

COMPARATIVE STUDY OF DIGITALISATION IN THE SPANISH CERAMIC SECTOR FROM A MARKETING PERSPECTIVE OVER THE PERIOD 2017-2021.

**L. CALLARISA⁽¹⁾, J. SANCHEZ⁽¹⁾, M.A. MOLINER⁽¹⁾, R.M. RODRÍGUEZ⁽¹⁾, J.C.
FANDOS⁽¹⁾**

**IMK Innovación en Marketing
Department of Business Administration and Marketing. Universitat Jaume I (Spain)**

ABSTRACT

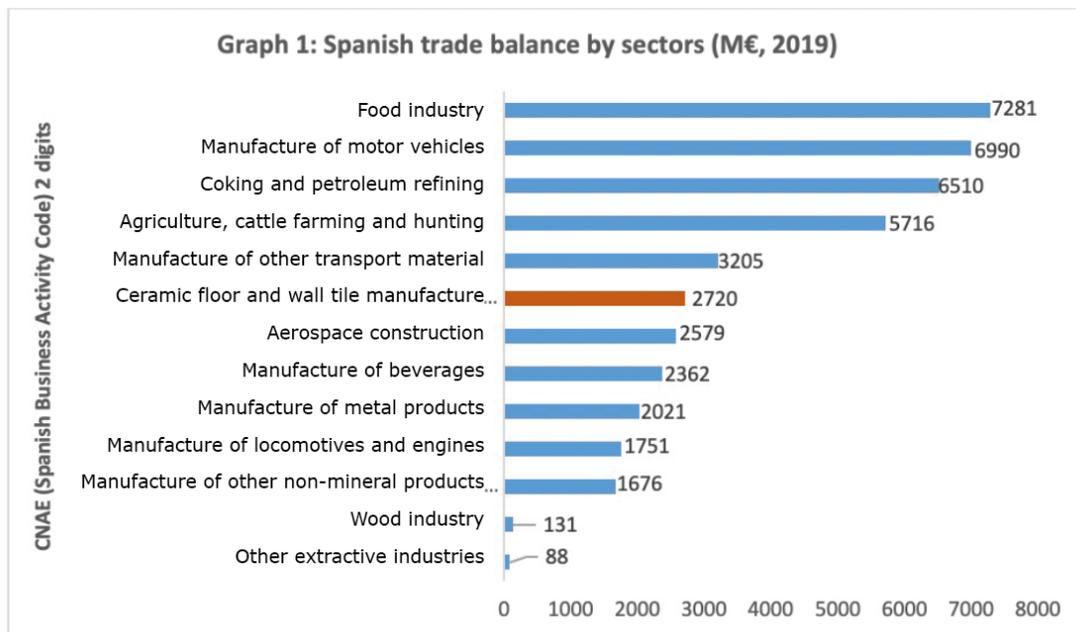
The turbulent times we have been living since the beginning of 2020 have only accelerated the process of digitalisation in many firms in service and industrial sectors. There is no doubt that a process that started a decade ago has been significantly accelerated in the context of this pandemic and social crisis, especially by adapting new information and communication technologies to both their production processes and decision-making by senior management. The recent arrival of the fifth industrial revolution, or Industry 5.0, unlike Industry 4.0, is characterised by seeking greater integration between machines and humans, by developing Artificial Intelligence so that it can perform processes similar to those carried out by human thought to improve productivity and efficiency. In this new scenario, the human factor once again has a significant role to play, seeking such improved production in a more integrated and warmer environment. Therefore, the constant disintegration of the border that separates the physical and digital worlds, based on a more holistic perspective with the use of cybernetics, the Internet of Things, cloud information systems, and Big Data, can be implemented in a more human and attractive fashion.

The ceramic sector has been immersed in changes for some time, both in its production processes and in its marketing strategies, where one can see greater robotisation of the production process, the integration of digital or 3D printing, the inclusion of nanotechnology in ceramic products, or its extended use and manufacture for other purposes, both indoors and outdoors, as a product of decoration, home furniture or street furniture, etc.

Along with these new ways of perceiving ceramic products, end customers have also seen changes in the way in which they had traditionally related to their environment, both on the social and professional front. Companies have had to learn to work remotely, to meet frequently online and to manage companies from a distance, combining physical presence with work at home. Customers of the ceramic sector, both the various types of distributors (specialised distributors, generic outlets, large DIY and construction stores) and the end consumer have adopted a more active approach to searching for information in the pre-purchase and purchase stages of their different projects, whether that be renovation or construction of new housing or a new space. This paper aims to analyse what influence such a new context has had on the use of big data and social media by Spanish companies in the ceramic sector and to compare that evolution from 2017 to the present day.

