validate the results of the clustering process internally, a discriminant analysis is performed, obtaining the results shown in table 5.

Table 5. Contingency table: (Group assigned by Cluster Analysis) X (Group assigned by Discriminant Analysis)

		Group assigned by Discriminant Analysis			
		1	2	3	Total
Group assigned by Cluster Analysis	1	204 24.6%	3 0.4%	0 0.0%	207 24.9%
	2	2 0.2%	13 1.6%	0 0.0%	15 1.8%
	3	0 0.0%	7 0.8%	601 72.4%	608 73.3%
	Total	206 24.8%	23 2.8%	601 72.4%	830 100.0%
Kappa index		0.964			

From table 5 it is inferred that in 98.6% of the cases the classification obtained through discriminant analysis coincides with the one obtained through cluster analysis. The kappa index of agreement between both classifications is of 0.964, significant for a level of confidence of 99%. In particular, the variables that contribute to a greater extent to the discriminant analysis are construction material, hardware and durable goods, being their Wilks' lambda 0.504, 0.123 and 0.121 respectively ($p <$ 0.000).

In addition, regarding external validation of the results of the cluster analysis, diverse variables of resources, results and other characteristics have been analyzed in order to discover the existence of differences between clusters in diverse dimensions. Table 6 shows the results obtained through the ANOVA analysis.

Finally, we define the clusters based on their main characteristics. In table 7, the particular features of each cluster are summed up. Following the typologies of Vallet and Mollá (2006), we call the first cluster "traditional distributor with wide assortment", since it includes both pure retailers and distributors that are simultaneously wholesalers and retailers, which sell a large number of product families, with an assortment of construction materials, hardware and others. They diversify their activity acting as property developers. They are characterized by having the highest income, an intermediate market share and an intermediate negotiation power with the suppliers, among their main characteristics.

Table 6. Average of cluster descriptors and variance analysis

	Cluster 1	Cluster 2	Cluster 3	F	Differences between groups[*]
ROLE IN DISTRIBUTION CHANNEL					
- Retailer	0.6715	0.4000	0.2843	55.281[a]	1-2, 1-3, 2-3
- Wholesale	0.6280	0.9333	0.1736	114.943[a]	1-3, 2-3
- Wholesale and retail	0.27	0.13	0.02	69.365[a]	1-2, 1-3, 2-3
- Trade intermediary	0.09	0.13	0.10	0.213	-
- Only trade	0.75	0.93	0.68	3.804[b]	1-3, 2-3
- Only trade construct. materials	0.00	0.00	0.19	25.678[a]	1-3, 2-3
DIVERSIFICATION					
- Installation	0.04	0.13	0.02	4.778[a]	1-2, 2-3
- Manufacturer	0.0483	0.0000	0.1025	3.594[b]	1-2, 1-3, 2-3
- Transportation	0.07	0.00	0.16	6.526[a]	1-2, 1-3, 2-3
- Property developer	0.09	0.00	0.04	3.105[b]	1>3>2
- Estate agency	0.01	0.00	0.01	0.112	-
- Constructor	0.09	0.00	0.11	1.183	-
RESOURCES					
- Assets	5.341.502	12.579.124	3.635.587	8.807[a]	1-2, 1-3, 2-3
- No. employees	31.28	45.46	22.01	9.851[a]	1-2, 1-3, 2-3
- Own brands	0.96	1.85	0.87	0.966	-
- No. product families	2.3285	1.6000	1.1530	213.447[a]	1-2, 2-3, 1-3
- No. warehouses	3.50	4.69	2.54	5.160[a]	1-2, 2-3, 1-3
- Warehouse area	12.147.36	8.616.77	10.782.59	1.152	-
- Average store area	4.044.5585	2.735.2367	4.940.9750	2.519[c]	1-2, 2-3
- Employees/1000 m^2 store area	19.2672	33.7392	12.9801	3.669[b]	1-2, 2-3
- Vehicles	8.61	7.60	8.43	0.020	-
RESULTS:					
- Turnover	7.928.658	6.768.293	5.494.609	10.727[a]	1-2, 1-3, 2-3
- Market quota	0.1562%	0.2411%	0.0980%	14.278[a]	1-2, 1-3, 2-3
- Profitability	2.8771	4.4300	3.8530	0.316	-
- Productivity	1.7043	1.7286	1.7846	0.146	-
OTHERS:					
- Customer credit	89.71	111.64	93.19	1.154	-
- Supplier credit	105.31	158.22	105.11	4.683[a]	1-2, 2-3

[a, b, c] Significantly different from zero at confidence levels of 99%, 95% and 90%, respectively.

Table 7. Summary of cluster characteristics

Cluster 1: Traditional distributor with wide assortment	Cluster 2: Specialized distributor	Cluster 3: Traditional distributor with narrow assortment
N = 207 (24.94%)	N = 15 (1.81%)	N = 608 (73.25%)
ASSORTMENT: In comparison with the other clusters, there is a higher presence of: - construction materials - hardware - others products ROLE IN DISTRIBUTION CHANNEL: Percentage of exclusive retailers higher than in the other clusters. Percentage of wholesaler-retailer higher than in the other clusters. DIVERSIFICATION Percentage of property developers higher than in the other clusters. RESOURCES: Assets: intermediate. No. employees: intermediate. No. product families: high. No. warehouses: intermediate. Average store area: intermediate. Supplier credit: intermediate. RESULTS: Income: high. Market share: intermediate.	ASSORTMENT: high presence of: - inter-industrial supplies - electrical supplies - oil and chemical products - machinery - durable goods - machinery ROLE IN DISTRIBUTION CHANNEL Percentage of exclusive wholesalers higher than in the other clusters. Percentage of exclusive trade higher than in the other clusters. DIVERSIFICATION Percentage of installers higher than in the rest of clusters. RESOURCES: Assets: high. No. employees: high. Employees/1000 m^2 store area: high. No. product families: intermediate No. warehouses: high. Average store area: low. Supplier credit: high. RESULTS: Income: intermediate. Market share: high.	ASSORTMENT: In comparison with the other clusters, there is a higher presence of construction materials. ROLE IN DISTRIBUTION CHANNEL Percentage of exclusive trade of construction materials higher than in the other clusters. DIVERSIFICATION Percentage of manufacturers higher than in the other clusters. Percentage of carriers higher than in the other clusters. RESOURCES: Assets: low. No. employees: low. Employees/1000 m^2 store area: low. No. product families: low. No. warehouses: low. Average store area: high. Supplier credit: low. RESULTS: Income: low. Market share: low.

The second cluster, denominated "specialized distributor with wide assortment", includes companies that act only as wholesalers, with a very diverse assortment, i.e. inter-industrial supplies, electrical equipment, chemical products and oil, machinery and durable products. They diversify their activity by providing their customers with installation services. Regarding their resources, they are the group with the highest level of assets, number of employees, number of warehouses and employee/sales area ratio. This cluster could be also denominated as "high-contact specialists", as most of its companies show a high ratio of employees per

store. Regarding results, they are the group with greatest market quota, intermediate income and greatest negotiation power with the suppliers. Several distribution chains as well as associated establishments are among the members of this group, constituting an example of the development of multi-store chains or companies and of the importance of associationism in this sector.

Finally, most of companies are in third cluster, including distributors that sell a small number of product families, specialized in trade in construction materials, with a very narrow assortment (smaller number of families of products and of construction materials only), and acting in many cases as manufacturers and carriers. Regarding their resources, they are the group with the highest average store area, but with respect to the rest of ratios they are the companies with the lowest assets, number of employees, number of product families, number of warehouses and employee/sales area ratio. According to their results, they are those with the smallest income and market quota. We have called this cluster "Traditional distributor with narrow assortment", even if it includes companies that could be denominated "value specialists", as well as some "factory stores".

6. Conclusions

The above analyses have allowed us to identify a set of structural characteristics of the companies involved in ceramic and construction materials distribution in Spain, considering secondary sources of information, constituting a first approach to the description of the sector. In this way, we consider that we have contributed to shedding light on the situation of a sector characterized by the wide heterogeneity of its companies in their assortment and activities. Through a clustering process, we obtained clusters differing significantly in their assortment, as well as in their business activities, resources and results. Once identified the assortment-based typology of companies, in order to provide practitioners with a valid instrument for the decision-making process, the next step in this research might be a longitudinal analysis of the relationship between the assortment decisions of the company and its performance.

It can be pointed out that the clusters obtained reflect the importance of associationism in this sector, where diverse companies are grouped into cooperatives, purchasing centers, alliances and distribution chains in order to obtain better commercial conditions, to reduce their logistics costs and to draw up marketing plans adapted to the market (Diaz, 2004). In this way, they try to face up to the competition coming from the big specialized DIY stores in the United States and a large part of Europe and which are being introduced into Spain with great success but with several years of delay with respect to European and North American distribution (Vallet and Mollá, 2006). The distribution chains and the associated companies show significantly better results and greater negotiation power with suppliers than the traditional distributors.

7. Limitations and future research

In this paper we have used secondary sources of information. This fact has limited the amount and quality of the results obtained. Such limitations are due to the presence of inaccurate or not fully updated data, and the restriction involved in using fields of information not specifically designed for the purpose of this research. Nevertheless, these results offer a first approach that can be completed in as far as new companies are located and incorporated in the database, and further information is available for all the companies.

However, with the existing data, only the breadth of the assortment can be studied, not its depth. A survey including questions about the depth of the product portfolio could greatly contribute to extending the conclusions of this study in the line of Tordjman (1991).

It is important to note that the characteristics of the databases used in this study involve incurring a set of a priori biases. In particular, the database of ANDIMAC includes a large number of small companies for which it was not possible to find financial information. On the other hand, the Alimarket database incorporates an excessive number of wholesale companies due to the purging decisions that were adopted in our study. All in all, the results offered in this study must be interpreted cautiously, as it is a work in progress and the analysis of the sector will be improved in as far

as further information on more companies comes from other sources. Thus, obtaining primary data through a survey constitutes a high-priority necessity. The use of primary data for a sample of companies of the sector can allow us to overcome some of these limitations and to introduce some more interesting topics to characterize this sector.

In this sense, this work provides a new point of view for three lines of research. Firstly, the effectiveness of the clustering process could be tested in other geographical contexts and other product markets. Another possible research involves going backward to understand the antecedents of the present situation of this sector. Finally, the relationship between the type of distributor obtained and its results can be analyzed more deeply. Additional data about the assortment and the activities developed by the distributor can contribute to a clearer definition of the situation in the distribution sector.

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