

# Competitiveness and Profitability – New Challenges in the Ceramic Frit, Glaze and Colour Industry\*

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## 1 Introduction

The ceramic sector has grown in recent decades as a result of growth in the construction industry and an increasingly sophisticated demand for wall and floor tiles. The ceramic business was traditionally dispersed but is now concentrated in specific zones such as Castellon in Spain and Sassuolo in Italy, an agglomeration that has created industrial districts as conceptualised by Alfred Marshall [1].

The industrial district (ID) of Castellon contains a high level of dynamism based on technological innovation, whose origin is based on suppliers (in relation with the Pavitt classification [2]). These suppliers are from two industries. Firstly, the engineering equipment industry, which is mostly Italian, is a sector which supplies ceramic presses and kilns used to produce tiles; and secondly, the frit, glaze and colour industry, which supplies the materials for protecting, colouring and decorating tiles and offers a range of services and technological solutions that have increased dynamism in the ceramic industry, for example through product differentiation. This assertion is shared by many authors and key experts in the ceramic industry [3–6].

## Abstract

The Spanish ceramic frit, glaze and colour industry encompasses 27 companies employing nearly 4000 staff with a total annual turnover of approximately one billion euros. These firms have based their growth since the 1990s on two strategies, the first of which is horizontal and vertical growth with an emphasis on overseas expansion and building foreign subsidiaries – many of which also manufacture and offer technical consultancy. The second strategy has been innovation. The result of these strategies is that the industry has become a technological base for the entire ceramics sector and has established

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worldwide leadership. Nevertheless, productivity and profitability have progressively fallen. This paper analyses and evaluates the financial results obtained by this industry and points to the variables that indicate the key changes. Two additional factors are expected to greatly impact the sector in Spain, i.e. a series of regulation issues and an increase in competition from the Asian frit industry.

### Keywords:

glaze, ceramics, profitability, competitiveness

In general, the role of the engineering equipment industry has been given more prominence in the provision of improved technological capability to ceramic production. These improved capabilities have also helped to reduce energy costs per unit. However, credit has also been given to various innovative companies, as well as scientific and technological institutions working in the ceramic sector – such as several departments of the Jaume I University, the Instituto de Tecnología Cerámica (Institute of Ceramic Technology), and the Instituto de Cerámica y Vidrio (Institute of Glass and Ceramics of the Spanish Council for Scientific Research (CSIC)) [7–8]. The competitiveness of the frit, glaze and colour industry has also been reflected in increased exports and overseas representation, and, additionally, several production plants have been opened in those foreign markets where the ceramic industry grows [9].

The glaze industry is still young in Spain and has been progressively separating itself from the ceramics sector for the past fifty years. The industry currently includes some 27 companies with a combined annual turnover of more than one billion euros a year (1,033,000,000 €) and employed in 2006 some 3776 employees – according to ANFFECC figures (ANFFECC is the industry's national association). Academic research analysing the sector development and factors such as its leadership and role in the devel-

opment of ceramic ID of Castellon has identified key sector characteristics [8–10].

However, despite this leadership role, the industry has begun to face several major challenges to which it must find effective responses in order to retain this role. It is experiencing a decline in profitability [11–12] while, at the same time, facing rigorous environmental legislation, applied because of the growing social demand for more sustainable production and consumption, as well as international commitments (IPPT directive, the REACH program, the Kyoto Protocol, etc.). Such legislation is likely to impact on competitiveness in a number of ways, but principally by imposing an administrative burden on firms, as well as increasing set-up and maintenance costs [6, 8, 13].

This paper analyses and evaluates the economic results of this sector and indicates the key variables that identify the relevant changes required. The paper discusses the period from 1993 until the present, the period in which the industry's current strategy has been configured. The research data analysed was obtained from key business statistical databases (in particular SABI triangulated with other data sources (INE, ICEX, etc.) and supported by interview findings from a range of industry experts.

This paper is divided into four sections. Section II describes the current state of the industry – comparing results with the ceramic sector and



making comparisons within the frits industry. Section III examines the evolution of the industry with respect to investment and profitability and assesses the strategies adopted by companies within the sector. Section IV presents the conclusions of the research.

## 2 Current state of the industry

### 2.1 Participants

The industry examined in this research is a sub-sector of the ceramic sector. It operates between the ceramic sector and other participants such as: mineral extractors and treatment companies, distributors, pigment and inorganic colour manufacturers, as well as makers of glaze additives.

A total of 27 companies have been identified that sell frit, glaze and colouring materials. Table 1 shows the active companies ranked by turnover. Most of them are located in the ceramic ID in the interior of the province of Castellon (around Onda, Alcora, Castellon, Villarreal, Almazora, Vilafamés, among other towns). This is a 400 km<sup>2</sup> area that contains companies which account for more than 90 % of Spanish production.

The average firm size is large (148 employees and 35 million € turnover) when compared with the dominance of small companies found in the Valencia region. There is a wide range of turnovers – from specialised firms with barely a million euros to those in the range of 200 million €. Many of these larger firms offer a diversified range of products and value-added services, as well as having foreign production plants and offices. The industry has a concentrated structure: 14 companies (52 %) employ 84 % of the sector's employees. This structure has been stable in recent years.

To clarify the sector's concentration, it is useful to distinguish various groups of companies: A) groups with foreign capital: 1) Ferro Corporation – an American company that widened its activities from covering metal materials to covering ceramics. It entered the Italian and Spanish markets (Ferro Italy and Ferro Spain) by acquiring established companies. 2) Grupo Colorobbia – originally from Tuscany in Italy. This was one of the first companies to emerge with the separation of the glaze industry from the ceramics industry. 3) Smaller foreign owned groups such as Johnson Matthey Ceramics and Pemco International. B) Spanish groups: 1) Grupo Torrecid – originated in the ceramic sector around Alcora.

It started Al Farben (colours) and recently bought the Reimbold & Strick group – which includes the Spanish firm CC de Tortosa. 2) Grupo Esmalglass-Itaca – which grew from an initiative by ceramic technicians and various investors from the ceramic industry (Table 1).

Glazes were traditionally made in-house by each ceramics company. The separation of these activities occurred in Spain in the 1940's and 1950's [10]. This same process began in Italy at the beginnings of the twentieth century – notably within the artistic ceramic industry around Tuscany and Veneto. In the 1960s and 70s, the glaze industry was initially identifiable as a result of outsourcing by ceramic companies (mostly ceramic tile companies) around Sassuolo. In Spain, it was multinational firms in the chemical industry that were striving to diversify their

product range that gave the industry a new decisive impetus [14].

In Italy there were 24 firms in the industry in 2005. All were located in the zone around Sassuolo (Emilia Romagna) except for two in Tuscany (Colorobbia and Cover) and another in Ravenna (Vetroceramici). However, there are just nine frit manufacturers in Italy, according to [13], compared to 21 in Spain and approximately 42 in Europe. In other words, many of the 24 Italian firms are distributors rather than producers. Many of the larger Italian firms also sell and manufacture in the Spanish market (Ferro Italia, Colorobbia, Johnson Matthey Ceramics and Smalticeram Unicer). There are currently many Italian subsidiaries of Spanish firms (Torrecid, Esmalglass, Fritta, Vernis, CC Bonet (Cer.Ser), etc.) that import and make glazes. Some other

**Table 1 • Spanish frit, glaze and colour industry 2005**

	Company	Location	Turnover	Employees		
			k1000 €	No.	/ %	Cum. / %
1	Ferro Spain SA (a)	Almazora	174,566	734	18	18
2	Colorobbia Espana SA	Vilafames	120,738	387	10	28
3	Esmalglass	SA Villarreal	108,139	400	10	38
4	Torrecid SA	Alcora	87,961	330	8	46
5	Itaca	Pobla Tornesa	71,899	217	5	51
6	Johnson Matthey C, (b)	Castellon	60,749	163	4	56
7	Fritta SL	Onda	45,731	199	5	60
8	Quimicer SA	Onda	34,066	153	4	64
9	Colorificio c, Bonet SA	Ribesalbes	33,774	153	4	68
10	Salquisa (a)	Cabanes	31,845	112	3	71
11	Esmaltes SA	Alcora	29,232	117	3	74
12	Colores C, de Tortosa SA	Tortosa	24,159	142	4	77
13	Coloronda SL	Onda	23,160	83	2	79
14	Vidres SA	Villarreal	23,684	125	3	83
15	Al Farben SA	Alcora	22,158	89	2	85
16	Cerfrit S,A,	Nules	19,534	146	4	88
17	Vernis SA	Onda	15,897	70	2	90
18	Color Esmalt SA	Alcora	14,610	87	2	92
19	Pemco Esmaltes S,L,	Vitoria	10,597	74	2	94
20	Wendel Email Iberica (c)	Nules	10,370	53	1	95
21	Esmaldur SA	S, Joan Moro	9,894	37	1	96
22	Colores Ceramicos SA	Onda	9,648	51	1	98
23	Prodesco SL,	Manises	4,344	41	1	99
24	Vitricol S,A,	Onda	3,468	30	1	99
25	Colores Olucha SL	Onda	1,261	9	0	100
26	Colores Cer, Elcom. S,L,	Manises	746	4	0	100
27	Color Cer, Lahuerta SL	Manises	586	11	0	100
	<b>TOTAL</b>		<b>992,816</b>	<b>4,017</b>	<b>100</b>	

Notes: a) Only part of the turnover corresponds to the products of the industry; b) Newly acquired by Edeka Ceramic Group; c) At present called Kerafrit.