INTRODUCTION

If we analyse the Sector Report on the ceramic industry published by Deloitte in 2021, the Spanish tile industry has successfully overcome a complex 2020, as evidenced by the sector's +2.3% growth. In 2020, according to the ASCER website, the Spanish ceramic sector produced 488 million square metres (4.4% less than in 2019), with a sales turnover of 3.842 billion Euros (up 2.2% on 2019), of which more than 75% was exported (2.941 billion Euros, up 4.36% on 2019), while the remainder (901 million Euros, 4.1% less than in 2019) was earmarked for the domestic market. During 2020, it employed 16,100 people in mostly small and medium-sized companies and exported to 187 countries, with Europe being its main market. It also holds a privileged position in production output, since Spain is the largest European producer in volume terms and the leading European exporter and no. 2 worldwide. The ceramic sector is the sixth largest industrial contributor to Spain's trade balance, with €2.72 billion in 2019, and helped to reduce Spain's trade deficit by 8% (Table 1 and Graph 1). Specifically, according to data from PWC (2020), the ceramic tile sector accounted for 2.7% of Spanish industrial GDP and contributed €982 million in tax revenues in 2019. The differential values underpinning its international presence in those 187 countries are its experience and know-how.



Year / million €	2014	2015	2016	2017	2018	2019	2020
Production	425	440	492	530	530	510	488
Exports	2,328	2,452	2,570	2,686	2,727	2818	2941
Domestic	574	643	746	824	870	939	901
TOTAL SALES	2,902	3,095	3,316	3,510	3,597	3757	3,842

Sales in million Euro and production in million square metres

Source: ASCER Balance Report 2021

Table 1: Spanish ceramic sector sales turnover (2014-2020)

The Spanish ceramic sector is immersed in a process of profound transformation and concentration, where the 8 largest groups in the sector already account for 60% of total industry sales, as pointed out in Alimarket’s *2021 Report on tiles in Spain*. Such concentration of the Spanish ceramic industry should favour an improved positioning of the product on the markets where it operates, since it now has the knowledge, know-how, resources, and amount of R&D to gain stronger recognition for Spanish ceramic products.

Nevertheless, a number of significant short-term threats need to be considered, such as the considerable increase in the cost of CO₂ emission rights, currently at all-time highs, together with the spike in electricity and gas prices, which is a veritable threat to the sector’s profitability and to it being able to continue competing on equal terms with other non-European producers that do not have the same stringent operating restrictions.

If on top of that, one adds the huge rise of over 150% in the cost of sea freighting during the pandemic as a result of a reduction in the number of ships, among other factors, one sees a panorama that could put the brakes on exports, especially to far-away markets, and pose a problem for imports, especially of raw materials. In view of these factors, and despite recent attempts to undertake regulatory reforms to reduce the cost of CO₂ emission rights and to ensure that economic recovery reverses cost pressures in the supply chain, the Spanish ceramic sector is necessarily forced to look for new ways of generating value, improving efficiency, and minimising the impact these factors have on their sales turnovers and income statements.

In short, despite the fact that we are facing a new scenario with significant threats that foresee an upward trend in costs in Europe and some uncertainty in global economy, Spain is currently the number one European exporter of ceramics and number two in the world. The ceramic tile business is Spain's sixth largest industrial contributor to the country's trade surplus, which denotes its companies' strong international performance. In addition, the sector is immersed in a growing process of concentrating its companies, and this should be accompanied by significant investments in R&D&I that allow them to continue extending worldwide, to differentiate their products better from those of third countries that operate with lower costs, such as China, India or Turkey, to reduce the price gap with Italy, and to improve recognition of the "*Made in Spain*" label worldwide.

INDUSTRY 5.0 AND THE CERAMIC SECTOR

When barely a decade has elapsed since the concept of Industry 4.0 appeared, a number of experts are already talking about the next industrial revolution, Industry 5.0. One of the most outstanding features of this new industrial revolution is that it puts people - the human being - back in the centre of the equation. It aims to focus and enhance the transformation of the industrial sector into intelligent spaces based on IoT and cognitive computing. In other words, this new technological revolution seeks a symbiosis between machines and human beings, developing Artificial Intelligence so that it can perform processes similar to those carried out by human thought, that is to say, it aims to humanise machine behaviour through the presence and interaction of people. In this sense, the ultimate goal is to improve corporate productivity and efficiency while achieving higher levels of job satisfaction.

Its arrival has been precipitated by the health, economic and social crisis caused by COVID-19. This industrial revolution generates effective processes and rapidly improves industrial and healthcare environments. Solutions to the challenges posed by the COVID-19 pandemic can be identified by deploying technologies based on Industry 5.0 (ElFar et al., 2021). Its appearance coincides with the emergence of other disciplines or 5.0 fields, such as Society 5.0 or "Super Smart Society" (Carayannis et al., 2020), Marketing 5.0 (Kotler, 2021), Hospitality 5.0 (Pillai et al., 2021).

Unlike Industry 4.0, which is more focused on improving the production process to maximise productivity and achieve mass production using emerging technologies, Industry 5.0 is a future evolution designed to employ the creativity of human experts that work together with efficacious, intelligent and accurate machines in order to obtain manufacturing solutions that make efficient use of resources and which the user prefers over Industry 4.0 (Maddikunta et al., 2021).

Although the progress that this fifth revolution entails will unquestionably destroy some jobs, it will also create new ones and will readapt or restructure others still to facilitate human work and improve business results (Pillai, et al, 2021, Maddikunta et al., 2021). Among the different features that make up this new Industry 5.0 are **manufacturing personalised by the combination of new technologies**, human creativity and interpretation, to which the deployment of **cobots** or collaborating robots will also contribute. A greater **empowerment of the human factor** will also be present, **which will be dedicated to the most relevant tasks, tasks with more value for the company and its customers**, while robots will be responsible for carrying out the most mechanical, dangerous and routine tasks (Pillai et al., 2021). **Greater speed and quality in production processes and its results**, and finally **greater environmental respect** will be achieved, thanks to the application of production systems increasingly based on renewable energies, thus contributing to reduced amounts of waste and gas emissions to the atmosphere.

In short, Industry 5.0 should provide a more holistic view that leads to a more productively and economically efficient work environment, with the creation of higher quality products and services, more responsible and more sustainable production processes based on the new trends set by a society increasingly sensitive to these issues, and where the human factor, its creativity and sensitivity, in combination with Artificial Intelligence - robots (cobots) - are able to generate an industrial environment and a better society, more in line with both current and future demands.

BIG DATA IN INDUSTRY 5.0.

It is a more than obvious fact that Big Data has been a trend for a number of years, and with the consequences of COVID-19, it has become an essential way of obtaining data and generating valuable information for business and organisational decision-making (Pillai et al., 2021). Companies' own business is a constant source of data, which, with new information technologies, becomes an important asset for them and the basis of their knowledge, thus changing the paradigm of business (Lee 2017, Kushwaha et al., 2021, Oracle, 2020). If, on top of that, the human factor of interpretation is added to derive the right meaning from that data and thus generate valuable information for decision-making, then an appropriate environment for improving the company's results will be achieved.

Although there is no denying that the Spanish ceramic sector has operated with different ERPs and CRMs for years, the truth is that big data usage is not widely present at companies, as PWC's report (2020) on the ceramic sector showed. In addition, the II Observatory of the Use of Social Media and Big Data in the ceramic sector carried out in 2019 (Callarisa et al., 2019) revealed that only 9.3% of companies stated they used Big Data in their commercial efforts and that the results obtained so far were fairly discreet. This is perhaps of no surprise, given that, according to a study by consultants Vector ITC, 65% of projects based on big data fail in Spain. While it is true that large and recognised companies such as SAP, IBM or Microsoft positioned themselves long ago in this field by generating and developing platforms, tools and applications that enable the collection, processing and display of this type of information, their level of involvement in the ceramic sector is not so intense, according to the results obtained so far. ITC uses the Dataraker tool to analyse critical factors for the ceramic market using Big Data techniques, which provides abundant information on ceramic sector imports and exports, both nationally and internationally, with information from the ceramic tile sector and also from the frits and glazes sector. This information comes from different national and international sources of official data, and as a whole, provides companies interactively associated with the platform with a photo of the current situation and a potential back-view analysis of any other moment in the last 15-20 years.

However, one of the main barriers that hinders the implementation of Big Data systems is that it requires specific knowledge that is still difficult to acquire due to a lack of specific skills training. Teaching syllabi have not progressed at the same speed as technology, and current training and availability of specialists in the field of data management and processing are insufficient to cover demand. Technical know-how needs to be accompanied by an adequate understanding of the extracted data in order to make proper diagnoses and predict future behaviours or trends. The truth is that nowadays, more data is accumulated in two years than in the entire history of mankind, but there exists a shortage of experts who can analyse them. According to the MIT Sloan Management Review, 40% of companies have trouble finding and retaining talent specialised in Big Data, an issue that continues to grow. Even the European Commission has made statements on the matter, pointing out that in 2020, more than half a million jobs related to Big Data were left vacant.

In short, Big Data is evolving rapidly and its implementation and adaptation must enable companies to gain competitive advantages by developing valuable information that allows them, through reports and statistics, to make decisions that improve their results. Normally, data obtained from users and consumers are treated using mathematical and statistical models that create a series of algorithms which, through machine learning, can predict future behaviour patterns and provide solid bases for business decisions.

SOCIAL MEDIA IN THE CERAMIC SECTOR

The constant digitalisation of society is a fact and the use of social media has become widespread among the population. According to the XX Study of Social Media in Spain (IAB Spain-Elogia, 2021), 85% of Internet users aged between 16 and 70 use social media, which represents 26.6 million individuals in the Spanish population, a figure that is repeated from 2019. There are no differences among users in terms of gender (49% men / 51% women), while users aged 25-40 are the most numerous (35%), followed very closely by those aged 41-45 years (33%).

The companies in the recently christened 'Meta Group' are at the forefront in the use of social media. As such, WhatsApp continues to be the medium with the most users (85%), ahead of Facebook (75%), which is on a clearly downward trend (in 2019, it was used by 87% of Internet users but only 81% in 2020). TikTok is the social medium that has seen the fastest growth in number of followers (it has gone from 16% in 2020 to 25% in 2021), followed by Telegram (25% in 2020 to 33% in 2021) and Instagram (64% in 2021 compared to 59% in 2020). In 2021, Spanish internauts used 5.4 social media on average, compared to 4.5 in 2020 and 3.7 in 2019 (IAB Spain-Elogia, 2021).

Business has also seen a progressive incorporation of social media. During the first quarter of 2021, in grouped data, two out of three companies (66.6%) with an Internet connection used social media, 3.6% more than the previous year (63%). For its part, the feature that has increased the most in the last year is the purchase of cloud services. Specifically, it has risen 4.2% to 32.4%. If these data are split by company size, 35.29% of companies with less than 10 workers used social media (practically the same figure as in 2020, which was 35.2%), while that figure goes up to 66.57% for companies with more than 10 workers (in 2020 it was 63.3%, 5.61% less).

In the specific case of the ceramic tile sector, although it has improved ostensibly in recent years, it still displays low investment levels in Digital Marketing and a high dependence on face-to-face events and direct contact with customers, which means it has scant experience of new means of communicating with customers (PWC, 2020, Callarisa et al., 2019). It should be borne in mind that the COVID-19 pandemic has accelerated the use of the Internet and different digital platforms, since according to ANDIMAC, the pandemic has pushed online sales of household products up by 80%. In view of this situation, what heads of companies should be considering is to change the traditional product approach for a more relational approach, one that thinks more about the general public, their needs, and to gain greater experience in interaction (PWC, 2020 a) and b)). Such channels can encourage talk about their products among consumers, who in turn generate positive eWOM. However, the different digital platforms not only enable greater and improved communications with customers but also with other relevant actors in the sector, such as suppliers, retail customers, agents, partners and shareholders, employees, public administration at its various levels (local, provincial, regional and national, and even European, when appropriate), and with the general public.

Therefore, from this perspective, the arrival of digital transformation and the digital economy must be seen by ceramic companies as an opening of new channels of dialogue, both to build knowledge and reputation and to improve their own knowledge from interaction with all these audiences.

The use of social media is entering a process of significant change, as reflected in the IAB Spain Elogia study (2021), where certain behaviour patterns on social media continue a downward trend. In fact, 48% of users declare they follow brand names on social media (compared to 52% in 2019 and 72% in 2019 or 81% in 2018), and only 37% use them a lot or quite a lot (49% in 2020), i.e. brand following and its intensity have decreased. 71% of users use social media to make enquiries or solve doubts, and 64% do so to receive technical assistance, while 48% make a purchase as a result of the attention received. In addition, 1 in 3 users perceives a higher level of trust towards a brand if it has a profile on social media.

Despite this, social media are seen to be an important reference as a source of information in users' purchasing process, since 45% of users state that social media have influenced their final purchase decision (although that figure is down by 11% over 2020). 48% use social media to investigate before buying a product, and 37% post comments about the purchase (down by 7% compared to 2020). Those comments are positively received by users (63%) and influence the purchase they make significantly. Finally, the most widely used device to browse social media is the smartphone (97%), followed closely by PCs (93%), although there has been significant growth in the use of smart TVs (which goes from 25% in 2020 to 68% in 2021).

The conclusions drawn from all this is that social media are fundamental to any company's marketing strategy. Although it seems that there is a certain rationalisation or selectivity in their use, it is also true that new ways of using them are appearing. Therefore, social media platforms are still appropriate channels to reach all types of audiences.

To sum up, social media continue to have a significant presence in society and for companies, their use has relevant effects on boosting sales (social sales), building a reputation and brand image, providing services to customers, and improving the company's overall image (reputation) and communications with its environment and with the general public. The relevance of their role is changing and adapting to new trends, but undoubtedly, they remain prominent and will continue to grow in the coming years.

METHOD

To perform the study, a structured questionnaire was prepared and sent out to 95 companies in the ceramic sector in the province of Castellon; it was completed between July and October 2021 (Table 2). The questionnaire was sent by e-mail to the addresses that appear in the ASCER directories (110), which after debugging still numbered 80. It was sent in 4 mailings and a telephone follow-up was made to each of the companies on the list. Surveys were made using both Google forms and Word to facilitate user response. The number of valid responses was 27. The sample is therefore representative of the sector and enables further progress to be made on the exploratory studies carried out in 2017 (when only 12 valid responses were collected) and 2019 (45 replies).

Sheet	
Start date	22 July 2021
End date	14 October 2021
Study population	95
Sample size	27 (28,42%)
Sampling procedure	Surveys were e-mailed to the entire population before telephone follow-up
Sector under study	Manufacturers of ceramic floor & wall tiles

Table 2. Technical data sheet of the study

The questionnaire was divided into three sections: the first referred to general classification matters: gender, age, level of education, and position held in the company. The second section referred to the use of social media in relations with distributors, suppliers and private customers, and how often they were used. The third section referred to the use of Big Data, asked which programs were used, the reasons for that choice, and how often they were used.

The program used to analyse the data was SPSS V28.

Prior to launching the study, all these companies were investigated on the Internet to see which of them were active on social media. The investigation revealed that only 75 of the original 95 were active on social media (78.94%).

Some of the main characteristics that we found during the research and after analysing companies in the Spanish ceramic sector's digital presence had already appeared in the earlier study, namely:

CHARACTERISTICS OF CERAMIC COMPANIES DETECTED ON SOCIAL MEDIA

- 23.15% of companies do not have a presence on social media or do not clearly indicate any presence on their website.
- In other cases, links are available but do not lead anywhere.

- On many occasions, they state they have a blog, but in fact, they are only product contents.
- Some have a presence on social media, but it is not easy to find their links on the website and, moreover, they are not displayed equally in the various sections (web, contacts...).
- Some companies have posted videos on YouTube, but they do not specify it as a social network nor does the YouTube logo appear on their website - they simply appear in the videos or multimedia section.
- Some companies have interesting contents (ceramic dictionary, replies to technical questions, etc.) but do not publicise that fact.

DATA ANALYSIS

Looking at the demographics and employment details of the respondents, the results obtained are very similar to 2019; 48.1% were men and 51.9% women; the average age of 36.78 years is in the 41-50 bracket; 51.9% have university studies, and 33.3% have master's degree studies or higher, and only 14.8% have up to secondary education. As far as the position they hold in the company goes, 63% occupy a position of responsibility in marketing, 18.5% in the sales department, and 11.1% in communications, 10.3% in the sales department, and only 3.7% are senior managers (Table 3).

	2019	2021
Men	44.4 %	48.1 %
Women	55.6 %	51.9 %
Age bracket	31-40	41-50 (44.4%)
Level of studies achieved:		
University	41.9%	51.9%
Master or higher	44.2%	33.3%
Secondary education	11.6%	14.8%
Position		
Marketing Manager	62.1%	63%
Sales Management	10.3%	18.5%
Head of Communication	17.2%	11.1%
Senior Management	3.4%	3.7%

Table 3. Socio-demographic and employment data

96.3% of the companies that answered the questionnaire stated that they had a presence on social media, a figure that is significantly higher than in 2017, when it was 85%, and 93.3% in 2019.

Table 4 shows the social media used by the companies analysed in their interaction with distributor customers, suppliers and private customers. Unlike the two previous editions, in this case Instagram is the most widely-used social medium (57.1%), followed by Facebook (39.6%) and LinkedIn (25.9%), while in the two previous editions, Facebook was the predominant medium in relations with all three audiences analysed – distributors, suppliers, and end customers or consumers, both when they were asked the total number of media used and when they were asked to name only the most often used medium.

If the type of information most used on social media by ceramic companies in their relationships with their distributor customers, suppliers and private customers is analysed, the most widely used in all cases, as in the two previous editions in 2017 and 2019, are images and photographs (Table 5), followed by videos and comments or discussion forums.

	Distributor customers						Suppliers						Private customers					
				Most used						Most used						Most used		
	2017	2019	2021	2017	2019	2021	2017	2019	2021	2017	2019	2021	2017	2019	2021	2017	2019	2021
Facebook	66.7	88.9	77.8	40	51.3	32	58.3	57.8	50.1	62.5	45.5	9.6	66.7	82.2	80.8	50.0	48.6	25
Twitter	50.0	48.9	38.9	20	-		16.7	17.8	17.7	12.5	-		25	28.9	13.3	12.5	-	
Instagram	58.3	84.4	84.6	20	38.5	52	16.7	53.3	52.2	12.5	30.3	57.1	41.7	75.6	84.4	25.0	43.2	62.5
YouTube	58.3	55.6	59.1	10	-		25	20	22.2	12.5	-		50	37.8	31.6	12.5	-	-
Pinterest	41.7	66.7	47.6	0	-		8.3	17.8	5.6	0	-		33.3	46.7	22.7	0	2.7	-
LinkedIn	41.7	71.1	75	10	7.7	16	8.3	46.7	54.5	0	24.2	33.3	33.3	37.8	22.3	0	5.4	12.5
Vimeo	-	4.4			2.6						-		2.2					
Flickr	-	2.2			-						-		-					
Block	-	4.4			-						-		4.4					
Houzz	8.3	4.4			-						-		4.4					
Google+	-	-			-						-		-					
Vk	-	-			-						-		-					
Tumblr	-	-			-						-		-					
WeChat	-	2.2			-						-		2.2					
None/no reply								11.1			-							

Table 4. Social media used (%)

	Distributor customers			Suppliers			Private customers		
	2017	2019	2021	2017	2019	2021	2017	2019	2021
Images and photographs	75	88.9	100	50	62.2	73.1	75	88.9	96.3
Videos	58.3	53.3	72	16.7	26.7	64	33.3	51.1	80.8
Comments or discussion forum	16.7	24.4	33.3	25	17.8	38.1	25	31.1	38.1
Sales statistics and web visits	-	2.2	3.7	-	8.9	16.7		2.2	28.6

Table 5. Type of information most used on social media (%)

Regarding whom consults information on social media and how often, significant differences were detected compared to 2017 and 2019. In this edition, following renowned people or professionals was the most relevant pattern of behaviour, in addition to following competitor companies and the social media of organisations and companies in the sector, in that order (Table 6). This may be a significant change of behaviour, since the source of inspiration no longer seems to be companies competing among themselves but rather seeking enhanced opinions and actions from people with a strong reputation in the profession.

	Average*		
	2017	2019	2021
Competing companies	3.80	3.38	3.63
People with professional reputation	3.50	2.24	3.78
Social media of organisations and companies in the sector	3.40	3.79	3.48
Suppliers/supply firms	2.67	3.47	2.92
Social media of organisations and companies in other sectors	2.40	2.76	2.85

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

Table 6. By whom and how often is information consulted on social media

As far as intensity of social media use is concerned, the companies analysed average 14,425 followers, which represents a slight increase over the previous two editions - 12,748 in 2019 and 8,547 in 2017 - with a maximum figure of 179,000 and a minimum of 127. Most companies connect every day, which is also a slight change from 2019, since, in that edition, the most frequent description was 'several times a day', as in 2017.

The second most frequent behaviour pattern was 'several times a week', while 'several times a day' now moves to third place. Perhaps this indicates certain weariness, or perhaps a greater degree of maturity that leads to more selective and less intense behaviour when using social media (Table 7).

Time spent browsing social media remains the same as in the previous two editions: 1 to 5 hours a week (Table 8). As for the time spent on each connection, the most common reply is 'between 10 and 30 minutes' or 'between 30 minutes and one hour', although the overall figure for 2021 once again indicates greater intensity of use (Table 9).

	%		
	2017	2019	2021
Almost never	0	2.4	0
Once a month	0	2.4	0
Several times a month	11.1	9.8	7.7
Several times a week	22.2	24.4	30.8
Every day	33.3	24.4	38.5
Several times a day.	33.3	36.6	23.1

Table 7. Frequency of connection to social media

	%		
	2017	2019	2021
Less than 1 hour	27.3	15.0	3.7
1-5 hours	36.4	42.5	48.1
6-10 hours	27.3	27.5	33.3
More than 10 hours	9.1	15.0	14.8

Table 8. Hours per week dedicated to social media

	%		
	2017	2019	2021
Less than 10 minutes	18.2	17.5	11.1
10-30 minutes	54.5	40.0	40.7
31-60 minutes	18.2	25.0	29.6
1-2 hours	9.1	12.5	7.4
2-3 hours	0.0	5.0	0.0
More than 3 hours	0.0	0.0	11.1

Table 9. Time spent every time they connect to social media

Regarding the use given to social media, in order of importance, they highlight: promotion, advertising their brands and products, improving the company's information and communications, and improving positioning, and unlike previous editions, being in closer contact with suppliers, distributor customers and end customers or consumers (Table 10).

Turning to content management and creation (Table 11), the results are in line with previous years. However, hybrid management (a company with professional outsourced assistance) has gained a lot of ground compared to the previous two editions. The reading that can be made of that is companies' greater need to try and differentiate themselves from their competitors, trying to generate attractive and interesting contents for their target audiences, and the need to be able to turn to professionals that know the digital market very well, given that it is subject to constant operational changes that are difficult to understand for professionals from the ceramic sector.

	Average*		
	2017	2019	2021
... brand and product promotion	4.00	4.57	4.52
... improved company information and communication and forge a greater presence and positioning online	3.91	4.46	4.15
... new product scouting	3.55	3.87	3.63
... competitor monitoring and surveillance	3.45	3.56	3.48
... research	3.09	3.67	3.33
... keep abreast of news and search for information	3.00	3.59	3.56
... to contact , interact and relate with our suppliers and customers, distributors and private customers (loyalty)	2.91	3.82	3.70
... communications channel with other companies in the sector	2.09	3.05	2.81

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

Table 10. Use given to social media.

	%		
	2017	2019	2021
Entirely the company by itself	66.7	46.7	50
An outside specialist firm	8.3	13.3	3.8
The company with the aid of outside specialist firm.	25	26.7	46.2

Table 11. Social media management (creation and content)

Looking at the last section of the questionnaire, that is the use made by ceramic companies of Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), human resources, and Supply Chain Management (SCM) systems and programs, in 2021, 81.5% of the companies analysed indicated that some type of management programs of those named above were applied in their company, compared to 88.4% in 2019 and 91% in 2017. The variance in this datum may be conditioned by the variability of the sample (27, 45 and 12 respectively) and also partly by the corporate concentration process that is currently taking place, with data management being centralised or certain companies in a transition process towards a new corporate status. However, it is a fact that requires further analysis in the future and should be thought about by companies' senior management.

As for the type of program or system used, although we noted significant fragmentation, the most widely used ERP is clearly SAP (Table 12), followed by As400 and SAGE. From there on, the dispersion is great, as other programs such as Salesforce, A3COM, Microsoft and Aro appear. New systems such as HAPI and SUMA/EFFICY also appear, with some ad hoc developments, while others that were mentioned in one of the two previous editions such as Sugar, PLANATEC, Gescom, Gnceramic or Wolkers Kluwer were not mentioned in this edition.

As for the reasons for using business management systems, Table 13 shows the results obtained, which are very similar to those in 2017 and 2019. Since the questionnaire allowed a multiple answer in this question, the main reasons given in 2021 were once again for the management and control of stocks and product deliveries, followed by improved agility in management and greater production and distribution control, and to afford a comprehensive view of the information, in addition to cost improvement or reduction. Again, it is clear from the replies they gave that companies are still highly oriented towards production and the product, where production and products score highly while improving customer knowledge has an average rating of 4, lower than on previous occasions.

