

FWC Sector Competitiveness Studies - Competitiveness of the Ceramics Sector

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Glossary of terms

Institutional Names

ASCER	Association of ceramic tile manufacturers of Spain
CE	Cambridge Econometrics, Cambridge, UK
Cérame-Unie	The liaison office of the European ceramics sector, Brussels.
DTI	Danish Technological Institute, Aarhus, Denmark
ECORYS	ECORYS Holding BV, Rotterdam, Netherlands
EC	European Commission
EU	The European Union as it was in the year of reference, e.g. EU in 2003 would be the EU15; EU in 2005 would be the EU25
EU10	The ten Member States that acceded to the EU on 1st May 2004
EU12	The 12 Member States that have acceded to the EU since 1st May 2004
EU15	The bloc of 15 Member States that made up the EU prior to 1st May 2004
EU25	The bloc made up of the EU10 and the EU15
EU27	The bloc made up of the EU25 plus Bulgaria and Romania
EuroCERAM	A ceramics network organisation
FEPF	EU ceramic tableware federation
IDEA	IDEA Consult, Brussels, Belgium
IFO	CESifo, Munich, Germany
IMA	The Industrial Minerals Association
US	United States of America

Names, policies, techniques and schemes

b2b	Business-to-Business
b2c	Business-to-Consumer
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortisation
EMAS	Eco-Management and Audit Scheme
ETS	Emissions Trading Scheme
IPPC	Integrated Pollution Prevention and Control
IPR	Intellectual Property Rights
NEPSI	European Network for Silica
OHS	Occupational Health and Safety
REACH	A regulation concerning the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) and establishment of a European Chemicals Agency (ECHA)
SWOT	Marketing / Strategic analysis technique highlighting <u>S</u> trengths, <u>W</u> eaknesses, <u>O</u> pportunities and <u>T</u> hreats
SME	Small and Medium-Sized Enterprises (typically defined as a firm with under 250 employees)

Units

bn	Billion
m	Million
m ²	Squared-metres
mt	Million tonnes
pa	Per annum
pp	Percentage point
CO ₂	Carbon dioxide
VOCs	Volatile Organic Compounds

Executive summary

The Mid-term Review of Industrial Policy in 2007 concluded that the integrated approach adopted in 2005 has been successful and should be continued. In order to do so, an up-to-date understanding of sectors is required and in recognition of this DG Enterprise and Industry set up a Framework Agreement for analysing the competitiveness of industry sectors. This report presents the work undertaken to study the competitiveness of the EU ceramics sector. The information presented in this report is based on data and literature collected from desk-based research.

In 2006 the EU ceramics sector produced and sold around €28bn worth of various ceramics products. Growth in output has been very modest in recent years. Since 2000 the level of output has fluctuated very slightly and only risen from €27.2bn in 2000 to €28.1bn in 2006. The composition of output has changed little since 2000. In 2000 the two largest sub-sectors were the wall & floor tile sub-sector and the bricks & roof tiles sub-sector, accounting for 36% and 24% of output respectively. In 2006 they accounted for 39% and 24%. Meanwhile, the refractory and technical ceramics sub-sectors saw very small increases in the shares they account for, from 11% and 9% respectively in 2000 to 12% and 10% in 2006. Sanitaryware accounted for 8% of output in 2006 while tableware and ornamentalware saw the sharpest decline, from 10% in 2000 to 6% in 2006. The major producing regions are Germany, the UK, Spain and Italy. Germany is a major producer across most of the sub-sectors, especially refractory ceramics, vitrified clay pipes, sanitaryware, and tableware. Italy and Spain are both major centres of production for ceramic tiles, and to a lesser extent sanitaryware. The UK is the third largest sanitaryware producer after Germany and Italy, and is the major producer of tableware and ornamentalware along with Portugal and Germany. Limits on transport due to weight mean brick and roof tile production is scattered all over the EU although Belgium and Spain have the biggest production ratios: 0.29 m³ and 0.28 m³ per inhabitant respectively. The major technical ceramics producers are in France, Germany, the Netherlands and the UK. Production in the new Member States of the EU appears to be strongest in the Czech Republic, Poland, and Hungary, who all have strong ceramics sectors, and have traditionally exported to the EU. However, the representation of new Members' ceramics sectors in the EU is low and so data and information is comparatively sparse.

Employment in the EU ceramics sector has generally been on a downward trend since 2000. The level of employment did increase in 2004 with the accession of new Member States, but otherwise the level has been falling, driven largely by a combination of productivity requirements in the face of increasing low-cost competition. In 2006 the EU ceramics sector employed 221,000 people, down slightly from the 235,000 in 2000. The largest employers are the wall & floor tile and the bricks & roof tiles sub-sectors. Wall & floor tiles accounts for around 30%, as it did in 2000 while bricks & roof tiles accounts

for 26%, up from 21% in 2000. The refractory ceramics and sanitaryware sub-sectors account for 12-13% of employment, up slightly from just under 10% in 2000, while the share of employment accounted for by the tableware and ornamentalware sector has fallen, from 27% in 2000 to 14% in 2006.

Typically, around 20-25% of EU ceramics output is exported beyond the EU. Import penetration varies from 3-8% in, for example, floor & wall tiles and refractory products, to over 60% in tableware and ornamentalware. The major export markets for the ceramics sector are the US, which accounts for over 25%, and then Switzerland and Russia on 6-7% each. The recent trend has been for a deterioration in the trade balance due to increased low-cost competition in EU markets from the likes of China and Turkey, continued restricted access to some non-EU markets and the gradual appreciation of the euro against most currencies since 2000. Consequently, trade, and in particular the terms of trade for EU exporters, have become important issues for the ceramics sector.

The EU ceramics sector faces a challenging period over 2007-09 as economic activity slows in the wake of the credit crunch and demand slows. GDP growth in the EU is expected to slow from 2.8% in 2007 to around 1.9% in 2008 and 1.7% in 2009. The construction sector looks to be especially vulnerable as household confidence and spending weakens, and investment demand is curbed. The construction sector is important for several ceramics sub-sectors, and as such the outlook for the ceramics sector is not good.

The EU ceramics sector is faced with a number of competitiveness challenges, many of which have been fuelled by globalisation and increased environmental regulation. The increase in the number of comparative low-cost ceramics products being imported from emerging economies is a sign that in some sectors, particularly in the ceramic tableware sub-sector, the EU's competitive advantage on the basis of cost is diminishing. The report shows that the EU is still nevertheless a major global player in many ceramics sub-sectors, especially in wall and floor tile manufacturing.

A second key competitiveness factor that the EU ceramics sector faces is increased environmental regulation and control. The relatively high energy-intensity of ceramics production, brought about by the need to heat kilns up to 2000°C, makes the reduction of carbon dioxide emissions especially challenging. The review shows that the technologies and techniques used in ceramics production to minimise energy use by kilns are already advanced and that major short-term future increases in efficiency are unlikely.

The cost structures of energy-intensive ceramics producers are becoming disadvantaged by increasing input prices - a feature of some of the EU ceramics sub-sectors is that they are highly reliant on a range of virgin raw materials, an increasing proportion of which is being imported from Non-EU countries. The review illustrates how the lack of competitiveness of inputs into the ceramics manufacturing process, especially in energy markets, is hindering the competitiveness of EU ceramics producers.

With regard to energy the price of energy in the EU has risen substantially since 2004 mirroring to a large extent the rise in the price of crude oil. A consequence of this is that energy costs are likely to account for a far larger share of operating costs than the roughly

30% estimated before oil prices surged. As a result, with regard to energy prices, the EU compares favourably against Japan, but less so against the US. EU industry would benefit from a better functioning, more competitive energy market to bring about more harmonised pricing and free firms from the decision of where to locate. Looking across the EU, there is great variation in the price of electricity in the EU, created by differences in the cost of generation and the rate of taxation applied to end users. Gas prices and tax rates show less variation across the EU. These variations have implications for whether and where firms choose to set up.

The main competitiveness problem that the EU ceramics sector faces is a sharp rise in the volume of ceramics imports from Non-EU countries where environmental regulation is less stringent and Health and Safety laws are more relaxed. The specific economic problems that this creates are reviewed. Relatively high levels of EU regulation have meant that EU ceramics producers are no longer competing on a level playing field in the global environment and this has created a number of competitiveness challenges, but also a diverse range of competitiveness prospects.

Whilst the negative effects of globalisation and increased environmental regulation are well documented, there is less literature regarding the potential economic benefits that it brings to the ceramics sector. Globalisation has encouraged specialisation in many markets within the EU, especially by SMEs, and the EU is a world leader in producing value added ceramics products, many of which are manufactured by flexible and innovative SMEs. Globalisation has also encouraged some EU firms to extend their activities to an international arena and to become global players. The review shows how high levels of SME technological innovation and productivity shield EU ceramics producers from the more damaging aspects of globalisation.

A systematic review through the framework profile of the ceramics sector was undertaken, covering the regulatory conditions, the framework conditions, and the so-called exogenous conditions. The review was based on a literature survey as well as on additional sources. Particular attention was paid to the sub-sectors. For each of the various conditions surveyed, the assessment included the importance, the expected future trend, the geographical concentration, and significance for specific sub-sectors. Furthermore, another column was added to map the potential effects of each of the conditions on the competitiveness of the EU ceramics sector. This facilitates the subsequent step: matching these results with the ones from the competitiveness analysis. This helps to indicate which of the potential effects that have been identified from a regulatory and framework perspective will have further consequences in the field of competitiveness.

Based on an analysis of the framework grid, we found that the following conditions have a substantial potential impact on the competitiveness of the ceramics sector as a whole:

- Environmental regulations (energy use (CO₂ emissions), pollution prevention, waste);
- Energy cost and availability;
- Intellectual property right issues;
- Knowledge and innovation; and
- Globalisation (low-priced imports) and trade barriers (EU access to third countries).

As far as regulations are concerned, the environmental regulations prevail. The scheme for greenhouse gas emissions, the Integrated Pollution Prevention and Control, as well as REACH have substantial potential effects on the production costs, particularly for SMEs which face more of a challenge to meet the workload and short time frames set by the regulation. However, it has to be mentioned that these regulations also provide an incentive to invest in R&D for better energy efficiency. Yet the return of these investments are relatively far in the future, while the adjustment pressure is felt immediately. The absence of an international level playing field on environmental regulations is perceived as a noteworthy threat for European global players.

Intellectual property right regulations are gaining importance. They are of particular interest for the fine ceramics sub-sectors such as tableware ceramics, and the wall and floor tiles. Most companies in these sub-sectors are SMEs. Fine ceramics are traded worldwide. The defence of IPR may be challenging for SMEs and its erosion will slow down innovation as companies will stop investing if their return on that investment is not guaranteed, or at least subject to fair competition.

The cost and availability of energy are the most important framework conditions. With energy accounting for between 10-30% of production costs this is not surprising. Energy-saving techniques become ever more important in the long run for securing a competitive position. This is accompanied by an increasing demand for high-skilled labour, which is not always the perception that job-seekers have of the ceramics sector. Trade barriers are important as well, especially in the tableware and ceramic tiles sub-sectors.

Competition from substitute materials and the relatively high dependency on the construction and renovation activities are exogenous conditions that may challenge the competitive position of the EU ceramics sector in the long run. In the short run, low-cost imports from emerging economies are increasing the competitive pressure.

Not all regulations are equally important for all sub-sectors, however, although some are relevant for the whole ceramics sector, e.g. environmental regulations. Looking at the number of specific conditions that have a potential effect on the competitiveness of a sub-sector, it appears that the conditions play a relatively larger role in the sub-sectors of tableware and ornamentalware, and of wall and floor tiles. These are also sectors that are predominantly populated by SMEs. Other sub-sectors are more concentrated, e.g. bricks and roof tiles, sanitaryware, refractories, and vitrified clay pipes. In these sectors economies of scales are important as well as energy efficiency. The viability of the technical ceramics depends crucially on R&D and innovations.

However, the main concern for the ceramics sector is the impact of the ETS (Emissions Trading Scheme) on gas prices. The ETS is likely to raise energy prices, which will feed into operating costs and will consequently decrease profitability and also the uncertainty created by the long decision period in re-evaluating the ETS makes decision-making within the sector difficult. This could lead to a reduction of investment levels in firms located in the EU, with production and job losses following. Delocalisation could occur towards areas where such environmental standards do not apply (e.g. Russia, China) as there is currently no international level playing field, although SMEs, which abound in the sector, do not have this delocalisation option and so they would have to cease

operations. In the wall and floor tiles sub-sector the recent but growing trend to delocalisation has been caused mainly by the need to better meet demand in local markets.

SWOT analysis takes this identification a step further and suggests that the challenges in the production and logistics systems of the ceramics sector are the same across the different sub-sectors, whereas the competition, markets, distribution channels, and the structure of the market vary to such a degree that different strategic responses may be suggested to different sub-sectors.

Using SWOT analysis, we have looked for ways to use the strengths of the ceramics sector to enhance opportunities and face the weaknesses and on how to use opportunities to strengthen weaknesses.

The challenges from globalisation are illustrated by new low-cost competitors, increasing prices for energy and raw materials and market imperfections with tariff and non-tariff barriers and IPR issues. The European ceramics sector will find it difficult to maintain low-cost production and will need help to secure a more level playing field with its competitors.

The climate is changing as a result of human activity, and the result will be further environmental regulation in the EU and in the Member States. This is a serious challenge to the ceramics sector with a production process at a mature stage with only limited ability to improve energy efficiency in the short term.

Turning to the strengths and opportunities of the ceramics sector and its sub-sectors in the EU, there may be a good chance for the sector to exploit its position as a market leader for high-value ceramics. In the face of the challenges from globalisation the ceramics sector is well positioned with new technologies, high quality brands, a tradition for innovation and knowledge intensive enterprises which must be exploited in the future. The ceramics sector will have to give high priority in new technologies, strengthening brands and developing services to maintain competitive advantage. Constant improvement in technologies to increase flexibility and efficiency must be encouraged.

The challenges from climate change must be met with constant development of cleaner technologies, introduction of alternative energy sources and reduction of total energy use in production processes, in management systems, in products, in transportation and services. Policy makers can focus on improving framework conditions such as a more level playing field, improvement in the skills of the workforce, helping to sustain the clusters that are a key feature of the sector, and directing R&D resources towards cleaner technologies and yet more efficient production processes.

1 Introduction

1.1 Background

In 2005 the EC set out for the first time an integrated approach to industrial policy with horizontal and vertical initiatives, to provide the right framework conditions for enterprise and innovation to succeed, and to drive the economy forward. The Mid-term Review of Industrial Policy in 2007 concluded that the approach adopted in 2005 had been successful and should be continued, with a focus on how best to respond to globalisation and climate change. And in highlighting the importance of productivity as a driver of long-term growth, the European Competitiveness Report 2007 reinforced the importance of industrial policy in helping to deliver the framework conditions that allow firms and employees to raise their productivity.

In this context DG Enterprise organised in 2007 a conference ‘From 2007 on: the principal challenges facing the European glass and ceramics industries’. At this conference a range of conclusions were formulated by both Commission and industry, which are highlighted in this competitiveness study. In its conclusions the Commission recognised the importance of the environment and the role of the ceramics sector, as an energy intensive user, in improving the environmental performance of EU industry. However, it also recognised the need to find a mechanism for improving the environmental performance which was rational, proportionate and reflected the economic realities, and did not undermine the competitiveness of the sector. The industry emphasised the need to complete the liberalisation of the gas and electricity markets as soon as possible, and also argued the need for a harmonised benchmarking for the EU ETS to account for sector diversity. The Commission also noted the importance of the social dimension in industrial and competitiveness policy, and dialogues between trade unions and the firms. Both the industry and the Commission highlighted the need to develop a level playing field with respect to both access to third country markets, and the application and enforcement of IP rights and environment-related regulations in competitor countries. The ceramics sector also put forward conclusions on the acceptance or inclusion of standards/ levels related to ceramics products.

In order to sustain the progress made under the integrated approach an up-to-date understanding of sectors and the conditions affecting their competitiveness is required, and this prompted DG Enterprise and Industry to set up a Framework Agreement analysing the competitiveness of sectors and industries. Under this Agreement, the first set of competitiveness studies was commissioned towards the end of 2007, with the **ceramics** sector being the focus of one of them.

This report represents the final stage of work undertaken on the competitiveness of the EU ceramics sector.

1.2 Purpose

The purpose of the study is to provide the EC with a clear and up-to-date understanding of the competitiveness of the EU ceramics sector (as it is now and how it might develop), which will then allow the EC to knowledgeably engage with the sector in the development of horizontal and vertical policy.

This includes:

- Identifying the key aspects of the sector (performance, structure, processes and inputs) that can be described by reliable data sources or other available documentation;
- Identifying the competitive position of the sector in relation to main competitors;
- Identifying which horizontal aspects (e.g. regulation, labour force skills, infrastructure, energy supply, etc) are key issues for the sector;
- Presenting the strategic outlook for the sector, identifying threats, opportunities and policy challenges/issues.

1.3 Remaining sections

The Terms of Reference identified five key requirements:

1. The collection and presentation of data;
2. A synthetic literature review;
3. Assessment of the sector's competitive position on EU and global markets;
4. Analysis of regulatory and other framework conditions which have an impact on the competitiveness of the EU ceramics sector;
5. A strategic outlook.

In relation to these requirements the remaining sections of this report are organised as follows:

The collection and presentation of data are not confined to a single section or chapter. Collected data are used in chart and table form to illustrate and support points throughout the report where deemed necessary. For the moment however, most of the collected data that are presented in this report are used in chapters two and three.

Similarly, the synthetic literature review is not confined or relevant to just one part of the report, rather it is used to support and inform all sections of the report.

Chapter Two looks at key aspects of the ceramics sector by presenting some stylised facts on the way the sector operates. This includes a review of performance, structure, processes and inputs.

Chapter Three analyses the competitive position by looking at a similar range of factors, but focusing more on how they contribute to varying performance levels within sub-sectors and for individual firms.

Chapter Four presents work on horizontal aspects relating to the competitiveness of the ceramics sector, including regulatory and environmental issues alongside external factors such as trade links outside of the EU.

Chapter Five deals with strategic outlook, undertakes a SWOT analysis, and focuses attention on forward-looking challenges for the sector.

Finally, Chapter Six provides conclusions drawn together on the competitiveness of the EU ceramics sector while Chapter Seven provides details of any references used during the course of the research.

2 Key aspects of the sector

2.1 Introduction

2.1.1 Overview

This chapter outlines the characteristics of ceramics and reviews the types of ceramics relevant to the present study. Each ‘sub-sector’ of ceramics, i.e. wall and floor tiles, bricks and roof tiles, tableware and ornamentalware, refractory products, sanitaryware, vitrified clay pipes and technical ceramics, is analysed with respect to the structure of production, employment, productivity, trade patterns, and concentration (both size of firm and locational characteristics).