Source: SABI data base. Own elaboration.



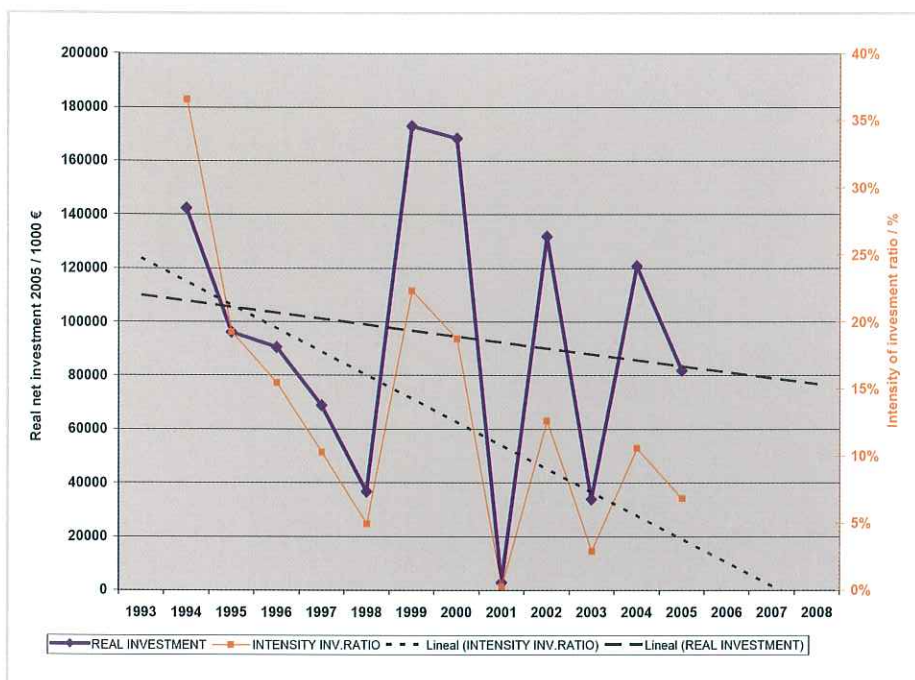


Fig. 1 Real net investment

firms belong to Italian ceramic companies (Ramacolor, Garcolor, Arco, Marazzi, Gardeinia, and the Iris groups respectively) but these have little impact on the Spanish market. Italian turnover in 2004 was 518 million € – around 50 % less than the Spanish industry. The principal reason is that the Italian ceramics industry uses less glaze than the Spanish counterpart as a consequence of Italian firms making fewer glazed tiles and, instead, specialising in porcelain tiles which uses little or no glaze [15].

## 2.2 A comparison of the economic-financial structures in 2005

This section offers a description of the economic profile of these companies using the latest statistics and emphasising certain variables such as turnover, employees, cost structure, export activity, debt, profitability, etc. Comparisons both within companies of the glaze industry and of those with the ceramic tile industry are presented. The following table provides a comparison between large and small firms.

### 2.2.1 Balance sheet

Table 2 shows the aggregate balance sheet for glaze companies and for ceramic companies dated December 31st, 2005.

The glaze industry shows total assets of 1.281 million € – equalling 23 % of the ceramic sector. Surprisingly, assets for both industries have a similar composition (46–49 % for fixed assets

and 51–54 % for current assets). Glaze companies have slightly more financial investments included in their fixed assets than the ceramic companies (17 % compared to 10 %).

Regarding financing assets it can be seen that frit companies are six points higher in self-financing than ceramic companies, with a debt coefficient of 54 % compared to 60 % for ceramic companies, which rely more on short-term finance. The industry net worth (shareholders funds) is 591 million euros – one quarter (26 %) of the value of the ceramic industry.

Companies with 100 workers or more constitute 52 % of the total, but represent 87 % of total turnover, 84 % of employees, and 88 % of total assets in the sector. In addition, these companies are responsible for a large part of the fixed financial investment (98 % of the total or 219 million €) which may reflect major investments in subsidiary companies (controlled through shareholdings). These larger firms invest 19 % of

Table 2 • Aggregate balance sheets 31.12.2005

Industry	Ceramic industry (a)		Frit. glaze. and colour industry		Frit companies with fewer than 100 employees		Frit companies with 100 or more employees	
	Mill, €	%	Mill, €	%	Mill, €	%	Mill, €	%
<b>Balance sheet structure</b>								
<b>Total assets (TA)</b>	5,584	100	1,281	100	152	100	1,129	100
<b>Fixed assets (FA)</b>	2,580	46	624	49	56	37	568	50
Tangible FA	1,890	34	372	29	50	33	322	29
Intangible FA	146	3	26	2	2	1	28	2
Fixed financial investments	544	10	223	17	4	3	219	19
<b>Current assets (CA)</b>	3,005	54	657	51	96	63	561	50
Stocks	1,155	21	190	15	34	22	156	14
Debtors	1,551	28	411	32	55	36	356	32
Cash	299	5	56	4	6	4	59	5
<b>Shareholder funds</b>	2,259	40	591	46	69	45	522	46
<b>Total liability (TL)</b>	3,326	60	690	54	83	55	607	54
<b>Non current liability (NCL)</b>	985	18	212	17	26	17	186	16
Long term liabilities	974	17	200	16	25	16	175	16
Other NCL	11	0	12	1	1	1	12	1
<b>Current liabilities (CL)</b>	2,341	42	477	37	57	38	421	37
Loans (L)	976	17	137	11	10	7	127	11
Creditors	808	14	236	18	28	18	208	18
Other CL	557	10	104	8	19	13	86	8
<b>Ratios</b>								
Debt ratio (DR) (=TL/TA)		60		54		55		54
Long term DR (=NCL/FA)		38		34		46		33
Short term DR (=L/CA)		32		21		10		23

Note: a) All companies with activity NACE Rev 1,1 code number 2640 (about 400 companies with registered accounts).  
Source: SABI base data. Own elaboration.



total assets, compared to 2 % in the case of the smaller companies, and an average of 17 %. An additional finding is that these larger companies have accumulated 93 % of intangible assets – and this may result from their commercialisation policies.

The structure of liabilities is fairly homogeneous between both groups of companies – long-term finance accounts for 31 % of liabilities while current liabilities account for the remaining 69 %. However, the most noteworthy point is that while firms coincide in their level of debt (54–55 %) the large firms rely more on short-term debt, while the smaller firms choose long-term debt.

## 2.2.2 Cost structure and income

Table 3 shows costs, margins, and earnings when comparing the ceramic sector with the glaze industry, while also distinguishing between firm sizes.

One major difference in the cost structures is immediately obvious. Glaze companies spend much more than ceramic companies on raw materials and other materials (58 % compared to 44 % of turnover respectively) and proportionately less on other costs (operating costs, depreciation, financial expenses, and personnel costs, despite the fact that average salaries are higher). Economic and financial profitability, as well as cash flow and value added per employee ratios, are higher in the glaze industry than in the ceramic industry.

Table 3 also illustrates that companies with 100 employees or more – although having enjoyed a better year in income, turnover, and cash flow per employee – also have higher material costs and lower staff costs than other small and medium sized companies. There do not, though, appear to be differences in the other operating costs (gas, electricity, etc.). Further details regarding profitability and costs in the industry are given below. It seems clear that raw material costs are a major factor for glaze companies, with the prices of these raw materials strongly influencing net income and profitability.

## 3 Investment and profitability

### 3.1 Investment and business strategies

The frit, glaze and colour industry has attempted to provide the added service of capturing new outsourced tasks from the ceramic industry. Two basic strategies have been adopted to enable these firms to survive and adapt themselves to the demands of ceramic clients.

Firstly, they pursue an ongoing strategy of innovation based on R&D and the application of innovations from sub-sectors associated with the ceramic industry [8]. After the introduction of new chemicals and specialist training in the 1970s, the frit industry was able to contribute to several areas of innovation in the ceramics industry, especially in the following six areas: the substitution and reduction of hazardous and questionable components such as lead, selenium and antimony in glazes; developing technology for making porous single-fired tiles; the development of atomisation and the implementation of co-generation; the development of new glazes, especially for porcelain tiles; the development of decoration technologies in screen printing; and finally, digital ink injection. All of these innova-

tions have helped improve those production processes that use glaze and added further value by delivering technical and design services to clients.

In order to capitalize on R&D and innovation spending, the leading firms have developed strategies for organic business growth, achieving synergies by expanding the scale of activities to neighbouring businesses in both horizontal and vertical directions. In this way, these companies have begun to cover the raw materials sector and are able to offer the following: value added services for client companies and a wider range of products (frit, glaze, colours, additives, etc.) for tile manufacturers, paving manufacturers that use various technologies, and makers of decorative ceramics including tableware. In another

**Table 3 • Cost structure and profit 2005 Industry Ceramic industry**

Industry	Ceramic industry (a)		Frit, glaze and colour industry		Frit companies with fewer than 100 employees		Frit companies with 100 or more employees	
<b>Concepts</b>								
<b>Turnover (T) (mill, €)</b>	4,165		993		127		866	
<b>Employees</b>	28,884		4,017		639		3,378	
<b>Cost Structure</b>	Mill, €	/ %	Mill, €	/ %	Mill, €	/ %	Mill, €	/ %
Personnel	911	23	154	16	22	18	132	16
Raw materials and other materials	1,755	44	551	58	64	53	487	59
Depreciation	255	6	49	5	6	5	43	5
Other operating expenses	972	24	178	19	28	23	150	18
Financial expenses (FE)	86	2	13	1	1	1	12	1
<b>Total ordinary expenses</b>	<b>3,979</b>	<b>100</b>	<b>945</b>	<b>100</b>	<b>120</b>	<b>100</b>	<b>825</b>	<b>100</b>
<b>Profit and ratios</b>	Mill, €	(T)=10 %	Mill, €	(T)=10 %	Mill, €	(T)=10 %	Mill, €	(T)=10 %
		0		0		0		0
Profit before tax	196	4.7	59	6.0	4	3.0	56	6.4
Extraordinary profit	33	0.8	8	0.8	0	0.2	8	0.9
Taxation	51	1.2	7	0.8	2	1.8	5	0.6
<b>Profit for period (PP)</b>	178	4.3	60	6.1	2	1.4	59	6.8
<b>Cash flow</b>	476	11.4	109	11.0	8	6.2	101	11.7
<b>Added value</b>	1,693	40.6	283	28.6	33	26.4	251	29.0
<b>Economic profitability = (PP+FE)/TA</b>		4.7		5.7		1.9		6.2
Rotation (T/TA)		74.6		77.4		86.9		76.2
Margin ((PP+FE)/T)		6.3		7.4		2.2		8.2
<b>Financial profitability = (PP)/(TA-TL)</b>		<b>7.9</b>		<b>9.9</b>		<b>2.5</b>		<b>10.8</b>
Turnover per employee	0.144		0.247		0.202		0.255	
Added value per employee	0.059		0.071		0.053		0.074	
Cash flow per employee	0.016		0.027		0.013		0.030	

Note: a) All companies with activity NACE Rev 1,1 code number 2640 (about 400 companies with registered accounts).

Source: SABI base data. Own elaboration



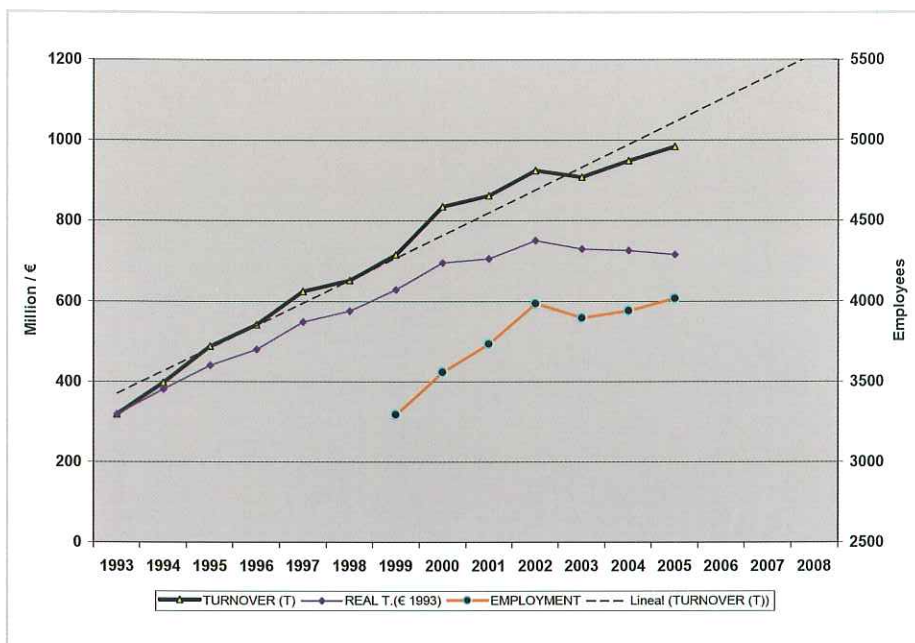


Fig. 2 Turnover and employment

part of the value chain, companies have sought to control the supply of their raw materials, either for themselves or for their clients, especially in mining and minerals processing (atomisers, zirconium, alumina, etc.), as well as adopting a strategy of internationalization. The industry has always had some international business with foreign clients and has long exported to countries with ceramic industries. The establishment of a local presence in international markets began in the 80s and 90s with the aim of getting closer to clients in order to improve service and reduce costs. Major Spanish companies now have subsidiaries in some twenty countries. Among the main locations are Italy (6), Portugal (3) the United Kingdom (3), Brazil (5), Mexico (4) the United States (2), China (5), and Indonesia (4).

The significant investment applied to develop these competitive strategies requires evaluation. For this purpose, financial statements for the period 1993 to 2005 have been analyzed in an effort to assess the development of this investment and the profitability achieved.

Firstly, the so-called Net Investment for the industry has been studied, a statistic defined as the annual change in the total asset value reflected in the balance sheets. Figure 1 plots two variables, the real Net Investment (with data adjusted for Euro currency changes relative to 2005) and the ratio between this variable and the total asset value for the previous year. In addition, some trends have been delineated.

Results show that the sector has been making very high levels of investment. Over the last twelve years the average net investment has been around 90–100 million € per year (with a slight downward trend), while this proportion in comparison to total assets has been falling from levels of around 37 % in 1994 to 10 % and less from 2001. The average over the last five years has been 7 %. This downward trend may be a worrying aspect in a sector with technological leadership.

The source of invested funds has also been analysed (annual changes of internal and external funds), revealing how these companies have

been funding new investments over the last decade. Depending on the economic climate, companies have mainly used internal funds (during 1997–1999), or debt (during 1994–1996, and 2000–2003). Around the end of the 90s, there was an intense effort to self-finance (borrowings at just 30 %). However, this trend changed and indebtedness increased (up to 75 % in 2001; and 55 % in 2005) following the availability of low interest rates and also because of the limited amount of internal funds available compared to the volume of funds needed to finance expansion (Fig 1).

### 3.2. Turnover, employment, and overseas trade

Since 1990 there has been a significant growth in turnover, in the wake of the expanding ceramic sector, according to data from ANFFECC. Industry turnover neared one thousand million euros in 2006, amounting to more than a million and a half tonnes of physical product. These figures reflect the global leadership of the Spanish sector. Sales have been directed at both the national ceramic industry and foreign ceramic firms. At present, national sales account for 42 % of total sales and foreign sales for the remaining 58 %. Between 1990 and 2006 sales volumes as a whole multiplied by five. The industry was also substantially reinforced with an increase in productive capacity and the entry of new companies.

There are at least two timelines that help clarify these developments. In the first, from the be-

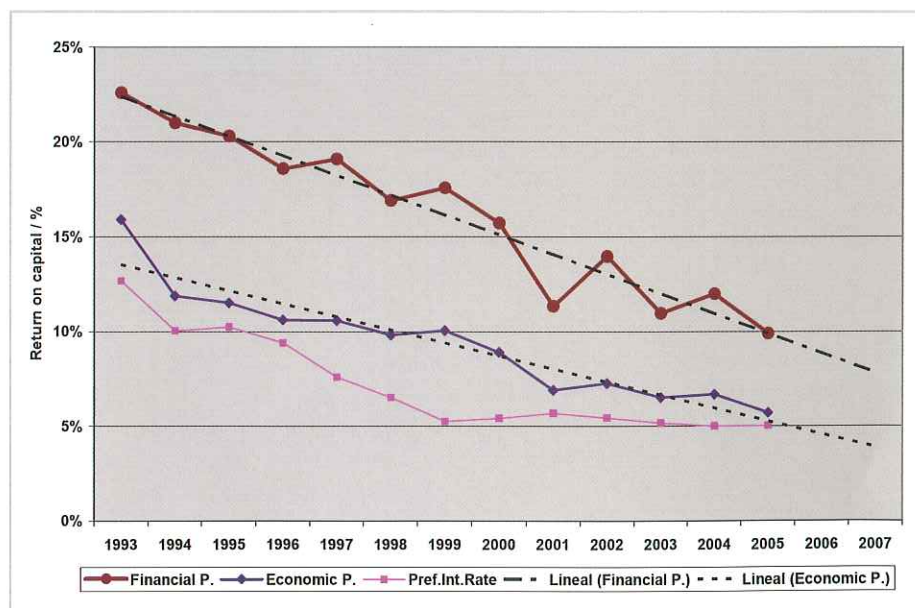


Fig. 3 Return on capital



ginning of the 90s until 2002, there was a linear growth in sales, with annual increases of between 55–60 million €, with one-third in the national domestic market and two thirds in exports. Between 2002 and 2005, this pattern disappeared for the domestic market, but not for the export market, which continued to grow at 35–40 million € annually, while domestic sales stagnated in line with Spanish ceramic production. From 2006 domestic and export sales revived, although the trend will only become clearer when figures are available for the rest of the decade.

Employment grew at a regular pace, increasing by a factor of 2.5 from 1500 employees in 1992 to 3800 employees in 2005, according to ANFFECC figures. Productivity, as measured by turnover per worker, can also usefully be divided into two periods. The first period runs until 1997 and shows a growth from 170,000 to 240,000 € per employee. The second period runs from 1997 until 2005 and shows no growth, which indicates a reduction in real terms after taking into account currency depreciation.

The same conclusions can be drawn when examining data from company annual accounts (SABI). Figure 2 shows the aggregated data of income and employment in the industry.

As turnover continued to increase almost linearly, there would seem to be no obstacles to investment continuing at the earlier rates; however, the trend appears slightly different if turnover is expressed in constant euros (1993), as reflected in the chart. If the volumes are not the cause of the stagnation, then perhaps it is the selling price. A stabilization of turnover can be seen, especially after 2002, and this is also reflected in the employment figures, stabilizing at around the 4000 employees.

International trade statistics are also revealing. They show that exports are widely dispersed geographically, while imports are more concentrated and low in volume. These imports are high-value products (i.e. ceramic colours) from various European countries, mainly Italy, though recently imports from China have increased. The trade balance for these products with the majority of countries remains very favourable for Spain. Recently, however, there have been slight changes due to increased international competition and the emergence of China as a competitor. The coverage rate of imports was 693 % in 2005.

Table 4 shows a number of details on the type of goods produced and exported by the industry, as well as their average unit value.

The export of higher value-added products increased between 2000 and 2005, with the shares of colours and glazes growing in comparison to frits. The export volume of frits in physical units barely changed (+9 %) over this period, when compared to the growth of colours (+87 %), and glazes (+151 %). In short, between 2000 and 2005, the following changes occurred: a) increase in volume: +28 %; b) increase in average price: +5 %; c) increase in value: +34 %.

Examining the annual change in average price shows that the increase was primarily in the year 2005, as the price only varied between 0.63–0.66 €/kg for the period 2000–2004 (which represents a decrease in constant euros). However, more careful analysis reveals that the average price actually increased (+5 %) because the reference mix was changed with greater weight given to more expensive materials. However, all individual prices dropped, with the exception of glazes, which increased slightly (+2 %). Average falls in the price of other products were: frits –4 % and colours –7 %. The average price fell by 4 % when including the initial weightings of the year 2000.

The findings show that export prices in 2006 grew by 9 %, with glazes (+5 %) and frits (+12 %), with colours falling (–9 %). In contrast, raw material prices have been adverse for the industry. Recently, prices for natural gas and materials such as zinc oxide have spiralled upwards.

### 3.3 Profitability

Finally, Fig. 3 shows the development of returns on capital in the glaze industry. The profitability is compared with the preferential interest rates applied to companies by banks (according to data from the Banco de España, the Spanish central bank). It shows how internal funds earned between 9–12 points more than the benchmark, but this difference fell markedly to levels of 5–8 points after the year 2000. The economic returns when applied to total capital have

been between 1 and 5 points above the benchmark, with performance varying from company to company. Firm data also show that some company groups (Colorobbia and Torrecid), and companies specializing in colours, managed economic returns above the industry average.

Previous literature, such as [11], suggested that the sector lost profitability in the 90s, dropping from 32 % in 1990 to 15 % in 2000. Also [12] indicate the loss of productivity and profitability in the industry. This downward trend has been confirmed by our research. As [16] mentions, the fall of prices and margins in the sector is a result of increased competition caused by the emergence of new players, and heavy industrial investment. This is also reflected in our work.

It was observed that during the analysed period, costs grew by nearly two percentage points more than revenues. Costs have grown by between 10 % and 13 %, according to rates, with the exception of financial charges, which have increased by a small degree (1 %/a).

However, the composition of operating expenses (Table 3) has remained constant. The years 2004–2005 and 1994–1995 provided similar averages in which the most notable differences in the cost structure occur in capital costs (depreciation increased nearly one percentage point from 4.4 % to 5.3 %, while financial expenses reduced their share by the same amount, falling from 2.4 % to 1.5 %). The share of staff costs remains unaltered during this period (around 16%), but raw materials drop one percentage point (from 59.2–58.1 %), and other operating expenses increased from 17.7–18.7 %. Data does not reflect the major price increase in certain raw materials such as zinc oxide and natural gas.

The research also illustrates that in 2005 the operating profit, continuing the trend of previous years, fell sharply as a result of slowdown in rev-

**Table 4 • Composition of exports – 2000 and 2005**

	Exports – Volume and value	Average export unit prices										
		Year 2000				Year 2005						
		Volume		Value		Volume		Value		Year 2000	Year 2005	Var.
Products	TARIC Code	(1000 t)	/%	Mill, €	/%	(1000 t)	/%	Mill, €	/%	€/kg	€/kg	/%
<b>Total</b>	<b>3207</b>	<b>590</b>	<b>100</b>	<b>382</b>	<b>100</b>	<b>757</b>	<b>100</b>	<b>513</b>	<b>100</b>	<b>0.65</b>	<b>0.68</b>	<b>+5</b>
<b>Colours</b>	<b>320710</b>	<b>31</b>	<b>5</b>	<b>83</b>	<b>22</b>	<b>58</b>	<b>8</b>	<b>144</b>	<b>28</b>	<b>2.68</b>	<b>2.48</b>	<b>–7</b>
<b>Glazes</b>	<b>320720</b>	<b>61</b>	<b>10</b>	<b>35</b>	<b>9</b>	<b>153</b>	<b>20</b>	<b>89</b>	<b>17</b>	<b>0.57</b>	<b>0.58</b>	<b>+2</b>
<b>Frits</b>	<b>320740</b>	<b>497</b>	<b>84</b>	<b>263</b>	<b>69</b>	<b>543</b>	<b>72</b>	<b>277</b>	<b>54</b>	<b>0.53</b>	<b>0.51</b>	<b>–4</b>

Source: Own elaboration. AEAT (Spanish Agency for Tax Administration). Camerdata data base.



enues. Despite this, profit for the period fell only 8 %, which was less than the fall in 2004. This was due to various extraordinary net revenues and a cut in tax (as a consequence of the implementation of an accounting rule, fiscal credit, that allows anticipation of future tax savings).

#### 4 Conclusions – the challenges ahead

As we have shown, the Spanish frit, glaze and colour industry is a billion euro-a-year industry, providing four thousand jobs. It is larger than other traditional Valencian industries which have received much attention such as the toy, footwear, or furniture industries. The glaze industry is based in the ID of Castellon and has contributed to the success of the ceramic sector, a sector with a turnover four times higher.

It sprang from the practice of outsourcing the supply of, and raw materials for, processing glaze. For the last three decades the industry has developed a strategy of ongoing innovation, which has contributed to the industry becoming a technology mainstay of the ceramic sector. The industry has also developed a strategy of growth, with an emphasis on internationalisation. The industry has, for example, managed to export up to 60 % of its output and establish new overseas manufacturing plants to serve customers locally. Its leadership role was widely recognised for the sector as a whole.

Companies have been extremely active commercially – supporting their clients in their competitive struggle in two ways: firstly, through improved product quality in terms of performance, aesthetics and design, which enables greater differentiation for ceramic products; and secondly, through a structured customer service, which includes assistance with product development, such as design, and post-product development, such as solving problems in the production phase.

The evolution of the industry has been studied since the beginning of the 90s. There has been strong growth in all critical variables (investment, turnover, employment, exports, etc.) which reflect the high level of competitiveness achieved. However, a stagnation of investment and turnover has been seen lately. Compounding the problem, the upward price trends in both energy and raw materials, such as zinc oxide, has eroded operating margins and results.

Accordingly, the industry has suffered an intense loss of profitability – down 50 % in little more than a decade. This fall has been especially

pronounced since 2001, when big price increases were experienced in the raw material and natural gas, elements that comprise 75 % of production costs. In addition, the pressure of international competition is increasing. The Asian glaze industry has been expanding since 2005. As a result, the industry data indicates that the Spanish industry will face debilitating commercial problems through a combination of higher material costs and investment costs imposed by environmental regulations that their competitors do not have to shoulder.

The research shows that there has been high investment in innovation; however, only continuous improvement in product quality and service will enable industry leadership to be maintained. We suggest that innovative approaches must include changes in mentality, which include industrial restructuring (mergers and acquisitions, and specialisation) and intensification of internationalization (searching for new customers; multi-locations). Also, and very importantly, more effective forms of cooperation with other organisations working in ceramic technology must be developed in order to facilitate technological advances and make more effective use of the sectorial innovation system.

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