	%		2021
	2017	2019	
SAP	25	24.4	19
Microsoft	8.3	6.7	4.8
SAGE	8.3	6.7	9.5
Ekon (ERP)	0.0	8.9	4.8
Jobers	0.0	6.7	-
As400	0.0	4.4	14.3
IFS	0.0	4.4	4.8
Zeus	0.0	2.2	4.8
A3COM	0.0	2.2	
Salesforce (CRM)	8.3	2.2	4.8
Sugar	8.3	0.0	-
JOVER	8.3	0.0	-
PLANATEC	8.3	0.0	-
Undegest	8.3	0.0	4.8
UNIT4	8.3	0.0	-
Expand (user IT)	8.3	0.0	-
Oracle	0.0	0.0	-
INFOR	0.0	0.0	-
Earring	0.0	2.2	4.8
Gescom	0.0	2.2	-
Gnceramic	0.0	2.2	-
Navision	0.0	2.2	4.8
Wolkers Kluwer	0.0	2.2	-
Have Software	0.0	2.2	-
HAPPY	0.0	0.0	4.8
SUM/EFFICY	0.0	0.0	4.8
Developed in-house	0.0	4.4	4.8

Table 12. Systems used (ERP, CRM, SCM...)

	Average value *		
	2017	2019	2021
Manage and control materials, stocks, shipments, and product deliveries	4.70	4.49	4.73
Improve agility in management and have greater control of production and distribution.	4.50	4.34	4.59
Have a comprehensive view of the information of all departments in the company.	4.40	4.09	4.32
Improve / reduce time and company resources management costs .	4.40	4.18	4.27
Get to know my customers better and offer them a better service.	3.70	3.37	4.05
Sharing data that really matters	3.44	3.34	3.77
Anticipate any incident thanks to an alert system, improving performance and optimising processes	3.44	3.69	3.77

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

Table 13. Reasons for using business management programs

Finally, in regard to the use of Big Data information management systems, the number of companies responding positively has grown significantly compared to the previous two editions. In 2019, the figure was only 9.3% of the companies analysed, i.e. 4, while those that indicated they used Big Data in this 2021 edition accounted for 22.2% of the sample (6 companies). As in 2019, 50% use a resident program (Python) and the other 50% the Cloud (Microsoft's Azure and Qlikview or Google DeepMind). Data refreshing frequency was daily (44.4%), monthly (11.1%), several times a month (11.1%), or weekly (11.1%). Finally, all companies that use Big Data software do so on a daily basis.

CONCLUSIONS

The ceramic sector is highly dynamic, which has enabled it, among other things, to successfully overcome a situation as difficult as the economic-financial, health and social crisis derived from COVID-19, and to continue holding a leading position in both production (No. 1 in Europe and No. 5 in the world) and exports (No. 2 world exporter). Over the years, it has incorporated significant technological advances and applied them outstandingly to its production processes, increasing the extent of automation and digitalisation of production processes and the way it manages its relationships with its environment, in which it is a world reference. These technological and production innovations should serve to continue advancing towards the new paradigm of Industry 5.0, where technification, robotisation and automation of production plants and stock management must incorporate the human factor as a differentiating and valuable element of industry. This new industrial paradigm combines human intervention with technology, but where the former has an important role to play by providing the capacity to think and interpret that adds value to the system and influences performance by the organisation.

The results obtained in this study once again confirm that new information technologies have a growing presence in companies in the sector, where the use of social media and Big Data programs has increased compared to previous editions. Despite that, there is still a clear orientation towards production and products, which puts a lot of pressure on the sales department in companies in the sector, who are required to maintain and improve business figures and results, but a clear orientation towards the customer is still lacking. Despite being a slow-moving product, ceramic tiles are present in the lives of many people and it is necessary to exhibit the virtues and benefits of this product in a friendly, attractive but also constant manner in order to build a positive image and desire to purchase.

The use of social media in the ceramic sector, as in the rest of society, has increased greatly since 2017. The use made is clearly product-oriented, with excessive reliance in all social media on the use of images, photographs, and videos. However, in this edition, a change in corporate behaviour has been seen, with Instagram becoming the most widely used social medium, to the detriment of Facebook, which has moved to second place, ahead of LinkedIn, YouTube, Pinterest and Twitter, in that order. They are used to relate and interact both with distributor customers and with suppliers and private customers.

The frequency with which information is consulted on social media shows significant differences compared to the two previous editions, since in 2021, the main reference is renowned people or professionals, followed by competitors, other organisations, and companies in the sector, in that order. As mentioned above, this datum seems relevant, as it moves away from its focus on immediate competitors towards obtaining new ideas and trends from the opinions and actions expressed by people with a professional reputation.

The study revealed that the use of social media has increased very slightly, with a parallel increase in the number of followers, which has gone from an average of 8,547 followers in 2017 to 12,748 followers in 2019 and 14,425 in 2021, although significantly, some companies have more than 100,000 followers on their social media. Unlike the earlier editions, companies this time stated that they connect every day, but did not emphasise “several times a day”, which could represent a change of habit and more selective use of social media, in line with data in the IAB study (2021). The second most frequent behaviour pattern was ‘several times a week’, while ‘several times a day’ moves to third place. This is consistent with the results of studies carried out by other authors in different sectors (Chae et al., 2020), where a certain reluctance to use social media, especially B2C, was seen and which may be a consequence of companies being more concerned about the risks of social media and not knowing how to use them properly in their full context and extension, as that could affect them negatively in future operations. It may also point to a higher degree of maturity that leads to more selective and less intensive use of social media, consistent with data from the IAB study (2021).

To reinforce all of the above, the time spent browsing social media stays at ‘from 1 to 5 hours a week’ and the length of time they connect is ‘between 10 and 30 minutes’ or ‘between 30 minutes and one hour’.

As for the use given to social media, habits are still very similar to those observed in the previous two editions, since they are mainly used to promote and publicise their brands and products, to improve information and communications about the company, and to improve positioning, but unlike previous editions, also to keep in closer touch with suppliers, distributor customers and end customers or consumers. It would appear from such an observation that behaviour on social media reflects a certain degree of in-breeding: the industry needs to open up to other sectors to find inspiration with more disruptive ideas or projects that can provide companies with a differential value and uniqueness and thus help them achieve greater notoriety and acceptance by customers, especially small and medium-sized companies, who need to distinguish themselves from large enterprises, with whom they cannot compete in means and resources but only in originality, flexibility and know-how.

Although most companies choose to manage the contents of their social media internally, hybrid management has gained significant ground in this edition of the observatory. The digital market’s complex operating makes it increasingly necessary, if budgets allow, to collaborate with companies specialised in this field in order to produce more attractive contents, adapted to the profiles of the different audiences to which they are directed. Presumably, this will be an upward trend in the coming years.

The use of enterprise resource planning (ERP) systems, or customer relationship management (CRM) and human resources programs is still widespread in the ceramic sector (81.5%), although slightly lower than on previous occasions.

This could be due to the variable size of the sample (27, 45 and 12 respectively in 2017, 2019 and 2021) and the current process of corporate concentration that may be behind more centralised data management or due to some companies undergoing transition to a new corporate status. However, it is important to keep close watch on this datum in the future to see how it evolves and why. SAP remains the most widely used management software (19%), followed by As400 and SAGE, among up to 14 different programs.

Although these systems continue to be used with a clear internal orientation (stock management, production and distribution control, and to provide a comprehensive view of the information, in addition to an improvement or reduction in costs), in this latest edition the reason for use 'to improve customer knowledge' for the first time scores a little over 4. It is to be hoped that this is a growing trend.

Finally, credibility about the use of Big Data remains low (11.1%), which indicates there is still much to improve and implement in this new 5.0 environment. In a globalised world, where about 80% of turnover for Spanish ceramic companies comes from foreign markets, having better knowledge at a global and local level is necessary for proper decision-making.

The concentration process taking place in the Spanish ceramic sector should favour investment in new technologies and R&D&I and firmly encourage the implementation of Big Data technology as a factor with which to generate business knowledge and to grow bigger and better. That would improve the perceived quality of our products, thus improving sales and so reducing the gap between Italian and Spanish selling prices.

The sector's predominant orientation towards production and products is again reflected in our analysis of its social-digital behaviour. Despite the significant features and opportunities social media and Big Data provide for a better comprehension of markets, customers and trends, and changes that may occur, their use in most cases is limited to simply presenting the company's products. And although that is important, when presented both individually and in context, these new tools and digital channels can offer much more to improving business results and, as stated throughout this paper, no longer serve just for economic-financial results, but are also of use in the company's social and environmental behaviour.

This work underlines the need to tackle the decisions that have to be taken in companies in the ceramic sector in a more professional manner and using reliable data. At a time when significant tensions exist due to increases in supply costs (emission rights, price of gas, electricity, etc.) and supply chain expenses (sea and road freight) that will inevitably force the price of products in the catalogue upwards, it is necessary to be more creative and keep tighter control over everything that happens in and around the company in order to make the right decisions without disrupting end sales. The globalised world changes and evolves, and it does so in a non-linear and sometimes difficult-to-understand fashion.

Having the latest, reliable data to start a negotiation process in the best possible conditions is essential for companies today and more so in the future.

Therefore, we must continue to invest in implementing database management and analysis systems (DBA) and in social media to generate Business Intelligence and thus differentiate ourselves from our competitors in a coherent and sustainable way.

In regard to this study's limitations, the sample size in this edition was not as large as expected. Corporate mergers between groups have reduced the number of companies and restricted from an operational point of view our access to companies, since several of them indicated they were in the process of change and could not deal with the questionnaire, and they did not know what would happen in the near future. In addition, the fact that it only covers one country (Spain) limits the richness of the results. In the future, it would be desirable to replicate this study in other producer countries, such as Italy, Mexico, the United States or Brazil, which would provide stronger and more varied information with more useful results regarding the ceramic sector worldwide. It would also be of interest to collaborate with other research groups with a different business and technical perspective to bring new insight to this study and also more valuable results for the sector and its companies.

In terms of new lines of research or future studies, further work should be done on the use of social media, their applicability, and the results obtained from their use. The need for better knowledge of the customer, both distributors and end customers, makes it necessary to enhance the use of management programs and big data, to improve the company's general knowledge about what is happening internally and externally, to strengthen our understanding of what customers and consumers think about ceramic products, or issues such as sustainability and environmental preservation, the use of alternative energies, and what their real needs are and how to incorporate new trends to make the sector generally more attractive and dynamic. Another line of research to address would be to detect ways that allow for the perfect integration of social media in sales processes. Another issue that could be tackled in the future would be to discover the factors that drive and facilitate customer participation in the social media activities of companies in the sector. Likewise, it would be of interest to study demographic changes in companies in the realm of social media management (for example, considering millennials' capabilities and preferences), as they substantiate the need for the human touch when generating contents and managing relationships within the framework of social media.

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