2.1.2 A note about the data

This report, and in particular this chapter, employs data from a number of data sources including Cérame-Unie, the liaison office of the European ceramics sector. Cérame-Unie is an umbrella organisation for eight ceramics sectors which together account for the vast majority of ceramics production (around 2000 companies) across the EU. Due to the lack of consistent, up-to-date, statistics (except for trade) from Eurostat, Cérame-Unie represents one of the most comprehensive sources of production and employment data available on the EU ceramics sector.

However, it should be noted that the data from Cérame-Unie suffers some short-comings. Firstly, these data are very rough estimates in many cases. Secondly, Cérame-Unie is not 100% representative of all branches of the ceramics sector. Finally, there is a skew in the organisation’s membership towards firms from the larger ceramic-producing Member States such as the UK, Germany, Italy and Spain - Cérame-Unie does have representation among the newer EU Member States (in Bulgaria, the Czech Republic, Hungary, and Poland) but it is not comprehensive. Though an attempt has been made to include data from Member States who are less well represented by Cérame-Unie this skew should be borne in mind when considering the data presented, and the conclusions drawn on the basis of these data, in this report.

2.2 Performance

2.2.1 Importance of the sector and its different sub-sectors

Ceramics in society

Ceramics are “non-metallic inorganic materials that lend themselves to permanent hardening by high temperatures” (Peterson, 2003, p11) and are a very diverse group of products and range from computer chips and electrical insulators to bathroom fixtures and tableware. Table 2.1 provides statistical definitions of sub-sectors within the ceramics sector which are to be covered by the study.

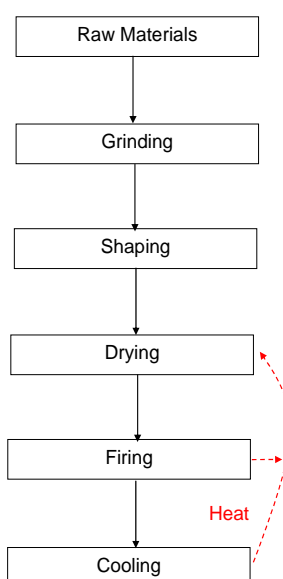
Table 2.1 Ceramics sub-sector definitions

Sub-Sector	NACE Code	HS Code	Definition
Tableware and Ornamentalware	26.21	6911	“Manufacture of ceramic household and ornamental articles” “Tableware, kitchenware, other household articles and toilet articles, of porcelain or china (excl. baths, bidets, sinks and similar sanitary fixtures, statuettes and other ornamental articles, pots, jars, carboys and similar receptacles for the conveyance or packing of goods, and coffee grinders and spice mills with receptacles made of ceramics and working parts of metal)”
		6912	“Ceramic Tableware, Kitchenware, Other Household Articles And Toilet Articles, Other Than Of Porcelain”
		6913	“Statuettes And Other Ornamental Ceramic Articles”
Sanitaryware	26.22	6910	“Manufacture of ceramic sanitary fixtures” “Ceramic sinks, washbasins, washbasin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures (excl. soap dishes, sponge holders, toothbrush holders, towel hooks and toilet paper holders)”
Technical Ceramics	26.23 26.24	6909 6914	“Manufacture of ceramic insulators & insulating fittings”.
			“Manufacture of other technical ceramic products” “Ceramic wares for laboratory, chemical or other technical uses”
			“Other ceramic articles”
Vitreous Clay Pipes	26.25	6906	“Manufacture of other ceramic products” “Ceramic pipes, conduits, guttering and pipe fitting”.
Expanded clay products	26.25	6901	“Manufacture of other ceramic products” “Bricks, blocks, tiles and other ceramic goods of siliceous fossil meals (for example, kieselguhr, tripolite or diatomite) or of similar siliceous earths”
Refractory Products	26.26	6901	“Manufacture of refractory ceramic products” “Bricks, blocks, tiles and other ceramic goods of siliceous fossil meals or of similar siliceous earths”
		6902	“Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods (excl. those of siliceous fossil meals or similar siliceous earths)”
		6903	“Other refractory ceramic goods (for example, retorts,

Sub-Sector	NACE Code	HS Code	Definition
		6815	crucibles, muffles, nozzles, plugs, supports" "Articles of stone or of other mineral substances (including articles of peat), not elsewhere specified"
Wall and Floor Tiles	26.30	6907 6908	"Manufacture of ceramic tiles & flags" "Unglazed ceramic flags and paving, hearth or wall tiles; unglazed ceramic mosaic cubes and the like, whether or not on a backing" "Glazed Ceramic Flags And Paving, Hearth or Wall Tiles; Glazed Ceramic Mosaic Cubes and the Like, Whether or not on a Backing (Excl. Of Siliceous Fossil Meals or Similar Siliceous Earths, Refractory Ceramic Goods, Tiles made into Stands, Ornamental Articles and Tiles Specifically Manufactured for Stoves)"
Bricks and Roof Tiles	26.40	6904 6905	"Manufacture of bricks, tiles and construction products" "Ceramic building bricks, flooring blocks, support or filler tiles and the like" "Roofing tiles, chimney pots, cowls, chimney liners, architectural ornaments and other ceramic construction materials"

They are characterised by their high strength, texture, longevity, chemical inertness and electrical resistance. Their most distinguishing feature is that they are “more resistant to heat than any other material on the face of the earth” (Peterson, 2003, p11). According to Cérame-Unie (2007), the world ceramics market is worth in the region of €120 billion. Manufacturers have significantly improved efficiency in what is a highly energy-intensive process, fuelled by the need for drying and firing at temperatures between 800 and 2000 degrees Celsius (EC, 2007a). Figure 2.1 below shows the stages in a typical ceramics production process (techniques vary and are product-specific).

Figure 2.1 Typical Ceramics production process



Wall and floor tiles

Ceramics tiles are used to cover walls and floors and are formed typically using clay and a range of other raw materials. Wall and floor tiles can be shaped, sized, styled and finished (glazed) in a variety of ways to enhance the final product, as well as being physically strong, long-lasting and aesthetically pleasing. The demand for wall and floor tiles is closely derived from the demand for construction which is influenced by the number of new-builds, and demand for renovations and upgrading. Demand is also closely influenced by changing consumer preferences and fashions.

Bricks and roof tiles

The market for bricks, blocks and roof tiles is mostly regional due to the relatively high unit transport costs involved in transporting both raw materials from their source and finished products to consumers and due to local conditions (requirements of different building traditions) and climate requirements.

The demand for bricks, blocks and roof tiles is seasonal as well as cyclical and is also driven by the demand for new housing and housing renovation. The brick and roof tile sub-sector suffered in the early 1990s due to a fall in construction (with the exception of Germany due to the boom after reunification) but this was made up by an upswing in construction in the late 1990s and early 2000s. More recently (in the UK at least) the change in the new housing mix from detached and semi-detached houses (which require up to 10,000 bricks per dwelling) towards flats and apartments (which require 3,000 to 5,000 bricks per dwelling) has resulted in a decline in the demand for bricks (UK Competition Commission, 2007a page 30). Also, the use of brick substitutes in construction such as in steel-framed and timber structures has reduced the demand for traditional load-bearing bricks in some EU countries.

The production of bricks is highly energy-intensive; energy costs account for up to 30% of total cost and brick production consumes approximately half of the total energy used by the whole ceramics sector (EC, 2007b).

Tableware

Examples of tableware ceramics include plates, dishes, cups, bowls jugs and vases. In the EU, output of tableware has fallen by 50% since 1990 and employment has fallen even more (EC, 2007b) largely in response to an increase in the number of low-cost comparable tableware products flooding the EU market from emerging economies such as China. Nevertheless the EU is still a major player in the high-value, high-quality, end of the tableware sub-sector.

Sanitaryware

Sanitaryware ceramics includes toilets, sinks, cisterns and bidets. Again, the demand for sanitaryware products is driven by the demand for construction and renovations. The production of sanitaryware like in other sub-sectors is energy intensive, requiring kiln temperatures of up to 1220°C. The weight of sanitaryware products limits the scope of long-distance international trade but EU manufacturers have still suffered due to an influx of cheap sanitaryware imports from countries such as Turkey, which is the largest sanitaryware producer in Europe. Typical profit margins of EU sanitaryware producers are as low as 1-2% (GHK, 2007).

Refractory Products

Refractory products are used in high temperature production processes. They are characterised by their resistance to mechanical, thermal and chemical stress and thermal shocks (EC, 2007b) which suits them to such processes. Refractory products are used in the production of a number of energy-intensive downstream products such as steel, cement, lime, glass, ceramics, etc. In the recent past, the decrease in the demand for steel (and the use of continuously cast steel-making) and the higher efficiency (longer lifetime) of refractory products has decreased the demand for refractory ceramics and this had led to a number of closures and consolidation. Net profit margins of between 2-5% are expected from EU refractory manufacturers (GHK, 2007). Although refractory products represent a relatively small share of overall ceramics production, they are an essential component to several major basic industries as previously mentioned (eg iron and steel for motor vehicles and cement for construction) and cannot be substituted.

Vitrified Clay Pipes

Vitrified clay pipes are used in sewerage and drainage and demand is largely driven by the policy of local authorities and utility companies. The sub-sector is highly concentrated and is threatened by the increased use of non-ceramic substitutes such as PVC.

Technical Ceramics

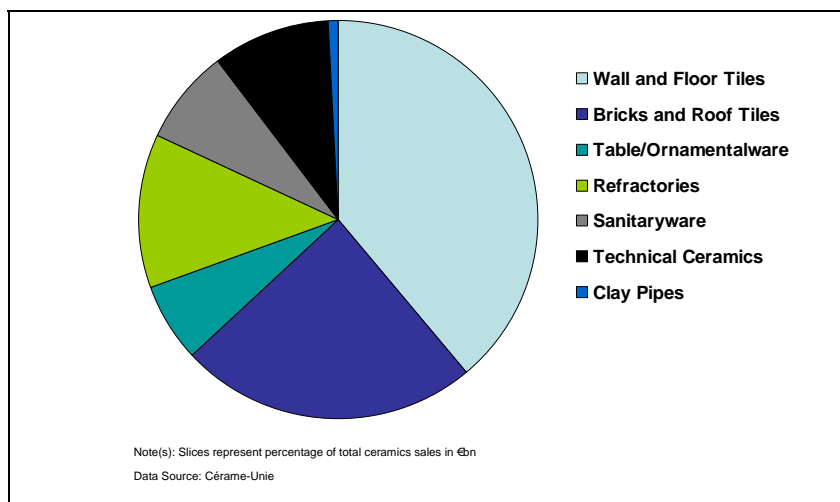
The technical ceramics sub-sector is very diverse but manufacture is usually carried out in kilns in the same way that other ceramics are produced. They are based partly on clays, and on synthetic raw materials and they are used, inter alia, in electronics products, bio-medical innovations and automobiles (EC, 2007a). Many technical ceramics are innovative and of relatively high value and low weight, reducing energy intensity and giving greater scope for exports. It is estimated that the EU supplies about a tenth of the world market, but lags behind Japan and the US that together supply over 80% of the world technical ceramics market (EC, 2007b).

2.2.2 Production and employment by sub-sector within the EU

Production

Figure 2.2 below shows that the majority of ceramics production is in the form wall and floor tiles and bricks and roof tiles. Overall the value of EU ceramics production has increased since 1999 primarily due to expanded wall and floor tile and brick and roof tile production, but overall ceramics manufacturing growth has been hindered by the apparent decline in tableware manufacturing.

Figure 2.2 Ceramics production by sub-sector (2006)



Employment

Employment in the EU ceramics sector has fallen substantially in the past decade, and this fall can be attributed to a combination of increased production automation and plant closures due to new low-cost competition and reduced demand (for example the decline in demand for refractory products from the steel sector). The share of employment across the sub-sectors in ceramics tends to follow the output shares, as shown in Figure 2.3, i.e. tiles have the largest share comprising around 60% of total employment.

Figure 2.3 Ceramics employment by sub-sector (2006)

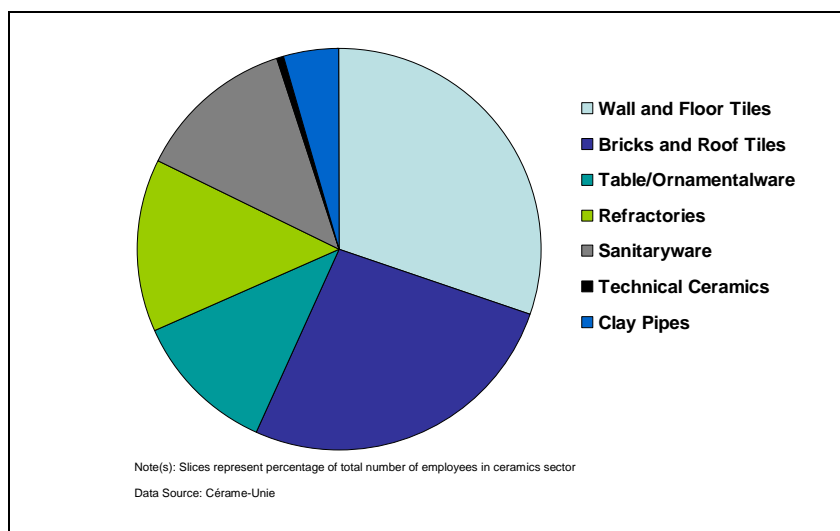


Table 2.2 summarises these same findings in tabular format.

Table 2.2 Output and Employment in the Ceramics Sector

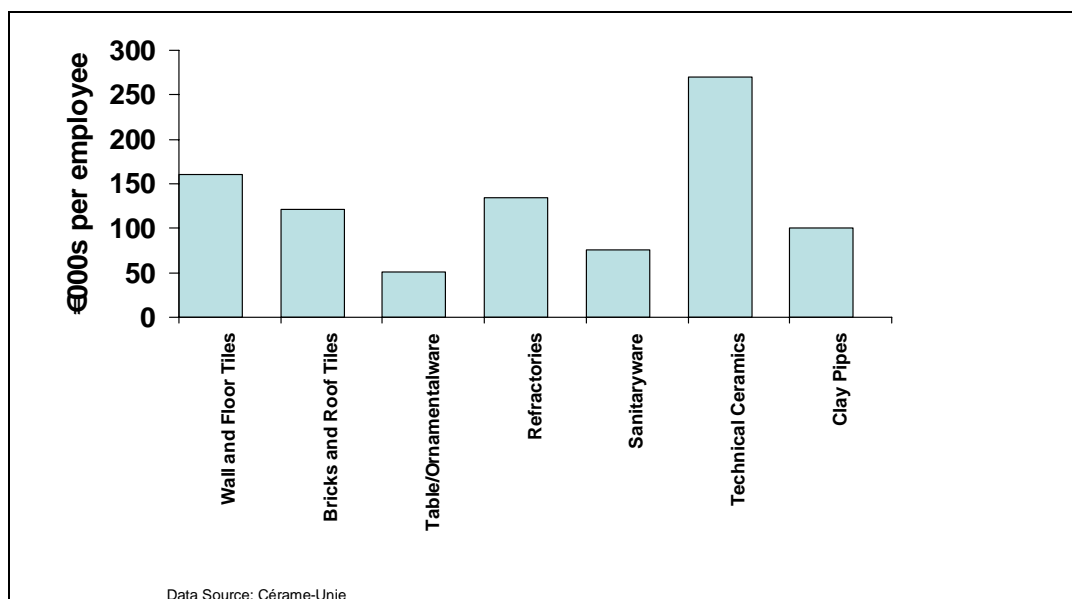
Sub-Sector	Sales (€ bn)		Employment (000s)	
	2005	2006	2005	2006
Wall and Floor Tiles	10.8	10.9	68	67
Bricks and Roof Tiles	6.6	6.8**	56	58**
Table / Ornamentalware	1.8	1.8	35	31
Refractories	3.3	3.5	26	26
Sanitaryware	2.0	2.2	29	28
Technical Ceramics	2.6	2.7	10	10
Clay Pipes	0.2	0.2	2	1

Note(s): * EU25 data, ** estimated. The data represent direct employment only. To estimate indirect employment, e.g. employment in industries that rely on ceramics as inputs and outputs from their production processes would require a detailed input-output analysis that is beyond the scope of this study.

Source(s): Cérame-Unie, 2007.

2.2.3 Productivity

Figure 2.5 Ceramics Productivity by Sub-sector (2006)



By taking the output and employment snapshot numbers for 2006, productivity (output per employee) is calculated and shown in Figure 2.5. Technical ceramics stands out as the highest productivity sector, while tableware and ornamentalware have an output-employment ratio some five times lower. It should be borne in mind that the figures shown here do not reflect the capital input that is often a large part of the production process.

2.2.4 Location and nature of key sector clusters

Tableware and ornamentalware

Production is concentrated in Saarland and Bavaria (Germany), Staffordshire (UK), and Portugal and one reason for this is that manufacturers are close to sources of skilled and experienced workers in what is a relatively high labour intensive sub-sector of EU ceramics (EC, 2007b). Cérame-Unie estimates indicate that Portugal and the UK are the largest producers, each producing 85,000-90,000 tonnes per year, and Germany comes close behind on around 75,000 tonnes. There is also production in the Netherlands and Luxembourg but on a much smaller scale (5,000-6,000 tonnes per year).

Sanitaryware

The most important producing countries in the EU are Germany (23%) and Italy (15%) followed by the UK (10%), Spain (9%) and France (8%). Combined these countries have a market share of 74%. In recent years, the general trend has been for southern European countries and new Member States in eastern Europe to increase their share of EU production at the expense of western and northern European countries.

Technical ceramics

EU technical ceramics firms produce a wide variety of products, based on clays and synthetic materials. Total sales in 2001 were estimated to be €2.5bn, while the volume of production in 2003 was estimated at 150,000 tonnes. The key producers in the EU are based in Germany, the UK, France and the Netherlands.

Vitreous clay pipes

Around 708,000 tonnes were produced in the EU15 in 2000. This was produced at 17 plants: eight in Germany, five in the UK, two in the Netherlands and one each in Belgium and Italy. The UK's five plants produced 209,000 tonnes while Germany's eight produced 208,000 tonnes. The one plant in Belgium produced 115,000 tonnes while the two in the Netherlands produced 102,000 tonnes and in Italy 74,000 tonnes.

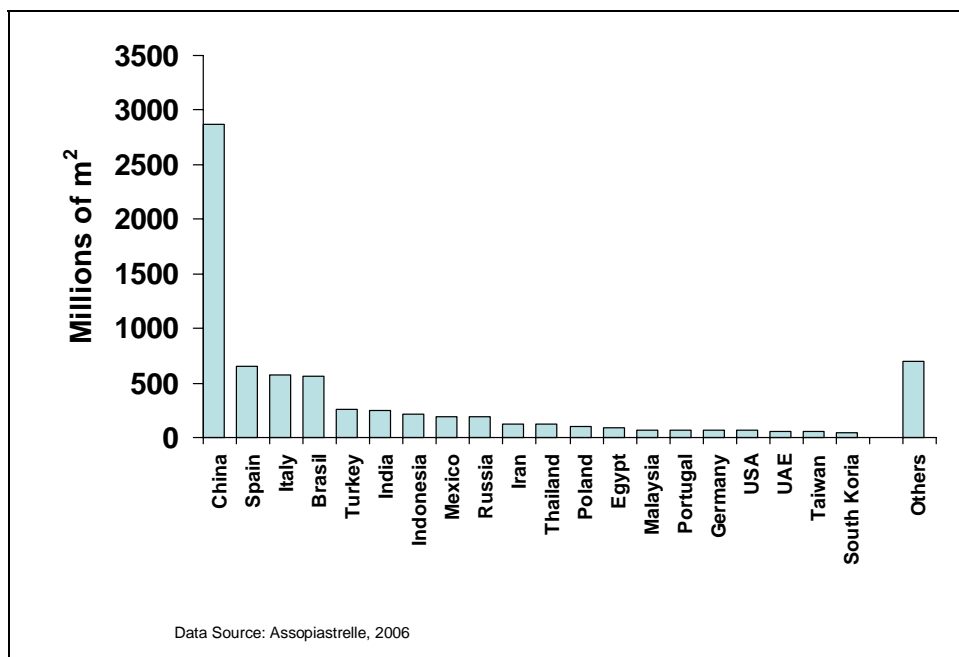
Refractory products

In 2001 total EU production of refractory products was 4.6 mt. The primary producers in the EU15 are Germany (1-1.5 mt) and Austria (on about 700,000 tonnes). Behind these two producers are France, Italy and Spain on 400,000-600,000 tonnes. Production on a smaller scale also takes place in the UK, Greece, Portugal and Scandinavia.

Wall and floor tiles

Europe has traditionally been a global leader in the production of ceramic wall and floor tiles. However, it was rapidly overtaken in the 1990s when China started to increase its production capacity from 300 million m² pa to 3 billion m² in 2006, to the point where China now dominates world production, as shown in Figure 2.4. Ceramic tiles production in Europe is mainly concentrated in Italy and in Spain. Italy is also the leading country with regard to the supply of technology and machinery for tile manufacturers. Production within the EU is geographically concentrated, especially in the Emilia Romagna region of northern Italy (Sassuolo/Modena) and in the Castellón region of Valencia in eastern Spain. There is also some production in Germany, France, United Kingdom, Ireland, the Netherlands, Portugal, Finland, and Sweden.

Figure 2.4 World Ceramic Tiles Production (2006)



Bricks and roof tiles

According to information obtained by the UK Competition Commission (2007b), 80% of bricks in the UK are sold within a 125 mile radius of the manufacturing plant. This means that brick and roof tile imports and exports are limited except in cases where producers are located close to borders; hence manufacturing is distributed amongst the vast majority of Member States. Also, differences in climate and culture around the EU are another reason for regionally located brick, block and roof tiles manufacturers.

Production of bricks and roof tiles occur in most Member States, however, the number of factories and intensity of production varies across countries. Italy has the highest number of factories, with 238, followed by Germany (183) and Portugal (150), while the likes of Belgium, Austria and Denmark all have less than 50. The number of employees per factory also varies from the UK and Belgium on 66 and 44 respectively to Denmark on 21. An analysis of production related to population shows that France has the highest roof tile production, with 0.89 m² per inhabitant in 2001, with Italy second on 0.61 m². For bricks and blocks the highest production ratio is in Belgium and Spain, with 0.29 m³ and 0.28 m³ per inhabitant respectively.

New Member States

Some of the new Member States of the European Union, such as the Czech Republic, Poland, and Hungary, have very strong ceramics sectors, and have traditionally exported to the EU. Hungary's biggest tableware producer for instance produces, according to EU competitors, some of the finest porcelain in Europe. However, not all ceramics producers are members of Cérame-Unie. Additionally, Cérame-Unie has no contact whatsoever with Latvia, Lithuania and Slovenia, so it is not known to what extent there is production of ceramics there. On the other hand, it is known that there is production of ceramic tableware in the Czech Republic, Hungary, and Poland, but producers in these countries are not (yet) members of the EU ceramic tableware federation. The largest share of

'ceramic and clay products' in any of the 16 Member States' economies (for which data are available) could be found in Hungary (33 %). Furthermore, Slovakia is one of the EU Member States specialised in ceramic and clay products manufacturing in value added terms (compared to the EU25 countries for which data are available).

2.2.5 Profitability

Given the high proportion of SMEs in the ceramics sector it is difficult to assess the profitability of individual manufacturers. However, in some sub-sectors, such as bricks and roof tiles, concentration is underway, and so performance figures are more publicly available. The tables below illustrates the turnover and profits of some EU ceramics producers.

Table 2.3 Profitability in the Ceramics Sector

Firm	Sub-sector	Turnover	Pre-tax Profit	Profit-to-Turnover Ratio (%)
CRH (2006)	Building materials	€8,939m	€814m	9.1%
Etex	Building materials	€1,863m	€192m	10.3%
Imerys	Minerals, including sanitaryware	€3,288m	€459m	14%
Marazzi Group (2006)	Wall & floor tiles	€964m	€97m	10.1%
Morgan Crucible Group (2006)	Refractory products, technical ceramics	€994m	€76m	7.6%
RHI (2006)	Refractory products	€1,336m	€110m	8.2%
Vesuvius (2006)	Refractory products	€1,110m	€131m	11.8%
Villeroy & Boch (2006)	Tableware and ornamentalware	€964m	€23m	2.4%
Waterford Wedgwood (2006)	Tableware and ornamentalware	€773m	-€189m	-
Wienerberger (2006)	Bricks and roof tiles	€2,225m	€277m	12.5%
<p>Note(s): Turnover and profit for Imerys and Etex is for their worldwide operations. Turnover for Imerys' European operations was €2100m but profit for European operations only is not available. Turnover for Etex's European operations only was €1,271m but profit for European operations only is not available.</p> <p>Source(s): Annual Reports and Accounts, company websites and CE calculations.</p>				

Table 2.3 presents turnover and profit figures for the larger firms in 2006. The figures indicate the great variation in the companies with regard to scale and profitability. At the top end CRH had a turnover of €8.9bn whilst Waterford Wedgwood generated revenues of just €773m. Profitability was equally diverse, with Waterford Wedgwood recording a loss in 2006, whilst Wienerberger had a profit margin of over 12.5% on sales of €2.2bn.

Table 2.4 Recent Trends in Profitability in the Ceramics Sector (selected)

Profit-to-turnover ratio (%)				
	2004	2005	2006	2007
Marazzi	16.8	10.1	10.1	9.2
RHI	8.7	7.9	8.2	8.5
Villeroy & Boch	2.5	1.8	2.4	3.5
Wienerberger	13.2	12.9	12.5	14.5

Source(s) : CE calculations using data from company accounts.

Table 2.4 presents profitability for a small selection of the larger firms across the sub-sectors since 2004. The falling profitability for Marazzi is indicative of the pressure the wall and floor tiles sub-sector is under from low-cost competition. Profitability at Villeroy & Boch is much lower and fell over 2004-06 before picking up slightly in 2007, indicating the smaller margins tableware firms have to operate with. As a proportion of turnover, profit at RHI has improved since 2005 but in 2007 it was still a little less than in 2005. Wienerberger, meanwhile, saw profitability come under pressure over 2004-06 before recovering in 2007. In the context of the slowdown in the EU construction sector that now appears to be unfolding margins for brick and tile firms are likely to come under further pressure, while a slowdown in manufacturing and the wider economy would put margins in technical and refractory ceramics under pressure.

2.2.6 Exports and trade

International trade is a significant element in the make-up of the European ceramics sector. The EU is a net exporter of ceramic products and roughly a quarter of EU output is sold on world markets (EC, 2007b) which is an indication that EU ceramics producers are very competitive in various world markets. Figure 2.6 below shows the vast range of export destinations of EU ceramics.

Low value-added versus high-quality ceramics

Ceramics with lower value added (eg bricks and roof tiles) are generally not exported long distances due to the high unit transport costs, hence exports consist predominantly of fine ceramics that are typically of high quality and added value, and of relatively low weight. The US is the most significant export market for high-quality ceramics producers, where over a quarter of EU output is sold. The majority of EU ceramic exports are wall and floor tiles, which originate primarily from Spain and Italy, as well as tableware, many of which are sold to the US.

Figure 2.6 Export Destination of EU Ceramics, 2005 (€m)

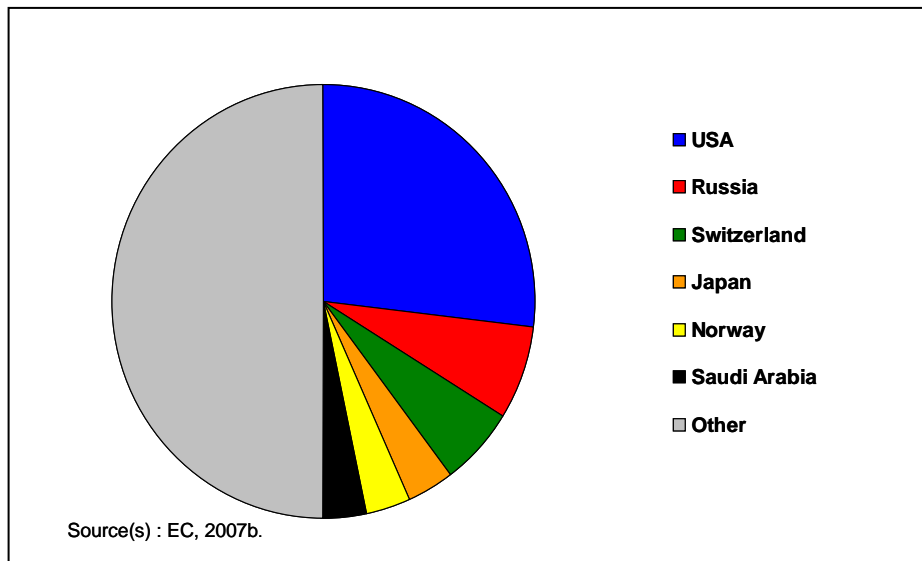
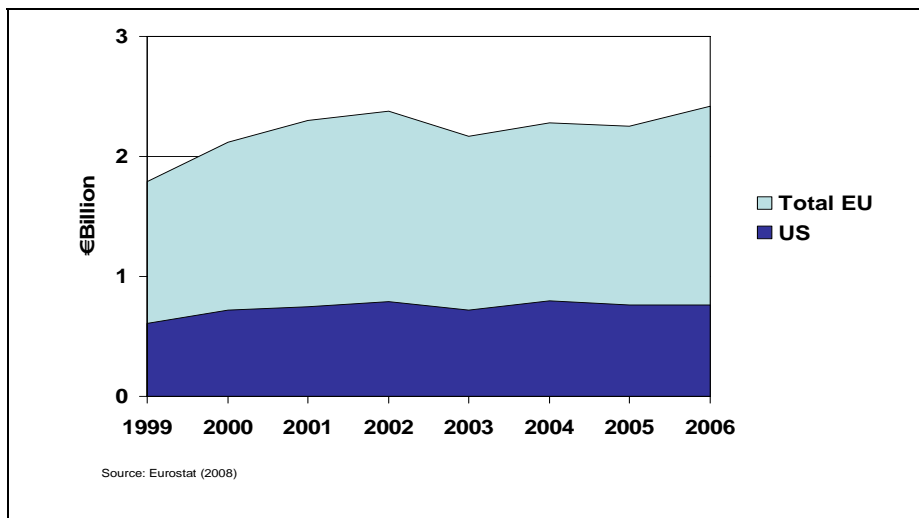


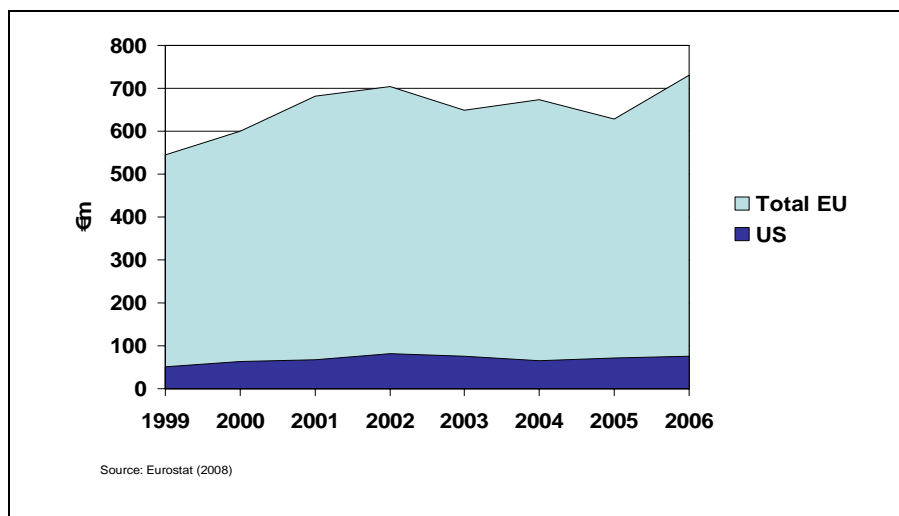
Figure 2.7 Exports of Ceramic Tiles



Refractory Products

Refractory products account for nearly a fifth of EU exports of ceramic products, 10% of which are sold in the US (EC, 2007b). A feature of EU ceramic exports is that although the majority of output is sold in the US, in nearly all sub-sectors output is also sold to a wide range of markets around the world.

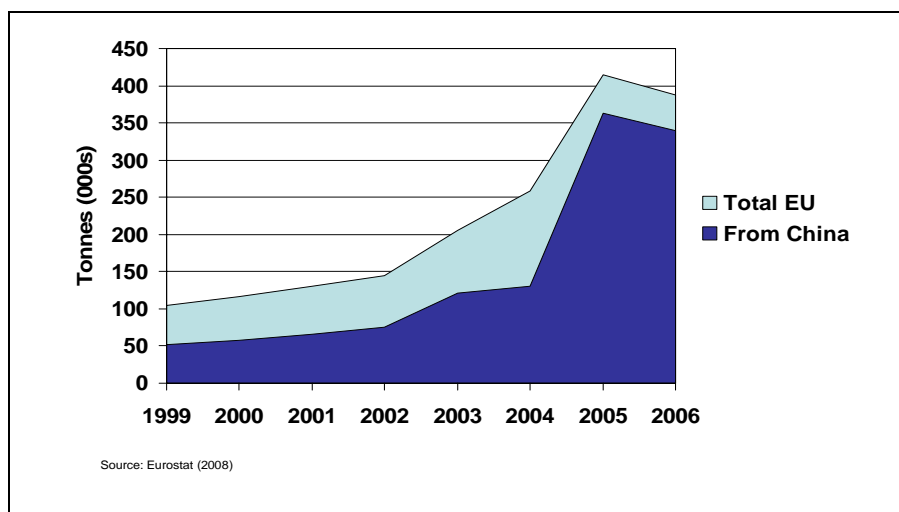
Figure 2.8 Exports of Refractory Ceramics



Tableware

Tableware is the most imported ceramic product into the EU, especially the relatively low-value ‘everyday’ tableware that is sent in high volumes (predominantly) from China. This has created a number of problems for competing EU ceramics producers which are discussed later. China dominates EU tableware imports, as shown in Figure 2.9, increasingly since the end of quantitative restrictions.

Figure 2.9 Import Volumes of Tableware Ceramics

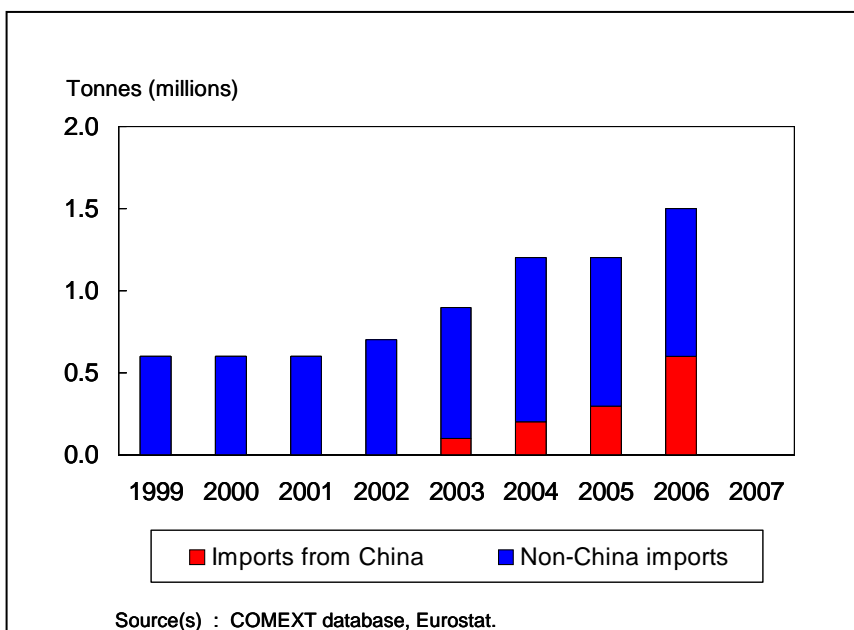
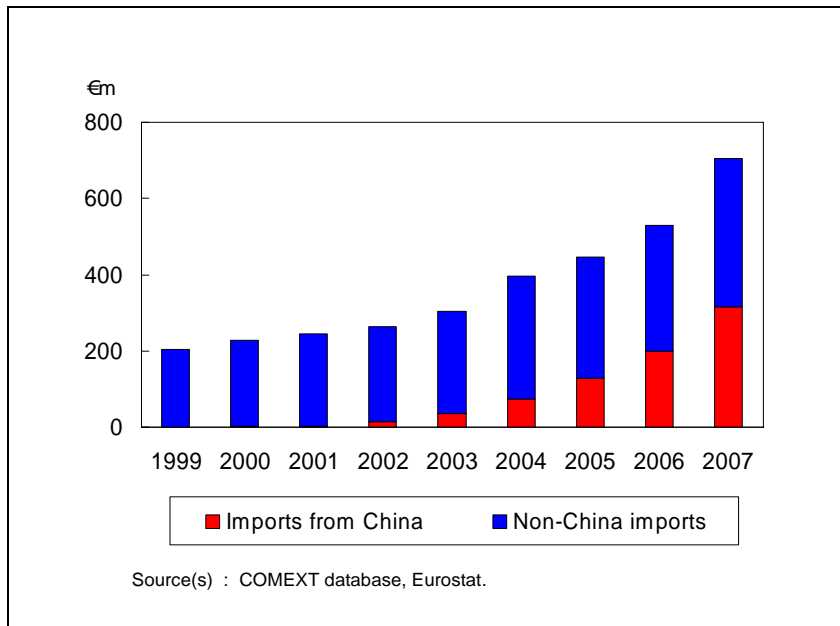


It is claimed that Chinese import figures are actually higher than documented as their ceramics items are routed via countries such as Hong-Kong (where there is statistically very little ceramics production) to maximise and bypass EU restrictions and further flood the EU market (EC, 2007b). There is also evidence of counterfeit Chinese tableware entering the EU that has been copied from the designs of EU ceramics companies or which use EU trademarks or origin marking, and are sold at a much lower price.

Ceramic tiles

Although the EU is a world leader in wall and floor tiles, in 2005 over 15% of total ceramics imports (EC, 2007b) were in fact wall and floor tiles, predominantly from China, where there has also been evidence of counterfeiting of EU origin tiles. In recent years the share of Chinese imports in total EU imports (by value) has surged from €1.5m in 2000 to €316m in 2007, and by volume from zero in 2000 to 600 thousand tonnes in 2006 (latest year available). Consequently, Chinese tile imports now account for around 45% of all EU tile imports by value and 40% by volume (for 2006).

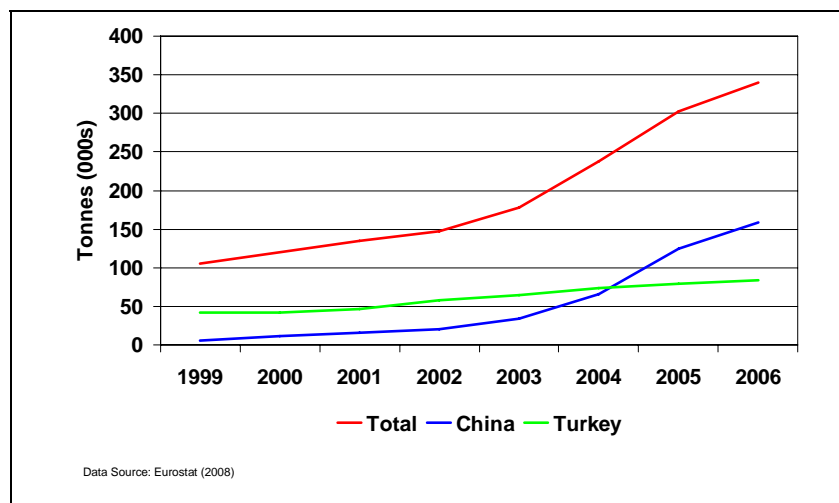
Figure 2.10 EU Imports of Ceramic Wall and Floor Tiles (by value and volume)



Sanitaryware

The sanitaryware sub-sector has also seen a rapid rise in imports from Non-EU countries. Imports have traditionally originated from Turkey, and other countries in close proximity to the EU, given the relatively heavy weights of sanitaryware ceramics. However, the relatively high weight does not appear to be stopping the Chinese from entering the import market, as shown in Figure 2.11.

Figure 2.11 Import Volumes of Sanitaryware Ceramics



2.3 Structure

This section examines the structure of the EU ceramics sector based on a review of a range of existing conceptual, empirical and analytical contributions that have been made about the sector. The first part of this section details some of the main EU ceramics producers and how the sector is dominated by SMEs. The second part identifies the main barriers to entry into the EU ceramics sector which shield it from new and existing competition. The third part considers the impact that international trade has on the EU ceramics sector. Import and export trends are traced, and the influences they have on competitiveness are examined.

2.3.1 Sector structure and size distribution of companies

EU ceramics manufacturers produce 23% of €120 billion world ceramics output, and, although there are some large firms, the sector is made up predominantly of SMEs (Cérame-Unie, 2007).

Italy and Spain are Europe's major producers of wall and floor tiles. Confindustria Ceramica, the association of Italian ceramic tile and refractory material manufacturers, suggests that Italy accounts for 43% of the EU's ceramic tile production. At the end of 2007 the Italian ceramic tile sub-sector reported a total turnover of about €5.8bn, of which €4.2bn came from exports. This turnover was generated from production totalling 547m m² of which 167.7m m² was sold in the domestic market of Italy and 379.4m m²

was exported. In 2007 there were just over 200 ceramic tile companies operating in Italy, operating some 300 factories across the country and employing approximately 28,000 people. The average size of an Italian firm in the ceramic tiles sub-sector is 132 employees. Spain accounts for around 45% of EU production. According to ASCER, the association of ceramic tile manufacturers of Spain, around 585m m² of ceramic tiles were produced in Spain in 2007. This translated into sales of €4.2bn of which €2.3bn came from exports and €1.9bn came from domestic sales. Production in Spain is concentrated in the Castellón region, which accounts for around 95% of total Spanish production. Valencia and Barcelona account for around 2%. In 2007 the Spanish ceramic tile sub-sector employed around 27,000 people directly and roughly 7,000 indirectly. Figures from ASCER indicate that Spain accounts for around 7¾% of global ceramic tile production and Italy just under 7½%.

In Italy, ceramic tile manufacturers are located in all regions of the country but are particularly concentrated in the “ceramic district” located in the provinces of Modena and Reggio Emilia, which accounts for a 78.6% of total production and is home to over 100 tile manufacturers and several other supplier and other client firms. The region accounts for around 19,000 of the 28,000 people employed by the sub-sector in Italy. There are also smaller clusters in the area of Imola and Faenza (almost 11% share of the Italian production), in the Veneto, Umbria and Tuscany regions and in the province of Salerno.

In the particularly concentrated area of Modena, production is comprised of medium to large firms with an average of around 182 employees per firm, against an average of 132 employees per firm in most other Italian clusters. In 2006 the ten largest Italian groups accounted for more than half (56.5%) of all sales of Italian tiles, with the top five accounting for about 45%. The production of other sub-sectors is geographically concentrated in Staffordshire (UK), Castellón (Spain), Saarland and Bavaria (Germany), Limousin (France), Aveiro (Portugal), and Maastricht (the Netherlands), though geographic make-up is changing (reviewed later in Section 3). The wide range of unique ceramics that are produced by SMEs is a key feature of the EU ceramics sector, and given their size some of them are especially vulnerable to cheaper imports and costs associated with pollution control.

The many small and medium sized firms which constitute the cluster are configured into consortia of suppliers, producers and market facing firms. There are five such consortia which pull together the various firms comprising the cluster into production systems. The consortia tend to be configured into hub and spoke type networks centred on a large firm which acts as the linchpin and coordinator. Despite this combining of firms and talents, many of these groups still operate several brands, rather than come under a single brand. As a result there is competition between and within these production groups. Nevertheless, this appears to embolden the cluster. The cluster also benefits from close collaboration with capital goods makers. The relationship is one of equals and very often it is the capital goods makers that drive innovation, by developing new technology which they set up in a tile production plant refine on-site. In return, the tile producer may be able to buy the equipment at a discount. And while the capital good firms are free to sell the equipment to whomever they wish, Italian producers do not seem to suffer. This is due to the tacit knowledge that exists and is transferred in the Sassuolo region, which allows Italian producers to continue to produce superior products.

The largest consortium centres on Marazzi, the biggest firm in the Italian ceramic tiles sub-sector, the largest producer of ceramic tiles in Europe and one of the largest producers for the US market through their subsidiary American Marazzi. Marazzi employs about 2,600 people in the Modena and Reggio Emilia cluster and in 2007 the company as a whole generated turnover of €984m and profit (EBITDA) of €174m.

Cooperativa Ceramica d'Imola is also one of Italy's largest ceramic tile producers. It employs about 2,250 people, has a turnover of approximately €390m (2007) and exports more than 70% of its product.

SMEs dominate the Castellón region, where engineering and innovation are key to the region's success. Around 75% of firms in Castellón employed 100 or fewer workers in 1998. Castellón was where the single firing process was developed and this formed the paradigm for future development of the sector: strong interaction between tile manufacturers, educational institutes and producers of glazing materials. The competitiveness of the cluster is driven by technological excellence and as such the role of engineers is recognised as paramount. The sectors in the Castellón cluster, and Spain generally, rely upon Italian equipment manufacturers – this is seen as a need rather than a weakness. Major firms include Porcelanosa, Roca Ceramica and Tauell. Zirconio employs around 500 workers at its 250,000m² plant in Castellón, which produces around 10m m² annually. Roca has an annual turnover of around €1.7bn and has plants in Barcelona and Castellón.

2.3.2 Extent and role of SMEs in sector

Some sub-sectors in EU ceramics are dominated by SMEs producing a wide range of items. However, in some cases, such as tiles, the recent trend has been for large corporate groups to buy or merge with SMEs. As such, some large corporate groups now own, and are represented by, a portfolio of SMEs. There is still a large number of SMEs in, for example, the tile sub-sector, where production is concentrated geographically in areas such as Castellón in Spain which is the base of over 200 ceramic tile businesses, mostly SMEs. In other cases, however, the SME brands & products may still exist, but the firm is no longer independent.

2.3.3 Key producers

The table below illustrates the ceramics producers with a major presence in the EU market.

Table 2.5 Key producers in the Ceramics Sector

Sub-sector	Producer	Country
Tableware and Ornamentalware	Lladro	Spain
	Mikasa	US
	Noritake	Japan
	Royal Doulton (Waterford Wedgwood)	UK/ Ireland
	Villeroy & Boch	Germany
	Wedgwood (Waterford Wedgwood)	UK/ Ireland
Sanitaryware	American Standard	US
	Ideal Standard	UK
	Kohler	US
	Jacob Delafon (Kohler)	France
	Roca Ceramica	Spain
	Sanitec	Finland
	Toprak Seramik	Turkey
	Toto	Japan
	Villeroy & Boch	Germany
Vitra	Turkey	
Technical Ceramics	CoorsTek	US
	Kyocera	Japan
	Morgan Technical Ceramics	UK
	NGK Insulators	Japan
Vitreous Clay Pipes	Hepworth	UK
	Keramo Steinzeug	Belgium
	Società del Gres	Italy
Refractory Products	Morgan Crucible	UK
	RHI	Germany
	Saint-Gobain	France
	Vesuvius (Cookson Group)	UK
Wall and Floor Tiles	Atlas Concorde	Italy
	Cooperativa Ceramica d'Imola	Italy
	Florin	Italy
	Grupo Ceramiche Ricchetti	Italy
	Iris Cermica	Italy
	Marazzi	Italy
	Pamesa Ceramica	Spain
	Porcelanosa	Spain
	Taulell	Spain
	Venis	Spain
Bricks and roof tiles	CRH	Ireland
	Hanson	UK
	Wienerberger	Austria

2.4 Conclusions

The EU ceramics sector is very diverse in terms of products, technology, and end-use, and serves a wide range of markets both in and outside of the EU. A key feature of the sector is that the majority of output is produced by a large number of SMEs that are better geared towards meeting regional demand, producing distinguishable and unique ceramic products, and targeting labour intensive high quality ceramic markets throughout the world. SMEs are especially dominant in the wall and floor tile sub-sector, where design uniqueness and creativeness and production flexibility are very important.

However, there are some sub-sectors within ceramics that are more concentrated. The brick and roof tile sub-sector in Europe (apart from Southern Europe) is dominated by large multinational firms such as Wienerberger that have a wide spread of production plants and products to meet regional demands. The brick and roof tile sub-sector is becoming increasingly concentrated due to the high volumes of brick production needed to earn economies of scale, to control soaring energy prices, and to gain access to raw materials. The clay pipes and sanitaryware sub-sectors are also highly concentrated.

A worrying trend is the increase in cheaper ceramics imports entering into the EU market, especially low-cost tableware products, which has adversely affected the EU's performance in some sub-sectors and has forced the closure of a number of EU ceramics manufacturers with associated loss of employment.

3 Competitive position of the sector

3.1 Introduction

This section elaborates the performance, trends, and competitive makeup of the ceramics sector using economic theory as appropriate. Particular attention is paid to identifying the business models of SMEs, and the effects that globalisation is having on competitiveness. The implications of barriers to entry are expanded, and a review is made of the competitiveness of main input suppliers to the ceramics production process.

As in the previous chapter, it should be stressed that, the figures for output and employment are from Cérame-Unie and they contain many estimates and are subject to a reasonable degree of uncertainty over their accuracy.

3.2 Performance

3.2.1 Developments in key product areas / sub-sectors

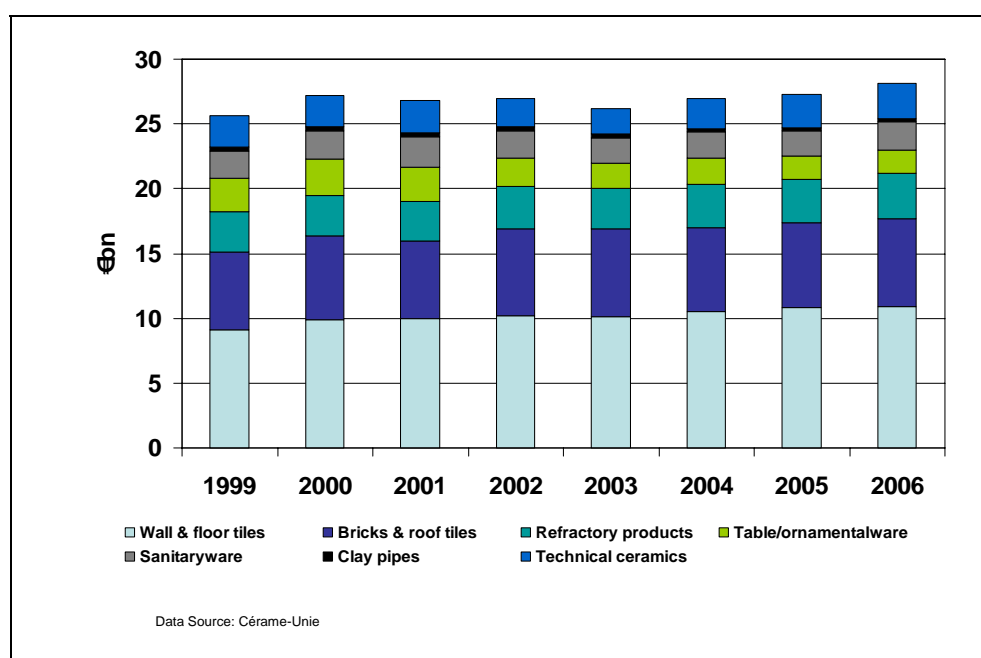
Output

EU brick and roof tile producers such as Wienerberger are world leaders in a range of brick and roof tile markets and have a strong presence in competitive economies such as the US and this is a sign of good performance. In terms of innovation the EU is a world leader in a range of sub-sectors. The fact that half of EU exports are in the form of wall and floor tiles and end up in a range of different countries illustrates that EU wall and floor tiles perform very well in world markets. Firms (both large and small) that produce wall and floor tiles are able to manufacture a wide range of unique high quality tiles that appeal to different market niches using innovative manufacturing methods, techniques and technologies. The EU is also a major player in the refractory products sub-sector, which is brought about primarily by high levels of innovation and associated high value ceramic products.

Given that roughly 20-25% of EU ceramics output is exported (EC, 2007b) a significant proportion of EU ceramics is still sold within the EU. A proportion of this is made up by coarse ceramics such as bricks that can only viably be sourced locally and are rarely imported. However, a significant proportion of fine ceramics, that are more easily transportable over long distances (and hence more susceptible to foreign import competition), is still produced and consumed within the EU. In the floor and wall tile sub-sector €10.8 billion of output was produced in the EU in 2005 (of which around €3 billion was exported) but only roughly €300 million worth of ceramics and tiles were imported into the EU (Cérame-Unie). This shows that the majority of wall and floor tiles ceramics

purchased by consumers living in the EU originate within the EU, and this is a sign of healthy competitiveness. However, this situation may change rapidly within the medium term, notably if imports from China continue to rise in the same proportion as currently. Indeed, from 2005 to 2006, imports from China in ceramic tiles increased by 150% (Source: China customs). Similar trends are observed in the refractory products sub-sector, where in 2005 €3.3bn of output was produced in the EU (of which about €1bn was exported) but only roughly €250m worth of refractory ceramics were imported (Cérame-Unie). The fact that EU consumers purchase the majority of wall and floor tile and refractory products from EU ceramics firms, and not from Non-EU sources, shows that generally EU ceramic products are more competitive than external manufacturers in these sub-sectors.

Figure 3.1 Ceramics production by sub-sector



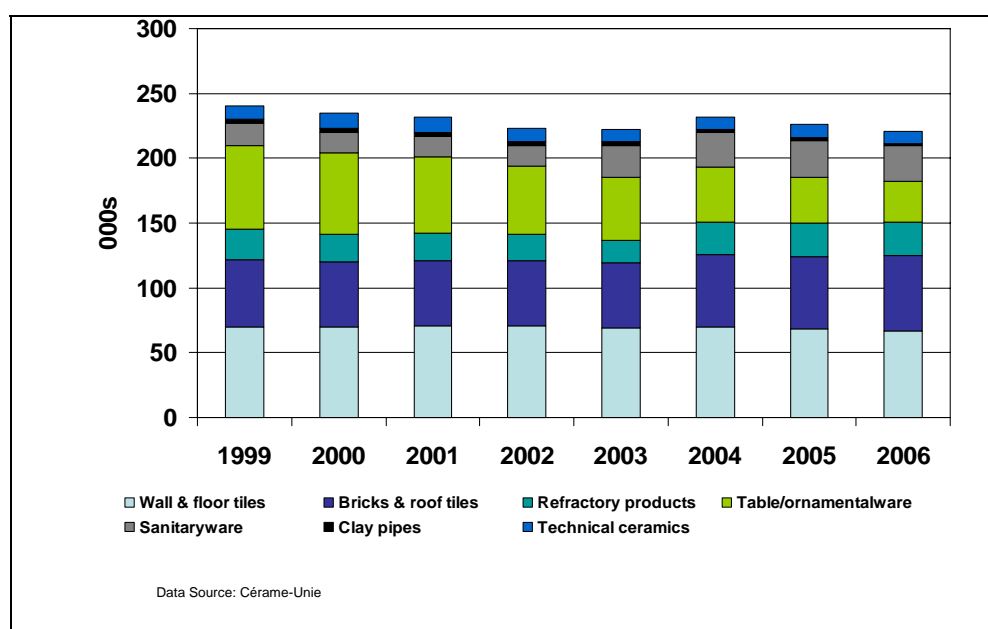
However, in the tableware sub-sector the performance of EU ceramics manufacturers is seriously deteriorating. In 2005, only €1.8bn of tableware was produced in the EU of which about €50m was exported (ibid). Production has declined significantly since 1999 but still over €1.1bn worth of tableware was imported in 2005 (ibid). There is a mix of factors that underlie this trend. Firstly, EU consumers are increasingly favouring Non-EU tableware ceramics that are comparable in quality but much lower in price than EU-produced tableware, and hence the competitive performance of the EU tableware manufacturing sub-sector is declining. Secondly, and related to this, lifestyle changes have meant that today's (younger) households are far less willing to spend money on expensive high-quality tableware, i.e. having a 'best set of china'.

In terms of value the EU is a net exporter of all ceramics products, which suggests that on the whole it is competitive in the global economy (especially given the relatively high tariff and non-tariff export barriers that it also faces), but unsurprisingly it performs better in some sub-sectors than others.

Employment

A more detailed review of employment trends by sub-sector reveals that some have suffered significantly greater employment losses than others. For instance, the tableware sub-sector has seen employment more than half since 1999, and this is attributed to a rapid increase in imports of comparable low-cost tableware from non-EU emerging economies. Employment in the wall and floor tile sub-sector appears to have started to tail off since 2002 and more significantly since 2005, partly in response to more challenging export conditions, and a similar trend is observed in clay pipes employment. However, other sub-sectors such as bricks and roof tiles and sanitaryware have seen employment increase, especially since 2002-2003 onwards and again this can be in part linked with the increase in demand for construction and renovations.

Figure 3.2 Ceramics employment by sub-sector



Productivity

Average labour productivity of EU ceramics manufacturers is shown in Figure 3.3 below where it can be seen that, on the whole, productivity levels have increased. This is primarily due to increased automation.

The technical ceramics, clay pipes, and wall and floor tile sub-sectors show signs of increased productivity, and this is attributed to the innovative nature of their products and the relatively high levels of Research and Development which is “conducive to boosting productivity” (EC, 2007e, p8). However, a closer inspection of productivity levels by sub-sector shows that not all sub-sectors have improved, as shown by Figure 3.4. Only technical ceramics has seen a significant improvement since 2000. In the other sub-sectors productivity has been largely flat or has dipped slightly. Productivity in technical ceramics has risen from around €200,000 per employee in 2000 to roughly €270,000 in 2006. The lowest productivity can be found in the tableware sub-sector and since 2000 this has risen only very slightly to €50,000 per employee. Productivity in the other sub-sectors ranges from around €75,000 to €150,000 per employee. The wall and floor tile sub-sector has the second highest level of productivity and over 2000-06 it has risen from

just under €150,000 per employee to just over €150,000. Productivity in the brick and roof tile and refractory products sub-sectors has fluctuated more than in other sub-sectors. After falling in 2004, productivity increased in both sub-sectors between 2004 and 2006 but it remained just below the 2000 level. Sanitaryware has seen the largest drop in productivity, with the level practically halving from around €30,000 per employee in 2000 to around €75,000 in 2006.

Figure 3.3 Productivity of the EU Ceramics Sector

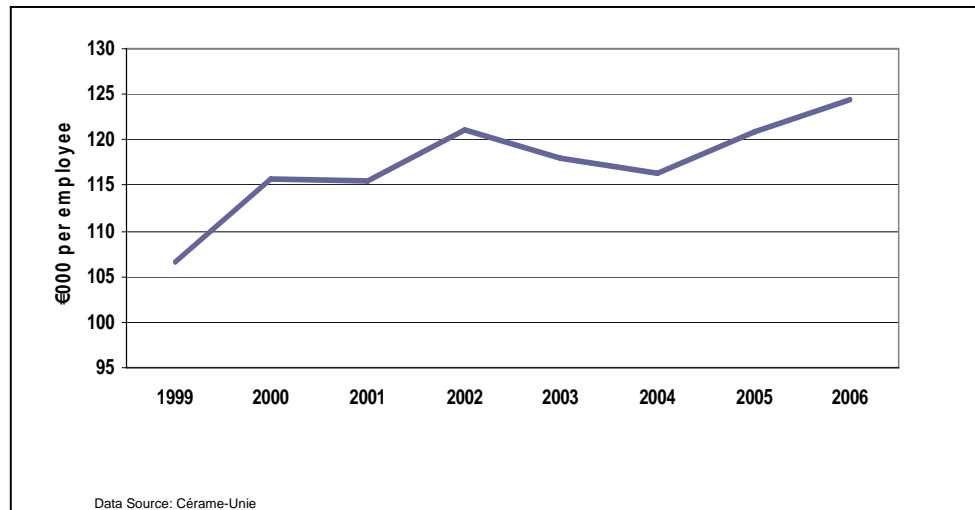
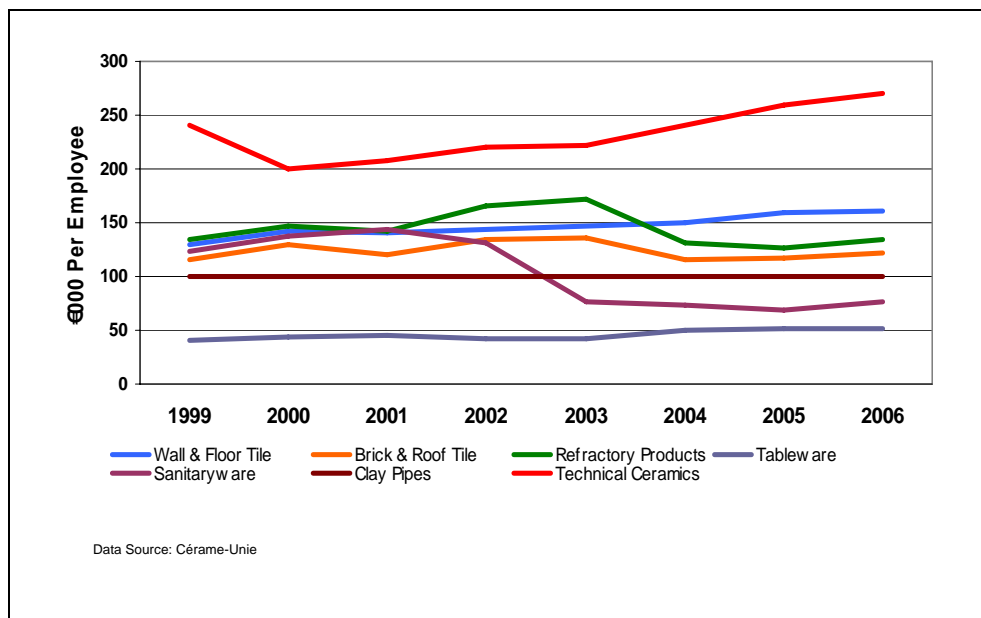


Figure 3.4 Labour Productivity by sub-sector

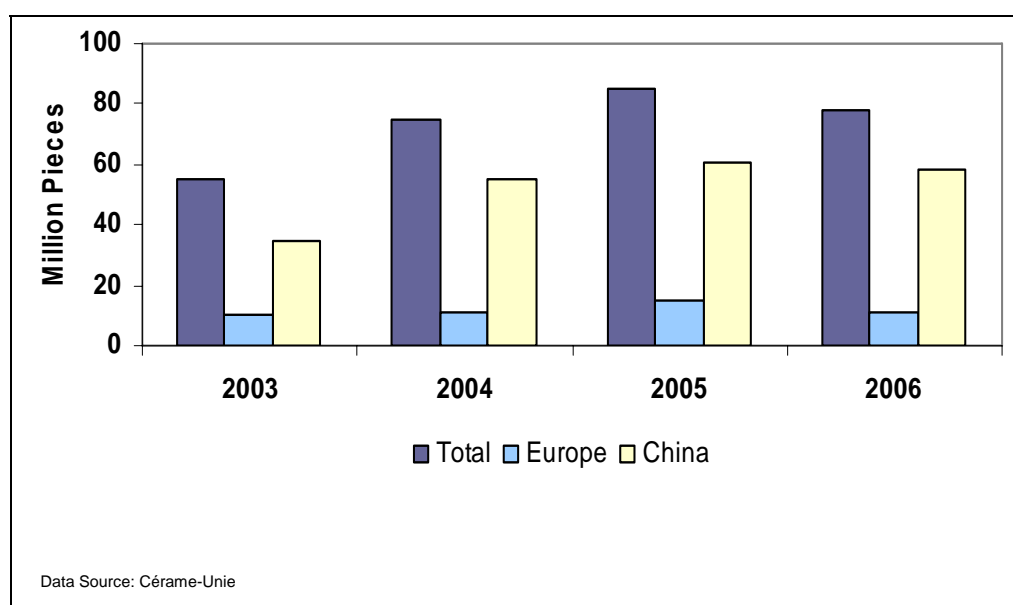


3.2.2 Developments in global market shares and relative prices of exports

As discussed earlier, the increase in comparable low-cost ceramics imports into the EU from emerging economies with ambitious global growth plans such as China has affected the distribution channels and competitiveness of EU manufacturers. Competitiveness has

been hindered further by the fact that in some cases industry believes that Chinese prices are fixed not in line with costs but according to Chinese currency needs (EC, 2007b). However, it is not just the presence of Chinese ceramics in the EU that is creating competitiveness challenges. Given the rapid growth of China's economy it is now a global player in many world ceramics markets - markets that the EU is also competing in. One example that can be used to illustrate this trend is China's increased presence in the lucrative US hotelware ceramics market. Traditionally the US has been a major export destination for EU hotelware ceramics, but in the past decade China has entered the market by flooding it with low-cost products. Figure 3.5 shows the high proportions of US imports that originate from Europe and China. It shows the rapid entry of China into the market and the competitiveness threat that it poses to European exporters.

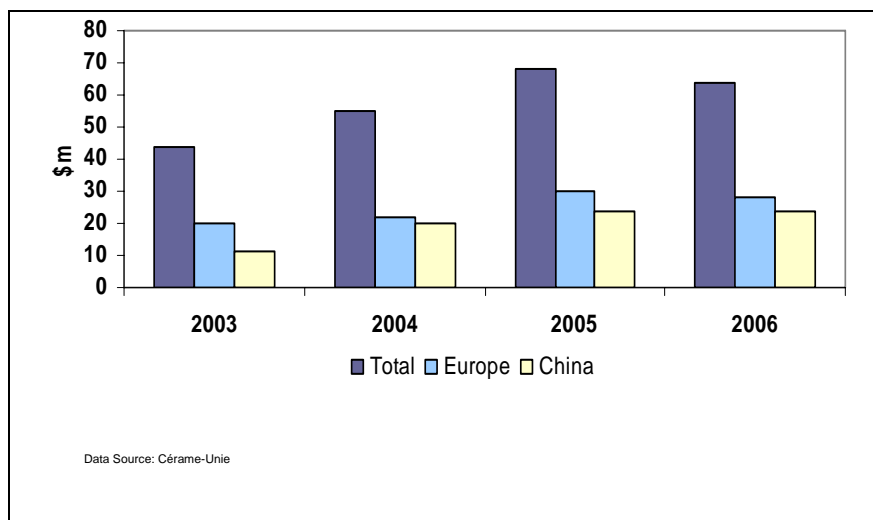
Figure 3.5 Origins of US Hotelware Ceramics Imports by Volume



3.2.3 Developments in terms of trade and relative product prices

Although China dominates US hotelware imports (and significantly overshadows European imports) in terms of *volume*, when the *value* of these imports is considered the EU is much more competitive.

Figure 3.6 Origins of US Hotelware Ceramics Import by Value

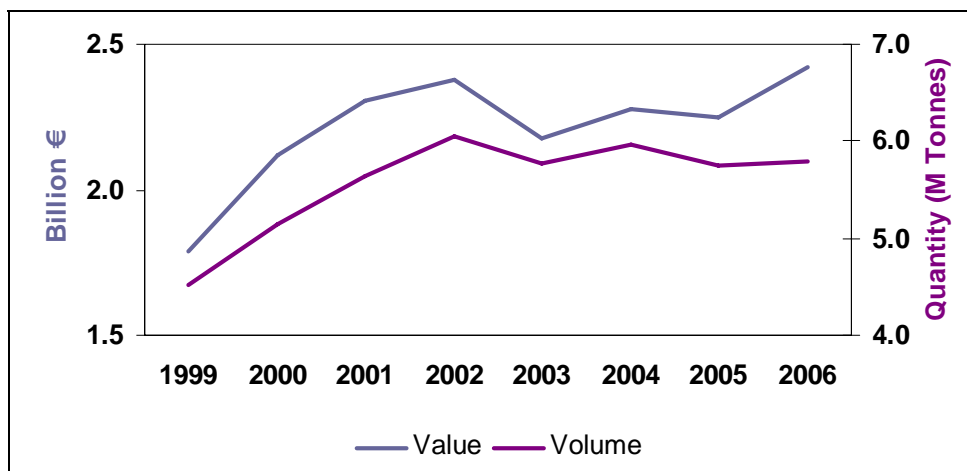


3.2.4 Developments in profitability and price-cost margins

The difference between value and volume of US imports illustrates that the EU has a competitive advantage in producing high quality value-added ceramics, which is a product of specialised SMEs pursuing differentiated production and marketing strategies. China, meanwhile, seems to be more competitive at producing ceramics with relatively low monetary values. From evidence in the hotelware sub-sector at least, it can be seen that the EU maintains a competitive advantage over China by competing on quality and uniqueness, and not on price. This is also true to an extent in other world ceramics markets. In the wall and floor tile sub-sector it can be seen that since 2005 (partly in response to an increase in the threat of Chinese tiles on world markets, counterfeited or otherwise), that whilst the volume of EU ceramic tiles appears to be steady, their *value* appears to be accelerating.

Again, this is a sign that EU tile producers are specialising in selling high quality ceramic tiles that are differentiated from low-cost alternatives and are increasing emphasis on selling high value-added ceramics; this suits the capabilities of SMEs. The EU is a major player in world markets, but it is not on a level playing field and this is hindering competitiveness. The EU continues to face high import duties into the US compared with countries such as China and Mexico. EU ceramics manufacturers are also faced with stricter pollution and Health and Safety regulations compared to those of world competitors and in some markets this translates into a loss of competitiveness.

Figure 3.7 Exports of Ceramic Tiles by Value and Volume



3.3 Structure

3.3.1 Identification of key players in the world market and their strategies

This section reviews the competitive makeup of the EU ceramics sector and the strategies adopted by different types of firms (especially SMEs), and how and why they are changing. Focus is aimed at highlighting the link between competitive advantage and strategy in the framework of economic theory. The role that globalisation, changing demand preferences, and emerging competition has on the success and strategies of ceramics producers is also examined.

In order to help to review the business models of EU ceramics manufacturers a framework of economic theory on competitiveness is required. In the Resource Based View of the firm put forward by Barney (1991), firms base their competitive strategy on their available unique resources and competencies. According to Barney (1991), firms will achieve a competitive advantage if their resources are valuable, rare, imperfectly imitable and non-substitutable. The Resource Based View is used to help to understand the strategies of EU ceramics producers.

Firm size

While the ceramics sector is heavily populated by SMEs, especially in the wall and floor tile sub-sector, there are some ceramics sub-sectors where large firms dominate. Conventional thought and evidence highlights the importance of SMEs in being creative and innovating, and driving the sector forward: ‘SMEs contribute greatly to the innovation system by introducing new products and adapting existing products to the needs of customers’ (OECD (2000), page 6). And as a result of their size, the internal organisation of SMEs tends to be simpler and this can imbue them with greater flexibility, allowing them to respond and adapt more quickly than larger firms (Aragon-Sanchez et al, 2005). However, to some extent this depends on the management structure in place and so this means larger firms can be very flexible and responsive too.

The creative approaches of SMEs to production and marketing in general are particularly appropriate to the ceramics sector. This helps them to offer unique and specialised ceramic products that are difficult to imitate, and target market niches. This is a key resource characteristic required to obtain a competitive advantage under the Resource Based View. Whilst many SMEs have successfully geared their strategies to supplying high quality ceramics based on their identified unique resources, globalisation has created a number of difficulties for EU SMEs. One of the greatest challenges has been the influx of low-cost substitutable (sometimes counterfeit) ceramics items that have been imported from emerging economies; tableware producers have been especially affected and many have ceased trading. Nevertheless, many SMEs in the EU ceramics sector are surviving by shifting to knowledge-based economic activities in order to remain competitive, and in many ways this suits the resources and strategies of EU SME ceramics manufacturers. Again however, this is not restricted to SMEs. Large firms also suffer from low-cost competition and imitation, so they too need to innovate and focus on higher-margin activities. The ability to innovate depends more on knowledge, competencies and management than size. In some cases SMEs need to work with large firms to fully exploit their knowledge and competencies. The increased competition that has come with globalisation has also led to shortening product life-cycles (Bonavia and Marin, 2006, page 513), supported by ever-changing consumer tastes and fashions. As a result ceramics producers are having to engage more with their customers and be more flexible across their activities. Those firms with a simpler internal organisation and greater flexibility are often in a favourable position to quickly respond to changing market conditions, and this can favour SMEs.

SMEs do not however, have the resources to compete in all ceramics markets. Large firms can exploit economies of scale better than SMEs in some areas such as purchasing, production or logistic. In the sub-sectors with lower margins, this favours larger firms which, in some cases, dominate the sub-sector as a result. Consequently, many SMEs position themselves away from these markets and the powerful players, and into other markets that better suit their unique resources highlighted above. At the same time, some large firms lack the flexibility of SMEs and so choose to operate in very specialised markets, and hence operate in markets that suit *their* resources. Porter (1996) identifies a strategy of 'trade-off' for large firms which restricts their ability to cover *all* markets. However, in some cases larger firms get round this by creating divisions or firms that specialise in niche markets or by buying one of the many SMEs in the EU ceramics sector that supply high quality, high value products to select markets. These SMEs are often in the best position to provide such items due to their superior resource capability. The relationship between SMEs and large firms can, therefore, be symbiotic rather than confrontational or competitive. Furthermore, the features classically assigned to SMEs as strengths are not exclusive to them. Large firms can be, or have the potential to be, just as innovative and flexible if they choose to and have the required competencies.

While SMEs define and drive some ceramics sub-sectors, especially in the wall and floor tile sub-sector, there are others where large firms play a more prominent role. The brick and roof tile sub-sector in North-Western Europe, for example, is served by some large firms and its structure is somewhat different to others such as the tableware and wall and floor tiles sub-sector because the raw material and product weight (and relatively low unit price of bricks) limits how far they can be viably transported. According to research by

the UK Competition Commission (UK Competition Commission, 2007a), its costs brick producers between €8 and €8 per thousand bricks to transport bricks from Belgium or the Netherlands to a port in the UK. Given the trend of increasing oil and fuel prices since 2005 this figure is likely to be even higher. This therefore limits how far a brick manufacturer can transport its products and hence large firms need to have a presence in a range of geographic markets to operate.

One problem that large brick and roof tile producers face is that the demand for bricks is volatile. As discussed in chapter two, the demand for bricks has fallen recently due to changes in housing demand and type. Also the demand for bricks is seasonal with March, June and September being times of peak demand, and December being the quietest time (UK Competition Commission, 2007a). The more volatile demand is, the harder it is for brick producers to manage capacity and be productively efficient as there is little flexibility in the utilisation of capacity, and output needs to be constantly high for economies of scale to be earned (*ibid*). Changes in demand have led to excess capacity in some brick and roof tile markets and ‘mothballing’ (the closure of least efficient plants), and this has stimulated further consolidation and resulted in a very price-competitive market.

3.3.2 Identification of potential barriers to entry and exit

Economies of Scale

Economies of scale occur when the long run average costs of the firm decline as output expands. In order to achieve significant economies of scale in production output needs to be on a mass scale and high labour and capital productivity is usually required. Many large EU ceramics producers are able to operate with low costs because they can earn significant economies of scale through high plant utilisation and large manufacturing units. In the brick sub-sector, a production level of 70 million bricks per year is required in order for economies of scale to be earned (UK Competition Commission, 2007a). Thus economies of scale place potential entrants at an immediate cost-disadvantage and act as a significant barrier to entry as new firms cannot earn the necessary economies of scale in the short term at least to be competitive. In order to obtain the required economies in production and to overcome this barrier, many ceramics manufacturers have outsourced production in Non-EU countries where major costs such as labour are lower (Hassard et al, 2001) and the prospect of earning economies of scale is higher. However, this is not an option for the many SMEs, especially in the tableware and ornamentalware sub-sectors.

Setup and Sunk Costs and Required Length of Investment

Following on from the economies of scale entry barrier above, high initial setup costs can also shield existing firms from new competition. In addition, according to Sutton (1991), the presence of sunk costs (costs which have been incurred and cannot be reversed) can influence the concentration of a sector.

According to information acquired by The UK Competition Commission (2007a) the cost of setting up a brick factory is between €50-70 million. The most significant sunk cost for ceramics manufacturers are kilns, which are costly and have a long average life, and

production technologies which have high initial setup costs. The fact that such costs could not easily be recouped in the event of failure can act as a significant deterrent to entry, assuming that it is not feasible to lease production facilities from another manufacturer.

There is also an element of risk involved with the purchase of a kiln as it is a very high, long-lasting investment, which makes it difficult to respond to short-term fluctuations in demand, and harder to comply with changing short and long-term legislation affecting energy use or emissions (EC Technical Update, 2006). Taking these factors into account, the new entrant has to be confident that it will be efficient enough in the medium to long term to produce output in a sector where emissions regulations are becoming stricter; otherwise the purchase of the kiln will not be economically viable. This high capital intensity and associated financial and economic costs and risks together act as a significant barrier to entry.

First-Mover Advantages and the Availability of Raw Materials

According to Istock and Hanson (two UK brick manufacturers) a 25 year clay supply is needed to justify investment in a new brick manufacturing plant (UK Competition Commission, 2007a), hence any new entrant needs to be in close proximity to a long-lasting source of this key raw material. The majority of such locations (in the UK at least) are already occupied by incumbents and they enjoy first-mover advantages for doing so, and this was one reason why Wienerberger acquired Baggeridge. Given that many of the ceramics sub-sectors rely on virgin raw materials and that ceramics are not infinitely recyclable, the geographical availability of raw materials can act as a significant barrier to entry – rising energy costs which feed into higher transportation costs have made this factor even more important in recent years. In this respect, locations of ceramic production near rivers confer great logistical advantage, as both the raw materials (clay) and the end products can be easily transported, resulting in positive economic and environmental effects. The fact that such clay reserves are scarce makes it more feasible for existing brick manufacturers to expand their current reserves. This puts incumbent brick manufacturers at a significant advantage compared to new entrants. In other specialised sub-sectors where raw materials such as metals have to be imported from abroad, bottlenecks in supply and inflated prices and tariffs can act as a barrier to entry for new firms.

In other sectors, such as refractory products, raw materials has become an extremely important issue as the vast majority of deposits required for production are located outside of the EU, eg in China, Russia and the US. Aside from the transport capacity and energy costs involved in having raw material locations well away from EU production sites, there is also the increasing problem of accessibility. China has installed a license system on the export of raw materials coupled with an auctioning system which threatens the availability of a sustainable supply as price becomes more and more uncertain. China has managed to gain control of many of the important raw material deposits – for example it controls up to 90% of the market for Magnesia Oxide, the most important raw material for high quality steel production, and 95% of the worldwide supply of Bauxite, the other most important raw material for general applications in the sector. Control of such a large proportion of available supply puts the refractory sector at extreme risk should China decide to favour its domestic producers and place even more stringent export quotas in force.

Legal Barriers, tariffs and non-tariff barriers

A significant legal barrier to entry into most large-scale sub-sectors of the ceramics sector is in the form of planning consent from Local Authorities. Even if the new entrant can locate the required raw material reserves, according to the incumbent manufacturers it can take up to 5 years to gain planning consent for a new clay quarry in the UK (Competition Commission, 2007a). This is one reason why incumbent manufacturers expand their current reserves rather than look for new sites. Also, Health and Safety legislation, environmental regulations, fiscal laws and competition policy are other examples of apparent legal barriers to entry.

An important parallel issue to consider here are restrictions to enter foreign markets, in the form of tariff and non-tariff barriers. Many export markets impose tariffs on EU produced goods. Arguably the most extreme example is the high rate of duty imposed on EU products (especially hotelware) that are sold in the US. The American Government imposes high tariffs on EU produced hotelware in the range of 25-28%, according to recent information based on the EC's Market Access Data Base and information from Cérame-Unie's members. Not only are EU ceramics producers hit by the high duty, but they are also disadvantaged by the fact that Mexico (which also exports ceramics to the US) has no import duty imposed on its products when they enter the US due to the North American Free Trade Agreement (NAFTA). These factors make it especially difficult for EU ceramics producers to compete in these protected markets and the fact that they continue to export such large quantities of ceramics output to the US with these tariffs in place is testament to the competitiveness of the EU ceramics sector. The second potential barrier to an EU ceramics producer wishing to sell its output outside of the EU is the existence of non-tariff barriers which in essence are any barrier to trade which is not in the form of a tariff. Quotas are one example of such a barrier where a home nation will limit the quantity of certain products that can be imported. Political relations can also act as a barrier to trade. There are reports of compulsory testing and certification schemes in export destinations such as Poland, before it joined the EU, but post-accession these issues remain in third countries such as Ukraine, Syria and Columbia. In a conference held in Brussels on 16 May 2007 regarding the principal challenges facing the European ceramics and glass sectors, it was implied that certification and testing is a virtual barrier to trade:

“The principal reason given for the introduction of such systems by most trading partners is the concern for public safety, which is presumably the reason why ceramic wall and floor tiles are the products most usually covered by them (but also some glass products). Industry feels, however, that the real reason is protection of domestic manufacture” (EC, 2007c, page 6).

Access to Markets and Distribution Channels

Even if the new entrant can somehow overcome the barriers to entry above, it must still be confident that there is room in the market for its new capacity. In the brick sub-sector manufacturers have had the problem of over-capacity as the demand for bricks has fallen. The new entrant would also be disadvantaged by the brand and customer loyalty of other established manufacturers. In sub-sectors where ceramic products are relatively heavy

and the unit transport cost is high, a new entrant may be limited to where it can set up its manufacturing plant, especially if it also needs to be close to its market.

High Energy Intensity

The relatively high energy-intensity of ceramics manufacturing, and energy price inflation and volatility, can act as a deterrent to entry. High short to medium term energy prices may lengthen the time that it would take a new entrant to earn economies of scale, giving it a cost disadvantage against established incumbent ceramics manufacturers, thus heightening barriers to entry.

The relatively high energy-intensity of ceramics production also means that a considerable amount of air emissions are produced, especially from the burning of various fossil fuels to heat the firing process. CO₂ is the main gaseous emission, along with compounds of fluorine and depending on the type and characteristics of raw materials used, quantities of nitrogen and sulphur dioxide are also released into the atmosphere. Another significant form of waste are the VOCs that are released into the air during the high temperatures of the firing process. Water is a major raw material in ceramics production, especially during the shaping and glazing stages, and this produces 'sludge' at various points in the production process. Whilst much of the water used in shaping evaporates relatively harmlessly into the air during the drying process, all of the water used in the glazing process does not. This results in process waste water that is chemically contaminated, and its re-use in production restricted due to variation in its chemical content (EC, 2007a). Energy intensity, and links to the Emissions Trading Scheme (ETS) as a horizontal condition is examined more in Chapter 4.

Macroeconomic Uncertainty

The final barrier to entry which applies to almost any sector is macroeconomic uncertainty. Uncertainty over inflation, interest rates, currency values, energy prices, political relations, stock market performance, house prices, credit availability and employment rates all potentially increase the barriers to entry into the EU ceramics sector.

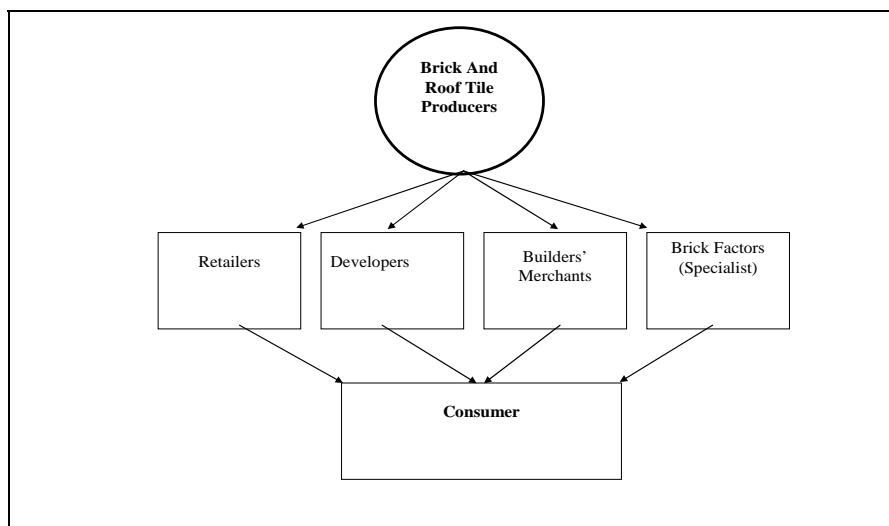
The current macroeconomic environment is one of particular uncertainty surrounding trends across Europe. As a large part of ceramics production is in effect a derived demand from the construction sector, prospects tend to be linked quite closely, and the construction sector is currently entering a downturn period in many countries (eg the UK, Spain and Ireland) following a boom period for residential property markets in the early part of the decade. While a cyclical downturn, as is now being experienced in virtually all Member States across Europe, is detrimental for most sectors, there are features of the current downturn, such as liquidity issues in the housing market, which make it likely that the construction sector could suffer more than most, and this is likely to have a knock-on effect to domestic demand for ceramic products.

3.3.3 Market structure of suppliers and customers

Traditionally the reason for the geographical clusters of ceramics manufacturing identified above was the close proximity of raw materials, and fuel and labour supplies,

and in some sub-sectors this is still the case. Many large brick manufacturers in Northern Europe are vertically integrated. For instance, many brick producers are also clay extractors and one motive for Wienerberger's acquisition of Baggeridge was to have greater control over clay supplies. As discussed earlier, the brick and roof tile sub-sector is influenced by the demand for construction (new builds and renovations) and has four core distribution channels (see Figure 3.8 below)

Figure 3.8 Distribution Channels in the Brick and Roof Tile Sub-sector



In each of the channels prices are formulated by negotiation, and each distributor (especially UK housing developers that are highly price elastic and are also in the process of consolidation) will source brick supplies from a range of suppliers leading to high competitiveness. According to Baggeridge (before it was acquired) there is an increased trend for direct selling via retail outlets such as DIY superstores (*ibid*).

More recently in other sub-sectors of ceramics, manufacturers have moved to new locations that are closer to markets (EC, 2007c). Being nearer to markets reduces distribution costs in a sector where transport can account for up to 10% of total costs (UK Competition Commission, 2007a), and in the case of SMEs allows them to create close relationships and feedback systems with buyers. Being nearer to markets also allows SMEs to adapt quickly to changes in tastes and fashions and hence they are able to accurately gear their products to demand in what is seen as a very dynamic sector (Rowley, 1996). It also allows them to keep up to pace with changing manufacturing techniques and technologies. The depletion of some raw materials within the boundaries of the EU has forced ceramics manufacturers to import raw materials, hence to an extent manufacturers can be more flexible in their choice of manufacturing location and they no longer necessarily need to locate near to traditional sources of raw materials.

The advancement of ICT and especially the internet has supported the development of SMEs' role in the ceramics sector. Principally, they help to support and strengthen existing relationships by improving access to (and for) customers and suppliers, and speeding up transaction, production and delivery times (and reducing costs). As a result the firm can typically be more flexible and is more able to meet clients' needs on both sides of the supply chain. In addition to this, the internet and ICT have been used by

some SMEs to help them access new markets and/or clients (typically customers). These technologies can “facilitate global reach” for SMEs and help to offset the disadvantage of scale economies which small firms face in all aspects of business (OECD, 2000, p1). The internet offers the potential for some SMEs to cost-effectively reach (on a global basis) specialised niche markets that might otherwise be shielded by barriers to entry and this creates new opportunities for SMEs.

3.4 Processes

3.4.1 Nature and developments in external economies of scale for products, skills and knowledge

There are a number of reasons why productivity might have fallen in certain sub-sectors. ACTD (The Association for Ceramic Training and Development) note that “skill shortages, skill gaps and recruitment difficulties have been giving some concern for the ceramics industry”. There are reports of recruitment problems in the brick sub-sector due to the seasonal demand for bricks identified in Section 2. ACTD argue that the current labour supply lacks the flexibility required to operate productively in a sector that is consumer driven, and requires fast turnaround from design to manufacture to meet changing and varying customer demands and preferences. This flexibility in production is especially important for SMEs that centre their strategies around targeting niche and opportunistic markets, and serving them rapidly. This is especially important given that differentiated ceramic producers are increasingly seeking to customise the goods on offer and reduce delivery times (Bonavia and Marin, 2006). According to ACTD, some ceramics sub-sectors (such as tableware and ornamentalware) have the problem of an ageing workforce and that as technology advances more skilled younger workers are required to improve levels of flexibility and responsiveness. ACTD states that attracting “technically competent employees” is a problem (especially graduates) and that image problems with the ceramics sector and its perceived volatility are deterring new people from working in the sector. In the future, if the EU is to continue to maintain its value-added competitive advantage in the world ceramics sector through innovation and product quality, a highly skilled and flexible workforce will be required.

3.4.2 Production processes

“The European ceramics industry has to invest in high-quality production processes, logistics systems that guarantee fast delivery, and the development of innovative products in order to keep its market share” (René Erven, European Ceramic Work Centre)

The use of automation technology is widespread in ceramics manufacturing, usually to perform tasks that would otherwise be performed less efficiently by labour. “The majority of companies in the sector, including the SME companies, have invested heavily in new technologies including new automated casting and decoration equipment” (EuroCERAM). This is not only to reduce long term costs, but it is also used to increase production flexibility in an increasingly consumer-orientated sector.

New technologies are also used to improve quality and to create unique ceramics products for specific differentiated markets. Spain is the world leader in supplying glazing machinery technology that gives SME ceramics manufacturers “the advantages they need to offer a service that is flexible and perfectly adapted to the needs of the ceramics industry” (ICEX, page 1). The close geographical proximity of ceramic wall and floor tile producers identified in Section 2 fuels continuous product and process improvement as news about innovations spreads quickly (Bonavia and Marin, 2006), and this high innovation intensity increases competitiveness. Again, in Spain innovation is increasingly the key source of competitive advantage in the wall and floor tile sub-sector in response to new competition:

“The constant advances of ceramic producing countries with much lower cost bases than Spain has made it essential for the Spanish sector to differentiate itself through design, quality and innovation” (ICEX, page 2).

3.4.3 Cost and availability of supply of energy

Energy intensity varies by ceramics sub-sector or product, but it can account for over 30% of production costs, so any fluctuations in energy prices can have a significant impact on overall cost levels. The chief source of energy supply for ceramics manufacturers is natural gas and the reasons for this choice boil down to cost, ease of control, lack of required storage space, high purity and low sulphur dioxide emissions (IPPC, 2001). The cost of energy has soared in recent years, and this has created serious problems for the EU ceramics sector, and many other energy-intensive sectors. The rise in energy costs is shown below and refers to industrial tariffs.

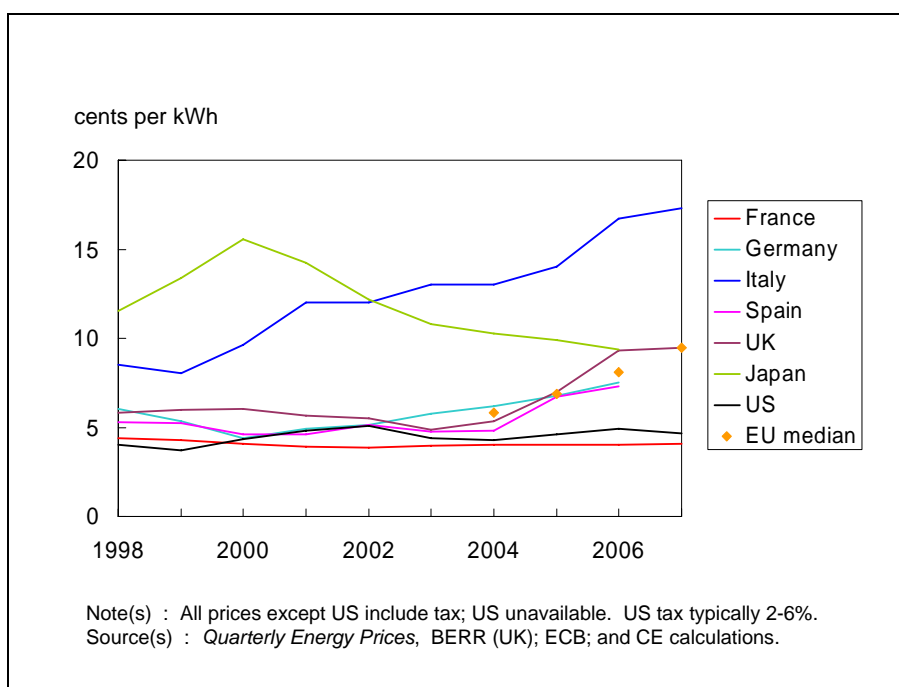
Section 2.5.2 discussed industrial energy prices in 2006. It indicated that while median electricity and gas prices in the EU were 8.1 cents and 2.2 cents respectively, there was great variation in prices across Member States. Median EU prices compared unfavourably against US prices but favourably compared to prices in Japan. The charts below present recent trends in industrial gas and electricity prices in the major EU producers along with the US and Japan.

In broad terms, the charts show the sharp rise in energy costs experienced by the ceramics sector in recent years. The median electricity price increased by 64% between 2004 and 2007 while for gas it increased by 50%, although the median gas prices eased very slightly in 2007.

Looking at electricity prices first, it is important to note that the figures in the chart for the US are excluding tax (all other series include tax), due to difficulties with collection. However, the tax rate in the US is typically 2-6% and at 6% US industrial electricity prices are in the range of 4-5.5 (euro) cents per kWh. One of the interesting features of the chart is the relative stability of US and French prices. In the case of the US the variation in price since 1998 has been less than 1.5 cents, in France it is less than 0.5 cents. In Japan the price has fallen substantially, falling from around 15 cents per kWh in 2000 to just over 9 cents per kWh in 2006 (2007 figures not available). In contrast to the stability of prices in the US and fall in prices in Japan, the median EU price for electricity

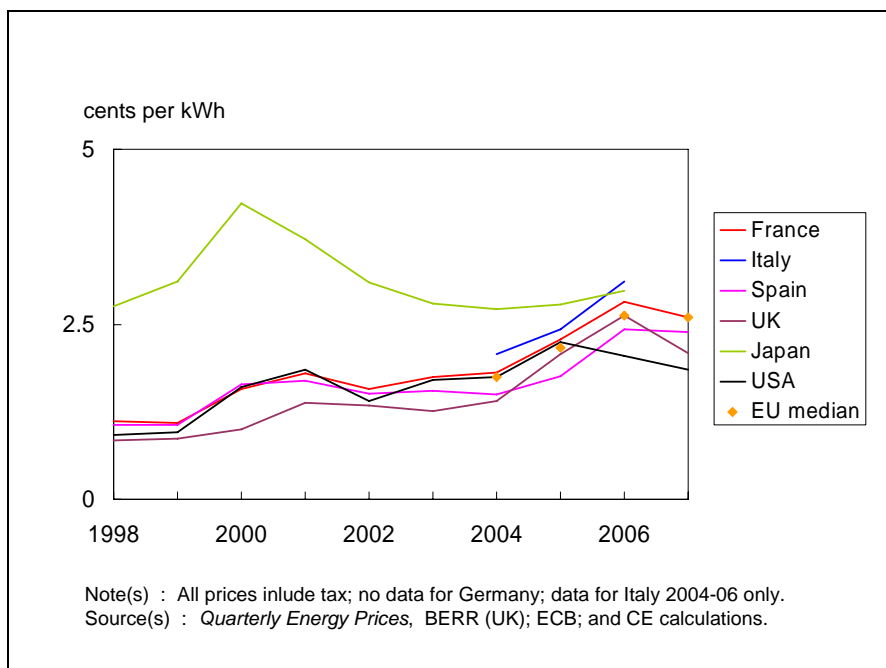
has shot up, from just over 5 cents per kWh to just under 10 cents per kWh, putting EU producers at a relative disadvantage. While price in France is both low and stable, this cannot be said for every Member State. Italy, for example, not only has one of the highest prices in the EU but industrial electricity prices there have risen by almost 80% since 2000. The UK enjoyed relatively cheap electricity until 2004. Italy and the UK, however, have seen strong rises in electricity prices over 2004-07, with prices in the UK almost doubling and prices in Italy increasing by around a third. Thus, there is great variation in the level of prices in the EU and their stability. While the EU compares favourably against Japan, it does less well against the US.

Figure 3.9 Annual Industrial Electricity Prices



With the exception of Japan (4.2 cents per kWh), gas prices in all the countries presented were 1.5-2 cents per kWh in 2000. Since then, prices have fallen in Japan and risen in the other countries. Prices in Japan did pick up slightly in 2005 and 2006, but they remain considerably lower than in 2000. Gas prices in the US have moved much more in line with EU prices than in the case of electricity, rising from 1.6 cents per kWh in 2000 to 2.3 cents in 2005 before falling back to 1.8 cents in 2007. EU prices were broadly flat or rose slightly between 2000 and 2004, but after 2004 prices rose more steeply. In France, for example, the prices rose from 1.8 cents per kWh in 2004 to 2.6 cents; in Spain it increased from 1.5 cents per kWh to 2.4 cents; and so the median price for gas in the EU has risen from 1.7 cents per kWh in 2004 to 2.6 cents per kWh in 2007. There is much less variation in gas prices across these countries, and they all seemed to experience the same surge in prices over 2004-07 (although much less in the case of Japan). The EU compares favourably against both the US and Japan, although one concern is that US prices have eased back since peaking in 2005 while the EU median has not and was 40% higher in 2007.

Figure 3.10 Annual Industrial Gas Prices

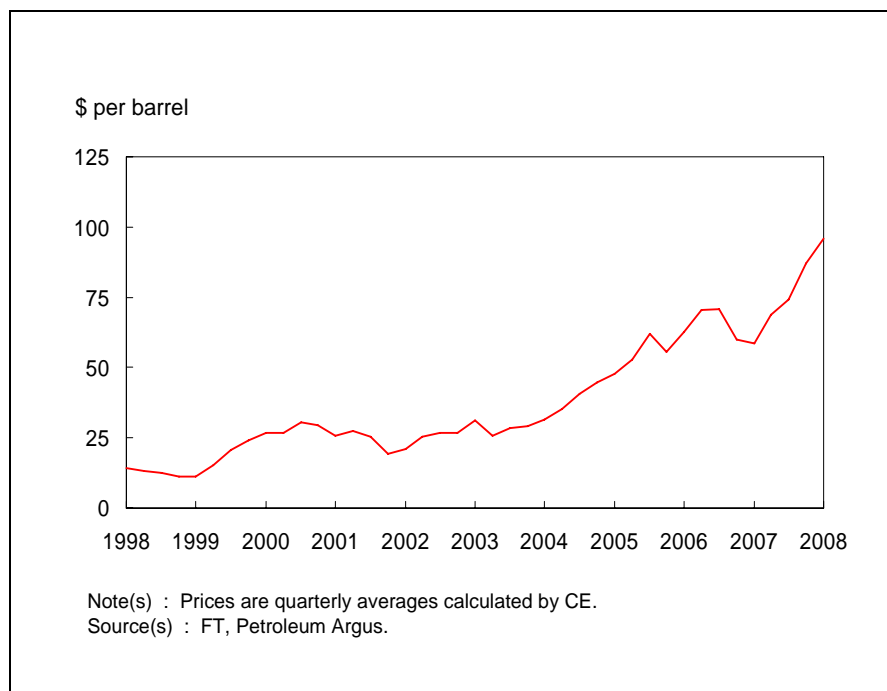


The recent changes seen in gas and electricity prices mirror to a large extent the trend in the price of crude oil (see chart below).

The price rose steadily between 2000 and 2004, from around \$28 pb to about \$38 pb and then surged over 2004-07 to reach an average of \$72 pb in 2007. The trend has continued, with the price of oil breaching \$100 pb in the first half of 2008 and reaching almost \$150 at one point. A consequence of this is that energy costs are likely to account for a far larger share of operating costs than the roughly 30% estimated a few years ago.

The dramatic increase in energy prices, coupled with environmental legislation discussed above, has emphasised the need for ceramics producers to improve efficiency and reduce the energy required to produce ceramics, and the carbon dioxide produced in the process. As discussed earlier, kiln technology is at a mature stage and in the short term reducing energy intensity is a major challenge for the ceramics sector.

Figure 3.11 Crude Oil Price (Brent Crude), 1998 - 2008



There have been a number of calls from the ceramics sector and other energy-intensive sectors to liberalise competition in energy markets, and encourage new entry in a sector that is dominated by established incumbents with significant market power. Neelie Kroes, member of the EC in charge of competition policy (EC Press Release 06/159, 2006), identifies five ‘obstacles to competition’ in energy markets as, market concentration, vertical foreclosure (long term contracts restrict new entry), market integration, lack of transparency and price formulation (the prospect of anti-competitive behaviour). These factors contribute to the soaring energy prices that are added straight to the bottom lines of EU ceramics producers’ cost bases. One concern is that:

“In the short term, if gas prices keep rising, the ceramic sector will have no choice but to raise end product prices, with the ensuing loss of competitiveness” (EuroCERAM).

There are also concerns about the future supply of gas to the EU, given that most of it is imported from Non-EU countries such as Russia as North Sea gas production declines. This has the potential to undermine the competitiveness of EU producers against non-EU producers, and diminish the competitiveness of the EU as a whole. Particularly in some new Member States, if industrial energy costs are raised to European market levels, the shock to companies is likely to be debilitating in the short term, especially for small companies.

3.4.4 Raw materials and additives

Feldspar, Calcium Carbonate, Kaolin, Silica, Talc (a hydrated magnesium silicate), Vermiculite, Wollastonite and Borates are some of the minerals used in ceramics manufacture. The producers of industrial minerals operate more than 810 sites throughout

Europe and supply a variety of inputs to EU ceramics manufacturers. In addition many producers of coarse ceramics (bricks; refractories) excavate their own raw materials. Given that raw materials account for around a fifth of total ceramics manufacturing cost (EC, 2006), any volatility in input prices has a marked impact on overall production costs and competitiveness. EU ceramics producers have been faced with increased raw material costs given that generally “the specific characteristics of some minerals makes them particularly sought after” (EC, 2007d page 15) not just by ceramics producers, but also by other sectors requiring the same raw materials. Given the shift of fine ceramics manufacturers to locations that are nearer to markets and away from traditional sources of raw material (identified earlier), and greater specialisation of SMEs leading to more diverse raw material needs, more and more raw materials are being imported into the EU (EC Technical Update, 2006). According to GHK (2007) EU ceramics manufacturers imported €40 million worth of raw materials in 2005. Clearly, a reason for the rise in the imports of raw materials is their cost, as many manufacturers have had to strive to become more efficient to contend with new competitors.

3.4.5 Developments in international technology efficiency, with special emphasis on reducing greenhouse gas emissions

Another important use of technology in the EU ceramics sector is in energy efficiency. Over the past decade, considerable effort has been put into improving energy efficiency in all of the stages of ceramics production, especially in light of soaring energy costs.

Figure 3.10 shows the main energy inputs in the production process, and that any gains that can be made in energy efficiency can be fruitful both for the ceramic manufacturer’s costs, and the environment. The Carbon Trust (1998) estimated that 30% of the energy consumed by UK ceramics was used in the drying stage of the manufacturing process, and that “simple, good housekeeping measures” could reduce this figure to 10%. New technologies and innovations have helped to reduce energy intensity as Figure 3.11 shows. Improvements in dryer technology and use, and innovations in kiln insulation and heat re-use have contributed to decreasing energy consumption levels.

Figure 3.12 Main Energy inputs into the Ceramics Production Process

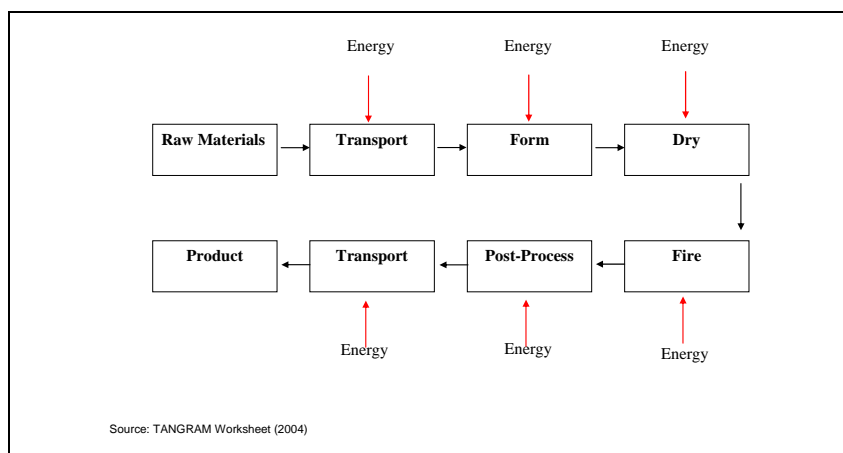
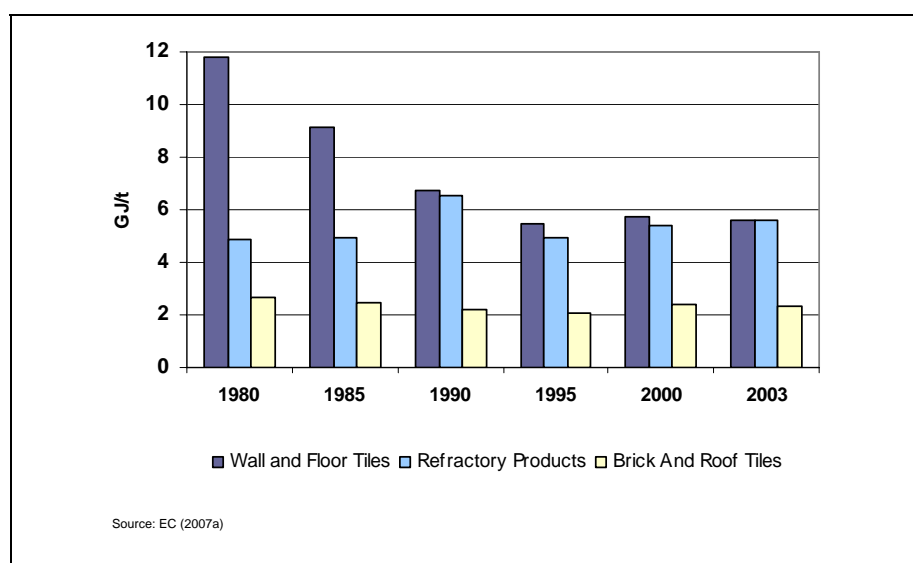


Figure 3.11 shows that in the wall and floor tile sub-sector, energy consumption has fallen by up to 50% since 1980. Given the rate of the decline in the wall and floor tile sub-sector, while other sub-sectors may have limited room for manoeuvre, the ceramics sector is reaching its optimum thermal efficiency. This limits the ability of EU ceramics producers to reduce energy consumption and reduce carbon dioxide emissions much further given existing technologies, in the short term at least, and this makes it difficult for ceramics producers to comply with Directive 96/61/EC – IPPC (Integrated Pollution Prevention and Control).

Figure 3.13 Specific Energy Consumption in Ceramics Manufacturing



3.5 Conclusions

Globalisation has had a significant impact on the make-up of the EU ceramics sector in a number of ways. Many EU fine ceramics manufacturers that have traditionally been successful, have suffered in recent years from an influx of cheaper comparable ceramics entering into the EU market from emerging economies with ambitious global growth strategies such as China. Many of these Non-EU ceramics manufacturers have less stringent environmental regulation, relaxed Health and Safety laws, cheaper labour and, ultimately, lower production costs than EU manufacturers. ‘Everyday’ tableware manufacturers have been particularly affected by increasing low-cost competition and this has forced the closure of a number of EU ceramics plants and has led to a substantial loss of employment.

However, globalisation has brought a number of benefits to the EU ceramics sector. It has created a challenging range of export opportunities. Perhaps more importantly, the existence of greater competition (especially on the basis of price) has forced all EU ceramics manufacturers to re-think their strategies to some degree in order to survive and prosper. Many firms have become more productively and allocatively efficient in order to compete with new competition. Globalisation has also encouraged product and process specialisation and created many new opportunities for EU ceramics manufacturers. SMEs in particular have concentrated on producing differentiated high-value unique ceramics

that are difficult to imitate. New low-cost competition has stimulated innovation by EU ceramics producers and this has led to “a highly varied and constantly changing range of products, where design and quality play an essential role” (Bonavia and Marin, 2006, page 513). High levels of innovation by EU ceramics producers have meant that the EU is increasingly a global major player in value-added ceramics manufacture.

Whilst some large multinational manufacturers operate in some sub-sectors, SMEs dominate the sector in the EU. They play a pivotal role in this value-added competitive advantage as they are able to serve highly differentiated niche markets and provide the desired levels of quality, uniqueness, creativity and service. Their flexibility also enables them to tailor their ceramic products to meet niche demands, and respond quickly to changes in customer requirements. Innovation in SMEs is driving the sector forward and creating a range of new markets and opportunities and protecting the EU’s competitive advantage. It is therefore important that the interests of SMEs are protected and that their innovation culture is allowed to flourish - but this is not always the case. Perhaps the most damaging problem has been the counterfeiting of EU ceramics designs by low-cost Non-EU importers. This has allowed new competitors to sell cheaper ‘copies’ of EU ceramics items without investing directly in the necessary continuous innovation required to produce them. In other words, some Non-EU ceramics producers are benefiting from EU innovation and intellectual property, and EU producers are not being rewarded for their innovation in the form of higher product value and this grossly disadvantages EU manufacturers. Another challenge that SMEs face is the increased bureaucracy brought about by pollution regulation. According to Liesch and Knight (1999, page 285), one “inherent advantage” of SMEs over larger firms is that they are “unfettered by bureaucracy”, but evidence from the EU ceramics sector implies that SMEs are in fact disadvantaged the most by pollution control administration because of their relative size.

Although globalisation has created a number of challenges, the phenomenon has also created many opportunities and encouraged specialisation and continuous technical innovation, which is especially suited to a sector that is represented by a high proportion of SMEs, which has fuelled the EU’s competitive advantage in value added ceramics products.

The price of energy in the EU has risen substantially since 2004, mirroring to a large extent the rise in the price of crude oil which has risen steadily from around \$38 pb in 2004 to reach almost \$150 pb in the first half of 2008. A consequence of this is that energy costs are likely to account for a far larger share of operating costs than the roughly 30% estimated before oil prices surged. As a result, with regard to energy prices, the EU compares favourably against Japan, but less so against the US. There is great variation in the level and stability of electricity prices in the EU, which will have a major influence on firms’ decisions on whether to invest and where. There is much less variation in gas. The sector would benefit from a better functioning, more competitive energy market to bring about more harmonised pricing and free firms from the decision of where to locate.

4 Horizontal aspects affecting competitiveness

4.1 Introduction

Task 4 of the ceramics sectoral competitiveness study focuses on the regulatory and framework conditions. The goals are twofold:

1. To identify the key sectoral issues of the regulatory environment and the framework conditions which influence sectoral performance and the competitive position of the ceramics sector;
2. To provide a comprehensive and structural assessment of the relevant regulatory conditions and framework conditions that determines the growth and competitive position of the ceramics sector.

The work that has been done so far focuses on the first goal and includes elements that are useful for executing the subsequent steps of the study.

4.2 The framework grid

The overall aim of the framework grid is to provide a general synthesis of regulations, conditions and effects from literature and from previous sector analyses in order to generate a clear and accurate view on the framework within which the ceramics sector operates. This synthesis should subsequently allow us to identify the most relevant indicators for the completion of the competitiveness grid. Furthermore, it will lead to the formulation of a number of general and sub-sector-specific conclusions.

The framework grid is divided into three parts:

1. Regulatory conditions;
2. Framework conditions and
3. Exogenous conditions.

For each type of condition, a list of items and sub-items is provided, according to the regulations and topics that are applicable to the EU ceramics sector.

It is at this level of sub-items that the grid is filled in, namely importance, trend, geographical concentration and specific sub-sectors affected are identified. A final column maps the potential effects of each of the conditions on the competitiveness of the EU ceramics sector. The subsequent step after this initial analysis will be to match these results with the ones of the competitiveness analysis. This will indicate which of the potential effects that have been identified from a regulatory and framework perspective will have further consequences in the field of competitiveness.

To comprehend the conditions and their effects described in the framework grid, it is important to point out the specific interpretation of each of the columns and how they were filled in.

Importance

The column “Importance” indicates the importance of the condition for the ceramics sector and its sub-sectors by means of a score between 1 and 10, 10 being most important. To grade the importance of the condition, a number of characteristics and issues were taken into account:

- Does the condition specifically/only apply to (a part of) the ceramics sector?
- Does the condition apply to the ceramics sector more than to other sectors due to its characteristics (cost structure, labour skills, energy intensity of the production process, use of raw materials, sector structure,...)?
- Does the condition apply to the EU ceramics sector in a way that influences its competitive position relative to non-EU countries?
- Does the condition apply to the EU ceramics sector in a way that influences its competitive position relative to substitute products?

Trend

The column “Trend” refers to the expectations stated in literature regarding the evolution of the condition’s impact. Will the impact of this regulation or issue increase/decrease/stay the same in the future? The underlying reasons for this trend can be, e.g. an increasing importance of the characteristic to which the condition refers, or a strengthening of the regulation or condition.

Geographical concentration

The column “Geographical concentration” shows the EU Member States that are likely to be most affected by the regulation or issue. A criterion for this is that the sub-sectors affected are concentrated in these Member States. The list is not exhaustive, in the sense that it does not include all Member States with plants of a particular sub-sector, but only the Member States in which a substantial share of activities is concentrated. Not all ceramic sub-sectors are geographically concentrated. In the past, however, access to raw materials, sources of energy and good transport links were important deciding factors for location in e.g. the tableware sub-sector and the wall and floor tiles sub-sector. And while nowadays producers are located more and closer to markets, there is still some residual geographical concentration in these sub-sectors.

Specific sub-sectors

The column “Specific sub-sectors” lists all ceramics sub-sectors that might be affected by, or that are the aim of, the regulation or condition in question. As mentioned before, this list is the basis for identification of geographical concentration.

Potential effects

In the column “Potential effects”, all potential effects of the condition on the specified sub-sectors are listed. These include the effects that are found in empirical literature [1], the effects that are described as potential in literature [2] and the effects that we find to be a potential consequence of the condition, based on economic theory [3].

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
I Regulatory conditions					
<ul style="list-style-type: none"> Labour market regulations 					
<ul style="list-style-type: none"> Good handling and use of crystalline silica and products containing it¹ (Social Dialogue as a better tool for addressing crystalline silica risks than regulation, i.e. implementation of Directive 2003/10/EC²) 	7	>	<ul style="list-style-type: none"> For tableware: especially UK, Germany For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> All sub-sectors, especially labour intensive sectors containing silica (wall and floor tiles, tableware and ornamentalware, brick and roof tiles)³ 	<ul style="list-style-type: none"> Improvement and protection of workers health: reduction of cancer risks and other negative health effects (silicosis) [1] Increase of production costs due to additional safety regulations, magnitude uncertain [3] Weakening competitive position because agreements in non-EU countries regarding this matter are less stringent [2]⁴ Distorting effect, larger in sub-sectors that are labour-intensive and where the automation process is less progressed [3]

¹ Negotiating Platform for Silica (NEPSI): multi-sectoral platform for the negotiation of a social dialogue agreement on workers' health protection through the good handling and use of crystalline silica an products containing it, which applies to all ceramics industries and other industries as well.

² Directive 2003/10/EC: minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise, optical radiation, electro-magnetic fields and vibrations).

³ EU manpower 2005: Wall and floor tiles 31%; brick and roof tiles 26%; tableware 15%

⁴ This regulation could have important competitive consequences for the EU ceramics sector because of the absence of an international level playing field. However, this Social Dialogue is autonomously approved by all important social partners of the EU ceramics sector because of the necessity to create a healthy climate for the ceramics employees. It replaces the more stringent regulation Directive 2003/10/EC that would place the EU ceramics sector in a much weaker competitive position (source: Draft analysis of the Competitive Situation in the European Ceramics Industry).

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
<ul style="list-style-type: none"> Intellectual property right issues 					
<ul style="list-style-type: none"> Design protection⁵ 	9	>	<ul style="list-style-type: none"> EU- For tableware: especially UK, Germany For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> Especially tableware, wall and floor tiles 	<ul style="list-style-type: none"> Protecting domestic manufacturers from high import volumes of counterfeiting firms (especially from China) =>enhancing EU competitiveness [1] Stimulation of innovation and creativeness => EU SMEs more and more players on niche markets producing high value-added products [2]
Enforcement of IPR ⁶	9	>	<ul style="list-style-type: none"> EU- For tableware: especially UK, Germany For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> Especially tableware, wall and floor tiles 	<ul style="list-style-type: none"> Protecting domestic manufacturers from high import volumes of counterfeiting firms (especially from China) and also protecting EU manufacturers in their export markets =>enhancing EU competitiveness [1] Stimulation of innovation and creativeness => EU SMEs more and more players on niche

⁵ Directive 98/71/EC of the European Parliament and of the Council of 13 October 1998 on the legal protection of designs.

⁶ Directive 2004/48/EC of the European Parliament and of the Council of 29 April 2004 on the enforcement of intellectual property rights, covering infringements of all intellectual property rights (copyright and industrial property such as trademarks or designs).

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
					<p>markets producing high value-added products [2]. Conversely, infringement of IPR is likely to lead to lower investment if returns cannot be guaranteed/protected against unfair competition.</p> <ul style="list-style-type: none"> • Limitations: despite the existence of protective legislation SMEs don't have sufficient resources to ensure its IPR has the correct status [1] => extra support needed, eg through making use of the EC's new EU Helpdesk for SMEs in China.
<ul style="list-style-type: none"> • Customs action against goods suspected of infringing certain IPR⁷ 	7	=	<ul style="list-style-type: none"> • For tableware: especially UK, Germany • For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> • Especially tableware, wall and floor tiles 	<ul style="list-style-type: none"> • Enhancing EU competitiveness through better protection of domestic manufacturers from high import volumes of counterfeiting firms [1]

⁷ Council Regulation (EC) No 1383/2003 of 22 July 2003 concerning customs action against goods suspected of infringing certain intellectual property rights and the measures to be taken against goods found to have infringed such rights.

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
<ul style="list-style-type: none"> Competition Policy 					
<ul style="list-style-type: none"> Mergers/ antitrust / cartels⁸ 	3	=	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> Especially bricks and roof tiles 	<ul style="list-style-type: none"> More consolidated structure in coarse-ceramics sub-sectors => in the short term no serious threats, nearly all merger cases in the past approved. In the long term, however, brick sub-sector possibly too concentrated => importance of consumer protection [3] Limited effects in fine ceramics sub-sectors due to SME-structure
<ul style="list-style-type: none"> State aid 	3	=	<ul style="list-style-type: none"> Especially Spain, (Eastern) Germany⁹ 	<ul style="list-style-type: none"> Especially tableware 	<ul style="list-style-type: none"> Complaints about state aid in Spanish tableware sector, but further no serious cases mentioned => presumably limited effects in the future [1]
<ul style="list-style-type: none"> Sector-specific standards 					
<ul style="list-style-type: none"> Lead limits in waste water¹⁰ 	7	>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors using 	<ul style="list-style-type: none"> Removing the lead content from waste water

⁸ Approval of 21 merger cases and imposed remedies in only 1 case by the European Commission, especially relevant for ceramic bricks and roof tiles, There has been no anti-trust case and no merger cases have been prohibited by the European Commission.

⁹ Recent case: European Court of Justice case C-39/06, Judgement of 19 June 2008, Commission vs. Germany. The ECJ ruled that Germany violated its obligations under the EC Treaty by not reclaiming state aids granted to the German porcelain producers Kahla Porzellan GmbH and Kahla/Thüringen Porzellan GmbH

¹⁰ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy.

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
				glazes	<p>increases production costs [2].</p> <ul style="list-style-type: none"> Regulation with very low lead limits would therefore make the EU sector less competitive on the cost side against countries with less stringent regulation [3] Yet opportunities in particular market niches for environmental friendlier products would arise [3]
<ul style="list-style-type: none"> Approximation of law, regulations, administrative provisions relating to construction products¹¹ 	6	=	<ul style="list-style-type: none"> For tableware: especially UK, Germany For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> Brick and roof tiles, wall and floor tiles, clay pipes, sanitaryware 	<ul style="list-style-type: none"> Fulfilling the requirements embodied in Council Directive 89/106/EEC may increase production costs and reduce competitiveness compared to other countries where regulation is less stringent [2]
<ul style="list-style-type: none"> Consumer standards (health and safety) 					
<ul style="list-style-type: none"> Regulations for materials intended to come into contact with food¹² 	8	=	<ul style="list-style-type: none"> Especially UK (Staffordshire), 	<ul style="list-style-type: none"> Tableware 	<ul style="list-style-type: none"> No international level playing field for this regulation: EU tableware sub-sector less

¹¹ Directive 89/106/EEC on the approximation of law, regulations, administrative provisions relating to construction products.

¹² Framework Directive 89/109/EC and Regulation No 1935/2004/EC on materials and articles intended to come into contact with foodstuffs. It applies to all ceramics sub-sectors, especially tableware, and to other sectors as well.

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			Germany (Saarland and Bavaria), and France (Limousin)		competitive due to less stringent regulation elsewhere and therefore fiercer international competition [2] However, by fulfilling the health and safety regulations, product quality in some cases increases => strengthen position in niche markets with high value added products [3]
<ul style="list-style-type: none"> Environmental regulations and issues 					
<ul style="list-style-type: none"> Scheme for greenhouse gas emissions^{13, 14} 	9-10	>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors (apart from tableware, technical ceramics and sanitaryware) 	<ul style="list-style-type: none"> The main concern is the disproportionate administrative burden and unpredictability the scheme is imposing on small emitters such as ceramic companies. The scheme already covers 1116 ceramic installations (cf. EEA report 2007), representing 10% of all installations covered by the scheme, but less than 1% of CO₂ emissions covered.[1]

¹³ Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community.

¹⁴ Draft Analysis of the Competitive Situation in the European Ceramics Industry.

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
					<ul style="list-style-type: none"> Another concern for the ceramics sector is the impact of the ETS on gas, and to a lesser extent, electricity prices: <ul style="list-style-type: none"> => increasing energy prices imply increasing operating costs and consequently decreasing profitability => reduction of investment levels in firms located in the EU, production losses and job losses => closure, or delocalisation for bigger firms to areas where these environmental standards do not apply (e.g. Russia, China) because no international level playing field (see also 'Framework conditions': cost and availability of energy) [1] and because the ceramics sector is highly exposed to international competition.
<ul style="list-style-type: none"> IPPC Regulations (the Ceramics BREF was adopted in August 2007 (BREF = Reference 	9-10	>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sectors 	<ul style="list-style-type: none"> Reduction of energy consumption Reduction of process losses by recycling and

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
document describing the Best Available Techniques and its associated emission levels on which the limits in the industrial permit should be based) ¹⁵					reusing measures/techniques <ul style="list-style-type: none"> • Reduction of process waste water <ul style="list-style-type: none"> • decreasing production costs • Reduction of pollution (gaseous air pollutants, diffuse and channelled dust) • Reduction of noise • => environmental improvement [1]
<ul style="list-style-type: none"> • REACH¹⁶ (the ceramics sector is mainly a downstream user, which means that the requirements are lighter than for a producer of chemicals) 	8	>	<ul style="list-style-type: none"> • EU-wide 	<ul style="list-style-type: none"> • All sub-sectors 	<ul style="list-style-type: none"> • (Possibly) reduction in number of products offered by EU ceramic suppliers due to costly registration and evaluation requirements [2] • No international level playing field => increased competition from non-EU suppliers
<ul style="list-style-type: none"> • Framework for Community action in the field of water policy¹⁷ • Waste Framework and Mining Waste Directive • National Emissions Ceiling Directive¹⁸ 			<ul style="list-style-type: none"> • EU-wide 	<ul style="list-style-type: none"> • All sub-sectors 	<ul style="list-style-type: none"> • Increased production costs [2] • No international level playing field => EU-producers have competitive disadvantage [2]

¹⁵ Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC).

¹⁶ Proposal for a regulation concerning the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) and establishing a European chemicals agency.

¹⁷ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy.

¹⁸ Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants.

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
<ul style="list-style-type: none"> Construction Products Directive (CE marking)¹⁹ 			<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> Construction ceramics, especially ceramic tiles 	<ul style="list-style-type: none"> The value added of the product increases ('CE marking' as a quality label) However, also production costs increase due to testing and the implementation of new standards[1] SMEs are rather against the CE marking: they have a low export rate to non-EU countries. Consequently the CE marking is a costly burden without additional value. Local markets are not in favour of too much transparency as offered by the CE mark because it becomes easier to compare cost/performance. Some countries prefer national quality mark, because a unified European quality label increases low price imports of other Member States (e.g. German imports on the Dutch market) Only a small number of customers understands the CE-mark. It is therefore important to inform them better in the future

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
<ul style="list-style-type: none"> Eco-labelling²⁰ 	7	>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> Especially ceramic tiles 	<ul style="list-style-type: none"> EU-producers on niche markets [3]
II Other framework conditions					
<ul style="list-style-type: none"> Geographical location and cohesion 					
<ul style="list-style-type: none"> Regional clustering due to access to skilled and experienced workers, raw materials and energy and good transport links²¹ 	7	<	<ul style="list-style-type: none"> Sassuolo (Italy) and Castellón (Spain) Specific regions in Germany, France, UK, Netherlands, Portugal Germany, UK, Italy, Belgium and the Netherlands 	<ul style="list-style-type: none"> Wall and floor tiles, tableware Vitrified clay pipes 	<ul style="list-style-type: none"> Ceramics manufacture is increasingly moving to new locations which are closer to the markets rather than to the supplies of raw materials => geographical expansion, regional clustering diminishes [1] By moving to the markets EU producers have a closer relationship with end-users and will be in a better position to react on changing consumer tastes, but the price of raw materials will increase due to increased transport costs. [2]
<ul style="list-style-type: none"> Labour force & knowledge skills 	7	>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> Especially brick sub-sector 	<ul style="list-style-type: none"> Diminishing workforce in the traditional skills such as gilders, dishmakers and lithographers

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			<ul style="list-style-type: none"> Especially Spain, and Italy 	<ul style="list-style-type: none"> Wall and floor tiles 	<ul style="list-style-type: none"> Negative image due to upheavals in the sector deterring recruits (particularly young recruits) <ul style="list-style-type: none"> declining supply of high-skilled workforce in the future (potential shortages) [1] Declining number of students in higher education directly relevant to the ceramics sector lack of key and basic skills²² <ul style="list-style-type: none"> negative effect on business efficiency [1] increased importance of training centres [2] Strong local dependency on the economic condition of the sector in certain regions: increasing competition from low-priced imports can have serious impact on local employment situation (job losses) [3]
<ul style="list-style-type: none"> Access to third countries / EU market access (trade and investment) 					
<ul style="list-style-type: none"> Tariffs: import duties in non-EU markets 	9-10	>	<ul style="list-style-type: none"> For tableware: 	<ul style="list-style-type: none"> Export: all sub- 	<ul style="list-style-type: none"> EU price less competitive on (potential) export

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			especially UK, Germany • For wall and floor tiles: especially Spain, Italy	sectors, especially tableware and wall and floor tiles; refractories	market (e.g. the US and India) due to tariffs => negative effect on export [1] • Increased competition on US market from Mexico (no import duty because of NAFTA) and China (lower import duties); [1] • Differences in tariff dismantling between EU and non-EU countries: (potential) increasing competition on EU market and EU export markets (e.g. Mexico and South Africa) [2]
<ul style="list-style-type: none"> Quota (non-tariff barrier) 	7	>	Especially UK, Germany and France	Especially tableware	Phasing out the quota system (since 2005), has a negative effect on demand due to low-priced imports from China
<ul style="list-style-type: none"> Compulsory testing and obligatory certification schemes (non-tariff barrier) 	7-8	>	<ul style="list-style-type: none"> Especially Spain and Italy Bulgaria 	Especially wall and floor tiles	<ul style="list-style-type: none"> Protection of domestic sector in countries as Ukraine, Turkey, Egypt, Saudi Arabia, Syria, Mexico, Colombia, and more recently, China => complicated, and very costly and time-consuming to comply with => unit price increase => decrease of competitiveness on (potential) export markets [1] For countries as Poland, Czech Republic,

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
					Slovenia, Slovakia, Lithuania these non-tariff barriers are phased out because of entry into EU [2]
<ul style="list-style-type: none"> Transport 	<p>3</p> <p>> 3 for wall and floor tiles</p>	<p>=</p> <p>> for wall and floor tiles</p>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> Brick and roof tiles; sanitaryware Ceramic wall and floor tiles 	<ul style="list-style-type: none"> Relatively high unit transport costs (raw materials and finished products) => new entrants limited to location where to set up manufacturing plant => barrier to entry [1] Transport costs are growing and will be ever higher because of regulations on road transport in the EU, coupled with rising oil prices. More flexibility and less bureaucracy in the port sector, and train transport development (importance of FERRMED initiative) are needed. [1] – [3]
<ul style="list-style-type: none"> Access of third countries to EU market 					
<ul style="list-style-type: none"> Absence of (and too low) import-tariffs on EU market 	6	=	<ul style="list-style-type: none"> For tableware: especially UK, Germany For refractories For wall and floor tiles: especially 	<ul style="list-style-type: none"> Import: all sectors, especially wall and floor tiles and tableware 	<ul style="list-style-type: none"> Decreasing demand due to low-priced imports from non-EU countries (China, Mexico, South Africa,...) [1]. Problems for EU customs offices to implement correctly the (vague) Common Nomenclature for refractories (in context anti-dumping levy

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			Spain, Italy		China). [1]
<ul style="list-style-type: none"> Origin marking 	7	>	<ul style="list-style-type: none"> For tableware: especially UK, Germany, France For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> Ceramic tiles (CE Marking for gaining access to the EFTA & European Union market) Tableware 	<ul style="list-style-type: none"> Increase transparency and informed purchase decisions by consumers, and reduce the incidence of fraudulent or misleading indications that would undermine the reputation of EC producers [2]
<ul style="list-style-type: none"> Knowledge-based development (R&D and innovation) 					
<ul style="list-style-type: none"> Innovation in terms of design, production, distribution and marketing 	9	>	<ul style="list-style-type: none"> For tableware: especially UK, Germany, France For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> Refractory products, wall and floor tiles, tableware (i.e. fine ceramics) 	<ul style="list-style-type: none"> Production of high quality value-added products, which are difficult to imitate in the short run in order to prevent counterfeiting of low-cost substitutable ceramics from emerging economies such as China, to enhance competitiveness in a globalising economy [2]
<ul style="list-style-type: none"> Eco-innovation: research on reduction of energy consumption and on waste prevention (process innovation) 	9	>	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors 	<ul style="list-style-type: none"> more energy efficient => large cost-savings [1] Eco-label => quality-improvement => EU increasing position on niche markets [2]
<ul style="list-style-type: none"> Automation of processes and tools for 	6	=	<ul style="list-style-type: none"> Especially UK, 	<ul style="list-style-type: none"> Tableware 	<ul style="list-style-type: none"> Flexibility of production, production cost

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
asymmetrical, large-sized items (process innovation)			Germany, France		decrease [1] • Employment decrease [3]
• Use of lasers in product decoration and improved techniques for achieving surface properties	6	=	• Especially Spain, Italy	• Tiles	• Improved quality and safety of products => strengthen position on niche markets, competition on quality instead of on price [3]
• Production on unfired clay blocks for load-bearing masonry; use of special glues in masonry; use of biogas for firing kilns	6	=	• EU-wide	• Bricks and roof tiles	• Decreasing energy costs [1-2]
• Physical aspects and infrastructure					
• Economies of scale	7-8	>	• EU-wide	• Especially brick sub-sector	• Immediate cost-disadvantage to potential new entrants (barrier to entry) => relocating production to Non-EU countries where labour costs are lower and prospects of economies of scale are higher
• High setup costs / high sunk costs (capital intensive due to investments in kiln)	7	=	• EU-wide	• Especially brick sub-sector	• Hard to comply with changes in short and long-term legislation affecting energy use or emissions
• Cost and availability of energy	9	>	• EU-wide	• All sub-sectors	• