COMPARATIVE STUDY OF DIGITISATION IN THE SPANISH CERAMIC SECTOR FROM A MARKETING PERSPECTIVE IN THE PERIOD 2017–2019

Callarisa Fiol, L.J., Sanchez García, J., Rodríguez Artola, R.M., Moliner Tena, M.A.

IMK Innovación en Marketing
Departamento de Administración de empresas y Marketing
Universitat Jaume I
(Spain)

1. ABSTRACT

Over the last ten years, industry has had to tackle the incorporation of new information and communication technologies in both its production processes and the decision-making processes by its governing bodies. The so-called fourth industrial revolution is characterised by the integration in production processes of technologies currently under trial or development, which is breaking down the boundaries between the physical world and the digital world. This mainly entails cybernetics, the Internet of Things, inCloud information systems and the use of big data.

The ceramic industry is no exception and in recent years, significant changes have taken place in its actual production systems and with developments such as digital printing or 3D printing, the inclusion of nanotechnology in ceramic products, or extended usage and manufacture of ceramics for other applications, both indoors and outdoors, as a product of home decoration or urban furniture, etc.

In line with these new ways of perceiving ceramic products, the end customer has taken on a more active approach when searching for information during the pre-purchase and purchase stages of a new house building or home reform project, as was reflected in the ITC Market Observatory's 2018 Study on ceramic tile consumers. In view of that trend, at the last edition of Qualicer in 2018, we presented a research paper that sought to define the state of this matter among ceramic floor and wall tile manufacturers, and how their companies were addressing the new commercial and social scenario. The aim of this year's study is to replicate the one carried out in 2017 on the use of big data and social media by Spanish companies in the ceramic sector, in order to compare how they have evolved over the last two years, given the increasing implementation of big data and the publication of contents on social media by companies in the Castellon cluster.

2. INTRODUCTION

The ceramic industry in Spain is fundamentally represented by the ceramic cluster in the province of Castellon, which encompasses 80% of Spanish companies and 94% of the country's production. It is one of the most important such sectors in the world economy and therefore equally so in the Valencian economy, and as an industrial sector in Spain's national economy. The Spanish ceramic tile manufacturing sector is one of the most dynamic and innovative industries both in the country and within the world ceramic industry, and specifically, is a driving force in terms of technological development, design and quality of service.

As follows from a study by KPMG (2019) and from the ASCER website, in 2018, the Spanish ceramic industry produced 530 million square metres (a very similar figure to 2017), with sales just under €3.6 billion (2% more than in 2017), of which over 75% were exported (€2.71 billion, 1% higher than in 2017), and the rest (€890 million, up 7% on 2017) went to the domestic market. In 2018, it employed 15,400 people in mostly small and medium-sized companies, and exported products to 187 countries, with Europe as its main market (49.1% of exports, up by 5% over the previous year), followed by the USA (9.4% of exports, with growth of 11.8% on 2017). The ceramic industry has the third largest surplus in Spain's trade balance, with its expertise and knowledge providing the differentiating values on which its international presence in those 187 countries is based.

According to data taken from the ASCER report (2018), Spain is the leading European tile exporter by volume and the second worldwide. It also holds a leading position in terms of industrial output, as it is the largest European tile producer. Continuing with macro-economic data, the Spanish ceramic industry contributes the third largest trade surplus to the Spanish economy, specifically €2.253 billion in 2014 (Table 1).

Year / € million	2014	2015	2016	2017	2018
Production	425	440	492	530	530
Export sales	2,328	2,452	2,570	2,686	2,727
Domestic market sales	574	643	746	824	870
TOTAL SALES	2,902	3,095	3,316	3,510	3,597

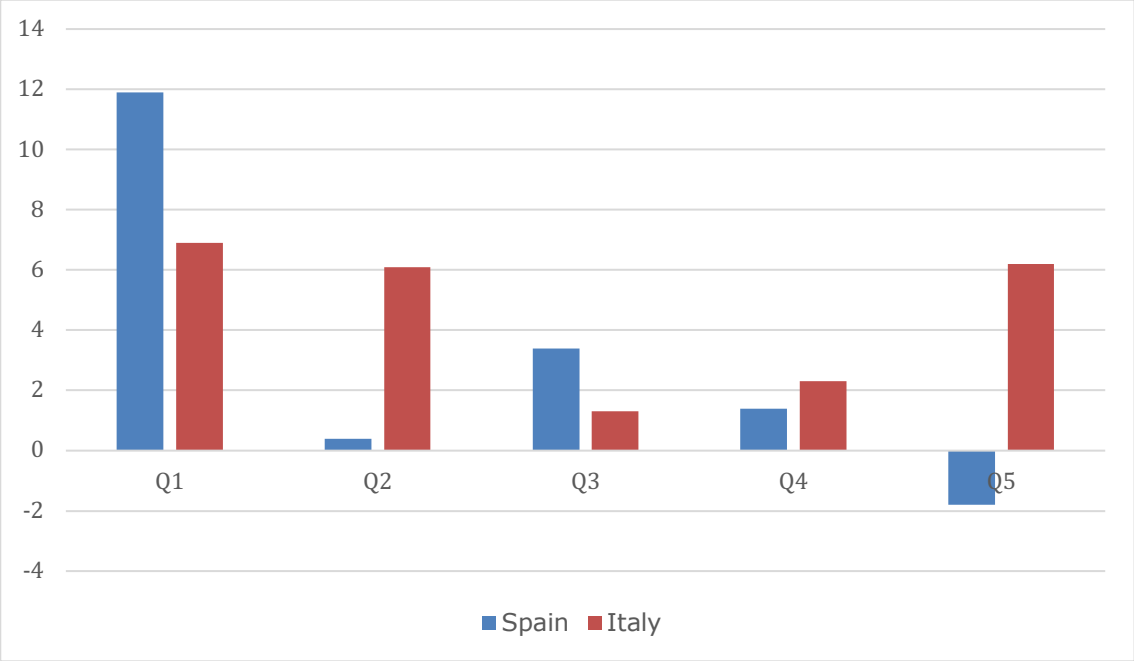
Sales in million euros and production in millions of square metres

Source: ASCER Balance Report 2018
Table 1*: Spanish ceramic industry sales (2014–2018)*

One of the main characteristics of this sector is the high concentration of companies in a specific geographical area, namely the province of Castellon, more specifically in the area formed to the north by Alcora and Borriol, to the west by Onda, to the south by Nules, and to the east by Castellon de la Plana. That district is home to 80% of all companies at national level and 94% of national production.

According to a study by Deloitte (2019) based on sources from ASCER, OECD, World Bank, Tile International 2017-2018, Alimarket, and Deloitte's own analysis, Spain maintains its status as a global power in world production with a 3.9% share, putting it in fifth position, surpassed only by China (#1 with 47.2%), India (#2 with 8.0%), Brazil (#3 with 5.8%) and Vietnam (#4 with 4.1%). It is also the 2nd largest world exporter by volume with a 14.8% share, again only surpassed by the Chinese giant (#1 with 33.0%), and ahead of countries like Italy (#3 with 12.3%), India (#4 with 8.3%) or Iran (#5 with 5.4%). In addition, it is the number 3 exporter in the world in terms of monetary value (€2.686 billion), behind China (#1 with €4.056 billion) and Italy (#2 with €4.704 billion), but ahead of the giants India (#4 with €728m) and Turkey (#5 with €488m). Therefore, Spain's ceramic industry is a very competitive, highly dynamic sector that has adapted to new global scenarios after the 2007 crisis and is thus very well positioned both worldwide and at national level as one of the most competitive sectors. In Spain, it is the leading industrial cluster, the most important ceramic cluster in Europe, and the second industry in terms of contribution of wealth and added value in the Region of Valencia, where it is one of the three mega-clusters, second only to the automobile sector and ahead of the footwear cluster (CaixaBank Research, 2016). Within such a setting, not only does it stand out for its large export volumes but also because of its highly productive and efficient industrial base. Nevertheless, it is worth noting that such an increase in productivity and efficiency has not been accompanied by a proportional increase in sales revenues, since Spain continues to maintain a notable price lag compared to Italy of -53%. This is the consequence, among other factors, of poorer brand recognition, marketing strategy, product mix (too many references and scant differentiation between companies), and the mix of geographic markets, as is deduced from Deloitte's report (2019) and following analysis of over 280 companies, which revealed a significant change of approach between large and small companies in both countries. Thus, 20% of larger Spanish companies have seen growth of 11.9%, compared to 6.9% of Italian companies, whereas growth in terms of sales volumes went down by -1.8% in 20% of small Spanish companies but up by 6.2% in companies of the same size in Italy, which reveals a significant concentration of power in Spain accompanied by a campaign of low sale prices that is pushing smaller companies with

little room for manoeuvre off the market. In short, growth in the Spanish industry is concentrated in the largest companies, while in Italy growth is more evenly distributed.



Source: Deloitte (2019)

Figure 1: *Comparison between Spain and Italy of average growth over the period 2015 -2017. Quintile analysis based on size of turnover. Data in %.*

Continuing with this analysis of the sector, the estimates for 2020 portray similar production levels as for 2019. While 2018 saw an increase of 2%, growth in 2019 and 2020 is expected to be slightly lower than that, given the political, economic and commercial situation in countries such as the United Kingdom (leaving the EU following Brexit), the United States (trade war and tariff hikes of up to 25%), Germany (economic slowdown), or France (very low forecast growth).

As far as world tile consumption goes, it continued its upward trend, with 2017 reaching a total of 13.27 billion square metres, which represents aggregate growth of around 3% over the period 2013-2017 (KPMG, 2019). This increase was mainly seen in Asia (accounting for 68% of world consumption) and, to a lesser extent, the Americas. In fact, 59% of world consumption is concentrated in just 5 countries: China is the country with the highest registered consumption, with a cumulative gain of 5% over the period 2013-2017. In second place comes India, with an aggregate increase of 1%. Fourth is Vietnam, with a cumulative increase of 23%, while in fifth place comes Indonesia, where consumption has slumped by 2%.

The Americas accounted for 13% of world consumption in 2017, with Brazil being the third largest consumer despite having dropped by 4% over the years 2013-2017. For its part, Europe, with 1.585 billion square metres, accounted for 11% of world consumption in 2017.

To summarise, despite the onset of a new potential slow-down in the world economy, Spain is currently the leading European exporter of ceramics and number two worldwide. The tile industry is Spain's third largest net contributor to the trade balance, behind automobiles and food, a fact that reflects the extremely international character of ceramic companies. In addition, the sector is currently immersed in an ongoing process of corporate concentration, which needs to be accompanied by significant investments in R&D&I to enable them to continue growing worldwide and thus to differentiate their products better from those of third countries such as China, India or Turkey, who are more committed to lower costs, to reduce the price gap with Italy, and to enhance worldwide recognition of the "Made in Spain" brand.

3. BIG DATA IN INDUSTRY 4.0 IN THE CERAMIC INDUSTRY

It is precisely within this dynamic and changing environment that digitisation of industry - also known as the 4th industrial revolution - has become more prominent in recent years, enabling industrial corporations to improve both the efficiency of their production processes and their knowledge of target markets and the general context surrounding them – a context that is increasingly concerned with the sustainability of the planet and therefore more and more demanding in regard to how companies operate and the impact they have on the environment. Given this new approach to production and consumption, companies need to be more efficient and respectful with their emissions, their management of production waste, and their distribution and logistics processes. In addition, this growing interest in improving efficiency must necessarily be accompanied by better knowledge of their customers in the sales and marketing area to allow them to manage their resources and capabilities more adequately. The use of big data is designed to enable companies to capture new trends, to strengthen their engagement with customers, to understand better what, when and how customers expect of them all the way from the design stage to customer services, including after-sales. The use of business management tools based on this "in-memory" technology is of increasing importance and can substantially help improve the competitiveness of companies in the Spanish ceramic industry.

The truth is that companies are increasingly digitising their presence and their way of thinking and acting, just as markets and individual people do in their behaviour patterns. We make more and more online purchases and we check other people's opinions more before going on holiday, buying a product or ordering a service. In this new physical-digital environment, new concepts are appearing in the sector: some of the new concepts to be considered are web traffic analysis, influencers, engagement, integrated marketing or 360° marketing, inbound marketing, fake news, followers, geeks, phablets, showrooming and webrooming, SoLoMo, trending topics, or sales funnels in e-commerce. This means that companies need to bring somebody into their organisation to improve their digital skills, to add value to the company and to enable it to improve its financial and economic results while becoming more sustainable and environmentally friendly.

Companies are immersed in a framework of activities that generate data, not just from the Sales area but also data which, thanks to new information technologies, is becoming an important asset for them and the basis of their knowledge, which in turn is changing business models. As various authors have stated (Bowker 2005 and 2013, Boyd and Crawford, 2012; Manovich, 2011), the era of Big Data has begun. This VUCAH world we are living in requires us to procure the best possible technology for obtaining data about how our competitors, suppliers, customers and wholesalers behave or

relevant information about the customer, his tastes, purchase criteria, etc. These technologies also make it possible to obtain other data that can help to interpret economic trends, market trends and changing consumer tastes, or how the company's available resources are being used.

In this hyper-competitive and hyper-connected environment in which corporations now undertake their commercial and company business, technology portrays the consumer as a permanent generator of traditional, structured and transactional data, and of more contemporary, unstructured behavioural data (Erevelles et al., 2016). The magnitude of data generated, the incessant speed at which it is constantly generated, and the richness of its diversity are transforming corporate decision-making and of course marketing. Three dimensions, commonly known as the three Vs: Volume, Velocity and Variety, help define Big Data (IBM, 2012; Lycett, 2013; Oracle, 2012). For this reason, data analysis has become a new source of competitive edge for companies, as it provides statistics that help decision-making at the management and sales level, as well as improve planning and monitoring of marketing campaigns.

The main reason why companies consider using big data is because of its ability to handle a high volume of data that traditional computer applications cannot deal with. Data obtained from users and consumers is processed with mathematical and statistical models. Thereafter, a series of algorithms are designed that use machine learning to predict future behaviour patterns and thus provide a stronger basis for taking business decisions.

For some authors, such as Ebner, Bühnen and Urbach (2014) and Lycett (2013), in addition to velocity, volume and variety, there are two more variables to consider when collecting, analysing and extracting information from Big Data: Veracity and Value. Veracity is understood to be the need to ascertain the quality of the data (IBM, 2012), since not all data is equally accurate, nor does it all have the same validity and relevance for the company. Therefore, the accuracy of Big Data is a major problem at a time when the Volume, Velocity and Variety of data are constantly increasing (IBM, 2012; Oracle, 2012). The other variable to be taken into account is the Value of the information collected, since any data that is not important or relevant needs to be eliminated from the huge amount of data obtained, so that what remains is useful. In addition, the data we keep must be valuable as a means of obtaining information and to accurately interpret and understand the environment under scrutiny, so that it is relevant for decision-making (Lycett, 2013). The challenge is to identify what is relevant and then quickly extract that data for subsequent analysis.

In a business environment such as the ceramic industry, data always comes from people, both on an individual level and from the role they play in companies, for example, through their e-mails, social media, and business transactions and their internet browsing or electronic sales patterns. Press releases, participation in trade fairs and events, visits to customers or information about suppliers also generate relevant data. Internally, the use of light, height or pressure sensors and other technologies such as Wi-Fi or Bluetooth also help to improve work processes.

According to the Vodafone Observatory, 23% of large companies consider that process efficiency is the main benefit derived from digitisation, followed by improved communications with customers (11%), maximised customer satisfaction (5%), and better knowledge of customers' needs (3%).

For some years now, people's and companies' digital competence has been used as one of the indexes or indicators with which to measure the level of involvement or

implementation of new information technologies. This index is used to measure the level of implementation of digital competence in the company. In fact, it would appear that the digital competences available to us are still largely unknown, despite the fact that they have been around for quite some time and despite the relevance they hold in a company's marketing and sales policies. Obviously, the rate at which these new technologies evolve and are applied in the field of communications and marketing makes it difficult to keep entirely up to date with them, something that only a few privileged technicians can do.

Committing to big data solutions - one of the pillars of Industry 4.0 - implies making a radical change in business culture: decision-making processes go from being based on reports and intuitions to being based on objective data and to sales and production projections based on an analysis of data introduced into the system by their main actors. This leads to remarkable improvement in how production and distribution are managed with the aim of reinforcing decision-making and shortening production times and delivery times to customers, improving energy efficiency, improving quality or, in other words, of optimising the entire industrial business. Having a better knowledge of markets and customers and suppliers, as well as of the competition, has become a key success factor for companies.

According to the latest Worldwide Semi-annual Big Data and Analytics Spending Guide of the International Data Corporation (IDC, 2019), forecast revenues worldwide for Big Data and Business Analytics (BDA) will grow to $189.1 million in 2019, a hike of 12.0% over 2018, and BDA revenues are expected to maintain that growth rate over the period 2018–2022, with a compound annual growth rate (CAGR) for those five years of 13.2%. By 2022, IDC expects worldwide revenues for BDA to be $274.3 billion.

When one looks at opportunity trends for BDA in the cloud, the three main industries that adopt it are professional services, personal and consumer services, and the media. All three industries are plagued by interruptions and have high levels of potential digitisation. Furthermore, one can often find many smaller and more innovative companies in this realm, companies that appreciate access to technologies that historically may have been out of their reach, because of either the cost or the technical complexity.

One of the main features and advantages of Big Data solutions is that they can be applied along the entire value chain of the industry, from provisioning and manufacturing to after-sales of the products and services the company offers. In an increasingly globalised environment, where companies have a greater need to be able to offer and sell their products to any customer in any country in the world, it is very important to make the right decisions that help predict which products best fit the needs and requirements of each individual customer and thus to be able to sell better by matching sales forecasts more closely to the company's manufacturing capacity. That then makes it possible to optimise the sourcing and production stages (optimising price and delivery in the purchase of raw materials and energy), as well as stocks, and optimise distribution logistics by optimising distribution routes. It also enables customer behaviour levels to be better understood in order to optimise marketing strategies, in addition to improving human resource selection in companies, by being in a position to detect real labour requirements as a result of this radical change in the business' culture and vision.

According to the 2019 survey on the use of Information and Communications Technology (ICT) and electronic commerce among companies on Spain's National Institute of Statistics (INE), 8.3% of companies performed Big Data analysis during

2018, which is a slump of 2.9% compared to 2017. Data generated by social media were the most widely used source, specifically by 4.0% of all companies with 10 or more employees. Behind that came data captured by geolocation of portable devices, used by 3.9% of companies.

Although the ceramic industry has been working with different ERPs and CRMs for years, the truth is that the use of big data has not spread notably among its member companies, and the results obtained to date vary greatly. Large companies such as SAP, IBM or Microsoft positioned themselves in this field long ago by generating and developing platforms, tools and applications that enable this type of data to be collected, processed and viewed. Through its Dataker project, funded by the Valencian Institute for Business Competitiveness (IVACE) via the European Regional Development Funds (Feder), the ITC seeks to analyse what factors are critical for the ceramics market using Big Data techniques. This project intends to provide solutions to the ceramic industry given the current chaos surrounding the strategic and market data available from countless sources, some of which are still unknown and therefore not being exploited. However, one of the main problems involved in this technology is that it requires having specialist knowledge that is still difficult to acquire, due to a lack of specific training. Study programmes and curricula have not advanced at the same pace as technology, and the training and current availability of specialists in the field of data management and processing is insufficient to cover the demand. Such technological knowledge must be accompanied by a proper understanding of the extracted data in order to provide a consistent diagnosis and to predict future behaviour or trends. The truth is that nowadays, more data is collected in just two years than in the entire history of mankind, but there is a lack of experts who know how to analyse it. According to the MIT Sloan Management Review, 40% of companies have problems finding and retaining talent specialised in Big Data, a trend that does not cease to grow: HR experts such as Hays point out that in 2019, they need to cover more than half a million jobs related to this field.

4. SOCIAL MEDIA IN THE CERAMIC INDUSTRY

The general public's use of social media has become widespread. According to the XX study of social media in Spain (IAB Spain-Elogia, 2019), 85% of Internet users in the 16-65 age bracket use social media, which represents more than 25.5% of the entire Spanish population, a fact that is repeated when compared to 2018. Among them, there are no differences between genders (49% men / 51% women), with the largest proportion of users in the 31-45 age bracket (39%).

Although there are no significant differences, the largest platform in terms of number of users is WhatsApp, higher than Facebook, which stays at the same level as in 2018. Instagram is the network with the largest growth in number of subscribers, while on average, today's Internet users visit 3.7 different social media (IAB Spain-Elogia, 2019).

Social media's progressive incorporation into the business world has led to significant changes in behaviour patterns, where consumer empowerment has forced companies to design and put into operation communication channels to enable them to resolve queries and find the contacts they seek. The truth is that, in recent years, the control of communications has switched from the company to consumers, which has meant that companies now strive to generate content, seek to share experiences and encourage communication about their contents among consumers (Heller, Baird and Parasnis, 2011). Consumers even discuss those contents with their peers, preferably generating positive eWOM. This does not only affect the customers but also the rest of a company's stakeholders, at least the most immediate ones, i.e., its suppliers, consumers, partners and shareholders, and public administration at its different levels (local, provincial, regional and national, and, if applicable, EU).

Democratisation in our interactions, accessibility and immediacy allows for greater flexibility in communications but also requires greater commitment to them, which means a sufficient number of people need to be allocated to manage those contents and relationships with the afore-mentioned stakeholders and which, in most cases, calls for certain changes in the organisation, since the way employees interact and collaborate both within the organisation (Deans 2011; Kim, Lee, and Lee, 2013) and externally has changed significantly. Marketing and PR departments have been the most affected, in some cases undergoing major changes by having to recruit new people with digital capabilities who are able to carry out these tasks efficiently (Heller Baird and Parasnis 2011) and to control and manage everything involved with them (Parveen 2012). However, one should not ignore the fact that, given the size of SMEs, in most cases, the responsibility for managing and controlling social media usually lies with the executive officers (Meske and Stieglitz 2013), or may be fully or partly delegated to outside specialist firms.

In regard to usage, companies mainly turn to social media to attract new consumers, develop relationships with their audience, or increase perception of their brand (Michaelidou, Siamagka and Christodoulides 2011). However, if their behaviour on the Internet is observed, very often many of these companies continue to use social media in a one-way fashion, i.e., they only use their accounts to advertise or publish new special offers to consumers, without necessarily seeking interaction with them (Parveen 2012, Bernard, 2016). However, it is also true that a more diversified use of social media has been seen in recent years. On top of their role as simple vehicles of communication as described above, a use more in line with their true potential has been added in the last few years, where social media are beginning to be used as an important competitive intelligence tool with which to develop corporate strategies based

on the data obtained and sometimes shared about competitors and consumers. Furthermore, when they are used as an instrument of communication with consumers, the purpose is to create a brand, generate corporate image, advertise and promote the company and generally to develop relationships with consumers and improve customer service (Bernard, 2016; Kim and Ko 2012; Kaplan and Haenlein 2010).

In Spain, according to the 2019 survey on the use of Information and Communications Technology (ICT) and electronic commerce in companies conducted by the INE (Spanish Statistical Office), 8.3% of companies carried out Big Data analysis in 2018, which is 2.9% lower than the previous year. Data generated by social media was the most widely used source, specifically for 4.0% of all companies with 10 or more employees. After that, data captured by geolocation of portable devices was used by 3.9% of companies. During the first quarter of 2019, 32.67% of companies with less than 10 employees used social media (22.7% more than in the same period of 2018), compared to the 52.94% of companies with more than 10 employees who used them in the first quarter of 2019.

Digital marketing today is an imperative, a "must" for every company: it is no longer a question of simply striving to make a profit; now, companies look for other types of benefits, sometimes even intangible ones, such as brand recognition, emotional bonding with users, etc. These processes depend on companies and their brands creating community with their target audience. Therefore, enhancing customer engagement, humanising the brand and building loyalty are among the targets that brand names aim for when advertising on social media.

According to the IAB Spain-Elogia study (2019), 67% of brands claim to have increased their investment in social media, especially Facebook and Instagram. The conclusions drawn from all this is that social media are fundamental to any company's marketing strategy. The use of mobile devices, together with the way social media user trends are evolving, makes these platforms the most ideal channels to reach all types of audiences.

A recent study by Clutch consultants (2018) reached very similar conclusions, namely that Facebook is the most widely used social platform by the business sector (86%), followed by Instagram (48%), YouTube (46%), Twitter (44%) and LinkedIn (36%). Almost three quarters (71%) of small businesses use social media - 47% started doing so before 2017 while 24% began in 2017 or later. Women-owned firms (74%) are more likely to use social media than men-owned businesses (66%), which reflects the fact that more women use social media. Also, millennial business owners (79%) use social media for their businesses more than business owners over the age of 35 (65%), because millennials feel more comfortable using social media. It is also worth noting that 3% of companies neither use nor intend to use social media in their companies in the foreseeable future.

The study revealed that more than half (52%) of small businesses post content on social media at least once a day, in line with social media experts' recommendations. Likewise, most companies publish images / infographics (54%) on their social media pages because people process images better than written text. They also pointed out that there is no universal rule on the way small businesses should act on social media. Thus, 35% post content and interact with followers on a weekly basis, whereas 26% interact several times a day.

The fact that LinkedIn is used by only 36% of the companies in the study does not mean that it is not a highly valued social network, since it is considered a meeting

point for employees that is used by both individuals and company personnel managers and job mediation and placement agencies.

Turning to the ceramic industry, according to the study carried out by the ITC Market Observatory entitled "Competitive Analysis of Digital Reputation and SM" in the world ceramic industry (2016), only 9.1% of companies scored above 50 in the Klout ranking that measures influence on social media.

These results are in line with the conclusions of the 3rd Study on Digital Skills in Spanish Business 2017, prepared by Kantar Millward-Brown for ICEMD-ESIC. In that study, only 20% of companies in the main economic sectors had a High Digital Competence index[1].

In short, social media are steadfastly increasing their presence and importance for companies as a way of managing communications with their stakeholders and with the general public. Their role is increasingly relevant and is expected to continue growing in the coming years. The least important matter is whether that presence is posted on existing social media or on new ones yet to appear. What really matters is that, through their content and the way they interact with their different audiences, companies can differentiate themselves from the rest, improve their positioning and become a benchmark or companies of value to the sector.

[1] The Digital Competence index is an indicator of the level of digital competence implemented in a business

5. METHODOLOGY

To carry out the study, a structured questionnaire was sent to 128 companies belonging to the ceramic industry in the province of Castellon, which was completed between September and October 2019. The questionnaire was distributed by e-mail to the addresses that appear in the ASCER (110) and ANFFECC (23) directories, which, after reviewing, returned 106 and 22 firms respectively. 3 mailings were sent out and a follow-up by telephone was made to each of the companies on the list. The number of valid responses was 45 and only two companies that responded belonged to the ceramic frits, glazes and colours sector, so it was decided to join their data together. The sample, therefore, is representative of the sector and enables us to further the exploratory study carried out in 2017, in which only 12 valid replies were received.

Technical details	
Start date	05 September 2019
End date	05 October 2019
Target population of study	128
Size of sample	45 (35.15%)
Sampling method	The entire population was sent the survey by e-mail with a follow-up telephone call
Target sector of study	Manufacturers of ceramic floor and wall tiles and manufacturers of ceramic frits, glazes and colours

Table 2. *Technical details of the study*

As far as the characteristics of respondents are concerned, 44.4% were men and 55.6% women; the average age was 36.78 years; 41.9% had university studies and 44.2% had a Masters' degree or higher, while only 11.6% had just secondary studies. In regard to position in the company, 62.1% held a position of responsibility in Marketing, 17.2% in Communication, 10.3% in the Sales department, and only 3.4% were managing directors.

The questionnaire was structured in three sections. The first section involved questions of a general nature: gender, age, level of schooling, and position in the company. The second section referred to use of social media in relationships with wholesalers, suppliers and private customers and to the frequency of that usage. The third section referred to the use of Big Data, including programmes used, reasons and frequency of use.

The programme we used for data analysis was SPSS V26.

Prior to launching the study, all these companies were assessed on the Internet, to see which ones were active in Social Media. From that initial enquiry it was found that only 74 of the original 110 were active on social media, which in the case of the ceramic frits, glazes and colours sector was only 7 out of 23 on the initial list.

Following our analysis of the digital presence of companies in the Spanish ceramic industry, the main incidents we encountered were:

PROFILES OF COMPANIES ON SOCIAL MEDIA

- 22.3% of companies have no presence on social media or do not indicate any such presence on their website, i.e., the site does not include any social media icon or links.
- In other cases, the link exists but is empty.
- On many occasions, the page states they have a blog but in fact there are only contents about products.
- The company has a presence on social media, but it is not easy to find its links on the website and also, they are not displayed equally in different sections (web, contacts, …).
- Some companies have posted videos on YouTube but do not specify it as a social network nor does the logo appear on their website. It just appears on its own in the video or multimedia section.
- Some do have interesting contents (ceramics dictionary, replies to technical questions, etc.) but they do not distribute them.
- The presence of companies from the ceramic frits, glazes and colours sector on social media is scant, although on their websites, many of them display very interesting information in the Environmental section about sustainability issues, and also about R&D&I.

6. DATA ANALYSIS

Despite the above, 93.3% of the companies that answered the questionnaire stated that they had a presence on social media, which was a significantly higher figure than the 85% in 2017.

Table 3 shows the social media used by the companies analysed in their relationships with wholesaler customers, suppliers and retail customers. As in 2017, Facebook was the predominant network in relations with the three audiences studied – wholesalers, suppliers and retail customers or consumers, both when they were asked about all media used and when they referred only to the platform they used most.

	Wholesalers				Suppliers				Retail customers			
			Most used				Most used				Most used	
	2017	2019	2017	2019	2017	2019	2017	2019	2017	2019	2017	2019
Facebook	66.7	88.9	40	51.3	58.3	57.8	62.5	45.5	66.7	82.2	50.0	48.6
Twitter	50.0	48.9	20	-	16.7	17.8	12.5	-	25	28.9	12.5	-
Instagram	58.3	84.4	20	38.5	16.7	53.3	12.5	30.3	41.7	75.6	25.0	43.2
YouTube	58.3	55.6	10	-	25	20	12.5	-	50	37.8	12.5	-
Pinterest	41.7	66.7	0	-	8.3	17.8	0	-	33.3	46.7	0	2.7
LinkedIn	41.7	71.1	10	7.7	8.3	46.7	0	24.2	33.3	37.8	0	5.4
Vimeo	-	4.4		2.6		2.2		-	2.2			
Flickr	-	2.2		-		-		-	-			
Block	-	4.4		-		2.2		-	4.4			
Houzz	8.3	4.4		-		2.2		-	4.4			
Google +	-	-		-		-		-	-			
Vk	-	-		-		-		-	-			
Tumblr	-	-		-		-		-	-			
Wechat	-	2.2		-		-		-	2.2			
None/no answer						11.1		-				

Table 3. *Social media used (%)*

Instagram appears in second place, not far behind Facebook, and for all three types of target audience analysed. The third most widely used social network is LinkedIn, even in relationships with retail customers, perhaps as a way of searching for new talent to join the company.

When the type of information most posted on social media by ceramic companies in their relationships with their distributor customers, their suppliers and their private customers is assessed, like in 2017, the most widely-used in all cases are images and photographs (Table 4), followed by videos and comments or discussion forums.

	Wholesalers		Suppliers		Retail customers	
	2017	2019	2017	2019	2017	2019
Images and photos	75	88.9	50	62.2	75	88.9
Videos	58.3	53.3	16.7	26.7	33.3	51.1
Comments or discussion forums	16.7	24.4	25	17.8	25	31.1
Statistics on sales and web visits	-	2.2	-	8.9		2.2

Table 4. *Type of information most posted on social media (%)*

In regard to information about whom is looked up on social media and how often, significant differences appeared with respect to 2017. Two years ago, the most valued alternatives were, in order of importance: competitors, professionals, business organisations and suppliers (Table 5). However, in this year's edition, first place went to the social media of organisations and companies in the sector (3.79), followed by supplier companies (3.47) and other competitors (3.38), which reflects a certain change in companies' internet browsing behaviour.

	Average *	
	2017	2019
Competitor companies	3.80	3.38
Reputed persons or professionals	3.50	2.24
Social media of organisations and companies in the sector	3.40	3.79
Supply companies	2.67	3.47
Social media of organisations & companies in other sectors	2.40	2.76

** Scale from 1 to 5 (1 = never, 5 = always)*

Table 5. *Information about whom is sought on social media and how often*

Turning now to intensity of social media usage, the companies in this year's study averaged 12,748 followers, compared to the 8,547 followers they had in 2017, with a maximum of 140,000 and a minimum of 10, compared, respectively, to 42,000 and 60 in the 2017 edition. Most companies connect several times a day, as was the case in 2017, but nowadays, they do so on a daily basis or at least several times a week, which indicates greater intensity of social media usage (Table 6). As was the case in 2017, the amount of time dedicated per week to social media rarely exceeds 10 hours, mostly

ranging between 1 and 5 hours (Table 7). Finally, in this block, with regard to the length of time spent whenever they connect, connections most commonly last between 10 and 30 minutes or between 30 minutes and 1 hour, although overall, the 2019 figures indicated greater intensity of use (Table 8).

	%	
	2017	**2019**
Hardly ever	0	2.4
Once a month	0	2.4
Several times a month	11.1	9.8
Several times a week	22.2	24.4
Every day	33.3	24.4
Several times a day.	33.3	36.6

***Table 6**. Number of connections to social media*

	%	
	2017	**2019**
Less than 1 hour	27.3	15.0
1-5 hours	36.4	42.5
6-10 hours	27.3	27.5
More than 10 hours	9.1	15.0

***Table 7.** Amount of time dedicated to social media per week*

	%	
	2017	**2019**
Less than 10 minutes	18.2	17.5
10–30 minutes	54.5	40.0
31–60 minutes	18.2	25.0
1–2 hours	9.1	12.5
2-3 hours	0.0	5.0
More than 3 hours	0.0	0.0

***Table 8.** Duration of connections to social media*

In regard to the use they give to social media, the following goals can be highlighted, in order of importance: to promote and publicise their brands and products, to improve information and communications about the company and improve its positioning, to learn about new products, and – unlike 2017 – to be in closer touch with suppliers, wholesalers and end customers or consumers (Table 9).

	Average *	
	2017	2019
…to **promote** and make our brands and products better known	4.00	4.57
…to improve **information** and **communications** about the company and to gain presence and **positioning** online	3.91	4.46
…to **find out about new products**	3.55	3.87
…to **watch** and **understand the competition** better	3.45	3.56
…to carry out market **research**	3.09	3.67
…to **keep abreast** of the news and to search for information	3.00	3.59
…to **keep in touch**, interact and know our suppliers, wholesalers and retail customers better (loyalty building)	2.91	3.82
… to maintain **communications** with **other companies in the sector**	2.09	3.05

** Scale from 1 to 5 (1 = very low, 5 = very high)*

Table 9. *Use given to social media.*

Focusing analysis now on the creation and posting of contents on social media, the two periods under study do not reveal significant differences. Indeed, in the vast majority of cases, the company handles the process internally, although the number of companies that receive the assistance of outside specialists increased, as did the number of companies that delegate all content management to external firms (Table 10).

	%	
	2017	2019
The company itself completely	66.7	46.7
An outside specialist firm	8.3	13.3
The company internally with the assistance of outside specialists.	25	26.7

Table 10. *Management of social media (creation and contents)*

In the last section of the questionnaire that was distributed to companies, the issues analysed there focus on the use made by ceramic companies of Enterprise Resource Planning (ERP) systems or Client Relationship Management (CRM) and human resources programmes, and of Supply Chain Management (SCM) programmes. In regard to this issue, in 2019, 88.4% of the companies surveyed stated that they worked with a type of business management programme like those noted above, compared to 91% in 2017, although the number of replies in the questionnaire is higher in this year's edition, since 7% stated they had no programme, while 4.6% said they delegated that function to an outside firm, aspects that did not appear in the answers in 2017.

As for the type of programme used, although there exists a great deal of fragmentation, the most common programme – by far - used is SAP (Table 11). Nevertheless, the size of the sample group revealed how the application of business management and customer management systems has evolved. In this sense, Ekon came in second as the next most widely used ERP, followed by Microsoft, Jobers and SAGE. New programmes also appeared, such as IFS, As400 and ad hoc developments, while others that appeared in 2017, such as Sugar or PLANATEC, were not mentioned in this edition.

	%	
	2017	**2019**
SAP	25.0	24.4
Microsoft	8.3	6.7
SAGE	8.3	6.7
Ekon (ERP)	0.0	8.9
Jobers	0.0	6.7
As400	0.0	4.4
IFS	0.0	4.4
Zeus	0.0	2.2
A3COM	0.0	2.2
Salesforce (CRM)	8.3	2.2
Sugar	8.3	0.0
JOVER	8.3	0.0
PLANATEC	8.3	0.0
Undegest	8.3	0.0
UNIT4	8.3	0.0
Expande (user IT)	8.3	0.0
Oracle	0.0	0.0
INFOR	0.0	0.0
Aro	0.0	2.2
Gescom	0.0	2.2
Gnceramic	0.0	2.2
Navision	0.0	2.2
Wolkers Kluwer	0.0	2.2
Ten Software	0.0	2.2
Developed in-house	0.0	4.4

Table 11. *Programmes used (ERP, CRM, SCM...)*

In terms of reasons for using business management programs, Table 12 shows the results of the survey, which are very similar to those of 2017. Given that the questionnaire included a multiple choice reply to this question, the main reasons put forth in 2019 were stock management and control of stock and product shipments, followed by more flexible management and greater control over production and distribution, and improvement or reduction in costs, as well as having a broader overview of the information. Note that improving knowledge about the customer has an average rating of less than 4.

	Average *	
	2017	2019
To manage and control raw materials, stocks, shipments and product deliveries	4.70	4.49
To make management more agile and have better control over production and distribution.	4.50	4.34
To have a **full view** of information from all departments in the business.	4.40	4.09
To improve /reduce **cost and time management** and the company's resources.	4.40	4.18
To get to know my customers better and offer them better service.	3.70	3.37
To share the data that really matters	3.44	3.34
To anticipate incidents thanks to an alarm system, thus improving performance and process optimisation	3.44	3.69

** Scale from 1 to 5 (1 = very unimportant, 5 = very important)*

Table 12. *Reasons for using business management programmes*

Finally, the survey focused on the use of Big Data management systems. Only 9.3% of the companies analysed, i.e. four companies, declared that they used Big Data, compared to 90.7% that stated they do not use it. Of this sample group, 50% used a resident program (Python and SAP-Hana), while the other 50% inCloud (Microsoft Azure and Pivotal big data suites), and the programme is refreshed daily, weekly or monthly, as often as they use it.

7. CONCLUSIONS

It is indisputable that in recent years, companies in the Spanish ceramic industry have sailed "full steam ahead" into the 4th industrial revolution by technically and digitally changing their production processes and the way in which they manage their relationships with their environment. The results obtained from this study lead us to the conclusion that in the ceramic industry, new information technologies are still in the phase of being implemented in companies (in the use of Big Data programmes) and at a stage of mild growth in regard to social media. Such usage continues to be clearly directed at production and the product, combined with some orientation towards sales as required to maintain and improve results, but there is still no clear orientation towards the customer.

The use of social media in the ceramic industry has increased significantly in the two years between one study and the other, but always clearly oriented towards the product, as stated above. The use of images, photographs and videos predominates over the rest. Consequently, and continuing our description of how companies generally behave, Facebook is still the most widely used social network in the ceramic industry, followed by Instagram and LinkedIn, which varies from the 2017 study, when the top media were Facebook, YouTube and Twitter, in that order. These media are used in relationships with wholesale customers, suppliers and private retail customers.

As to who the information consulted on social media relates to and how often it is queried, significant differences appeared compared to 2017. Two years ago, the most highly-valued alternatives were, in order of importance: competitors, professionals, business organisations and suppliers (Table 4), whereas in this edition, first on the list are the social media of organisations and other companies in the sector (3.79), followed by supply companies (3.47) and competitors (3.38), which reflects a certain change of behaviour in the way companies browse the Internet.

When the intensity with which social media are used was analysed, it was found to have grown, which was seen in the increase in companies' average number of followers on social media, which grew from 8,547 followers in 2017 to an average of 12,748 followers in 2019, and significantly, some companies even have more than 100,000 and one group with about 500,000 followers on its social media. The amount of time spent using social media has also gone up, both the number of times companies connect and the length of time they devote to consulting and using them.

Turning to the reason for consulting information on social media, the results from the two years of this study reveal a number of changes. While in 2017, they were mainly used to find out what the competition was doing or what professionals and business organisations in the sector were thinking and saying, this edition revealed that the main purpose is to see what companies in the ceramic industry in general, what their suppliers, and what the competition are doing, in that order, which denotes a certain change in companies' Internet browsing patterns. The sector has been undergoing a clear concentration process in recent years, with investment by foreign capital that has led to large groups of companies forming, and that situation has probably been one of the reasons for this change in behaviour. However, there still exists a certain amount of in-breeding and the industry needs to open up to other sectors to enrich itself with more disruptive ideas or projects that can provide companies with greater differentiation and uniqueness in order to achieve more notoriety and acceptance by their customers. This is especially valid for small and medium-sized companies, who need to differentiate themselves from large corporations, with whom they cannot compete in means and resources but only in originality, flexibility and know-how.

Intensity of social media usage is also significant. Although the companies in the survey had an average of 8,547 followers, ranging from a maximum of 42,000 to a minimum of 60, the actual time on social media, which companies connect to once or even several times a day, does not exceed one hour on average every time they connect or more than 10 hours a week, which indicates that companies' use of social media, although significant, is still limited.

Analysis of the results in regard to the use made of social media showed a clear orientation towards production and the product, since both editions revealed that they were mainly focused on promoting their brands and products. In second place, social media are used to improve information and communication about the company and to improve its positioning, as well as to find out about new products, and, unlike 2017, to be in closer touch with suppliers, wholesale customers and retail customers or consumers.

It is also worth noting that management of the information and content on these social media is mostly covered by companies themselves and to a lesser extent, with the support of outside specialists. In this case, in-house management of content by the company would seem to be important, given the speed with which that content can be published and presented, although without disregarding the advice and help of experts in the field of digital communications, who bring new approaches and ideas to differentiate better how to communicate to different audiences, mainly with their wholesale customers and end customers or consumers.

As Table 11 shows, the use of new information technologies to manage and improve customer relations is still in its initial phase. The main reasons that lead companies to use business management programmes are precisely to improve management and control of the company, then to enhance management agility, procure a comprehensive view of the information, and to aid cost management. On the other hand, strengthening their vision and knowledge of the customer does not seem to be among the main reasons but appeared as a secondary benefit, a clear indicator of companies' orientation, as pointed out at the beginning of this section.

Finally, the use by ceramic companies of Enterprise Resource Planning (ERP) systems, or Client Relationship Management (CRM) and human resources programmes, or Supply Chain Management (SCM) programmes is well established among the companies surveyed, as was reflected in both editions of the study. In 2017, 91% and in 2019, 88.4% stated that they used such a system, whereas 7% said they did not use any and 4.6% explained that they delegated that function to an outside firm, alternatives that did not arise among the 2017 answers.

Regarding the most widely used programme, although the survey reflects a great deal of fragmentation, SAP is the king programme, the one the largest number of companies that answered the questionnaire use (24.4%). The following most widely used programmes were Ekon (ERP) (8.9%), Microsoft, SAGE and Jobers (6.7% each). However, a total of 17 different programmes were named, compared to 10 in 2017, while it should also be noted that 4.4% of companies reported using a programme designed specifically for them. Perhaps, in the same way as occurs in product design and manufacturing, an imitation effect or strategy of following the most representative companies in the sector may explain, in part, this data.

The usage made of business management programmes is very similar in both editions of the study, because it is based primarily on control and management of stocks and product deliveries, followed by gaining management flexibility and more production and distribution control, and on improving or reducing costs, as well as achieving a

comprehensive view of the information. Improving knowledge about the customer remains one of the least interesting options for the sample group surveyed, since, as in the previous edition, the average rating it obtained was less than 4, which again denotes respondents' orientation towards production and the product.

Finally, the low number of companies that claimed to use Big Data information management systems denotes that the 4th industrial revolution has reached the sector but that there is still much to improve and implement. In a globalised world in which about 80% of Spanish ceramic companies' turnover comes from foreign markets, with their more than remarkable sales to 187 countries nowadays, having better global and local knowledge is essential for proper decision-making.

In this context of international trade and investment in new technologies and R&D&I, the ceramic industry needs to take the strong determination to introduce Big Data technology in its processes and resource allocation as a factor for generating business knowledge that helps it to improve its level of knowledge and allows it to grow, as a means of improving the perceived quality of our products, and thus of having stronger arguments with which to bridge the gap between Italian and Spanish sales prices. We cannot overlook the fact that, although Italy sells 3% fewer tiles, their average price doubles the Spanish price and thus they have a turnover of €5.381 billion compared to €3.597 billion for Spanish tiles. Even though Spain's tile production has grown by 2.4% and Italy produces less, the average price in Italy is €13.10 per sq. m., compared to an average price of €6.78 /m^2 in Spain. This price gap also reflects other tremendously important aspects, such as the generation of employment, given that Italy, while still producing fewer tiles, sells its products more expensively and generates more employment, specifically 19,692 jobs compared to 15,400 in Spain.

It is important to underline that the results obtained are in line with our 2017 study and with the results of other earlier studies and in other sectors, as is noted in the review of research papers detailed at the beginning of this article. Those results should make us reflect on how new information technologies are being implemented in the ceramic industry. Self- or in-house IT management of the use made of both social media and management tools enables greater control by companies but it can be lacking in aspects such as creativity, possibility of implementing new uses or obtaining new results and subsequently of generating new knowledge, which could be obtained by interacting with companies or specialist agencies.

The sector's predominant orientation towards production and the product was once again evident from the analysis of its social–digital behaviour. Despite the important benefits and opportunities offered by social media and big data for better understanding of the markets, of customers, and of the trends and changes that occur, they are used in most cases simply to present the company's products. Although products are important, both individually and when presented in context, these new tools and digital channels can offer many more ways of improving business results, which, as has been stated throughout this paper, are no longer limited merely to economic-financial results but must also include a company's corporate and environmental behaviour.

Information, and especially the knowledge that can be extracted from processing information, are power, and that power eventually leads to better business decisions, to more efficient use of the company's resources, and to improved relationships and satisfaction of suppliers, customers, consumers and the general public. The Spanish ceramic industry has always been characterised by its dynamism and its innovative character, applied mainly to its production processes and product design. So now it is

time to take a step forward, to apply that dynamism and innovative character to relations with the environment, to obtain data and use IT tools to enable that data to be turned into valuable information for decision-making, to strengthen companies' knowledge of their stakeholders in general and to provide early detection of possible changes in increasingly globalised and constantly changing markets. If we are to improve the image and international positioning of Spanish ceramic companies and thus improve our average sales price, we must work with business intelligence, we must try to differentiate ourselves from our competitors in a consistent and sustainable manner, and for that, we need to use big data and information generated on our social media. The data exists, but we still have to take steps to transform it into valuable information for the company.

As far as the limitations of this study are concerned, although the size of the sample group is significant, the fact that the survey was only distributed in one country (Spain) limits the potential of the results. In the future, it would be desirable to replicate this study in other producer countries, such as Italy or Brazil, which would return richer and more varied information to provide more useful results for the ceramic industry worldwide.

In regard to new lines of research, we believe that it is necessary to strengthen skills in the use of both social media and management and data processing programmes, in order to improve the level of understanding of customers' and consumers' real needs, and those of the industry in general, while incorporating new trends as and when they arise.

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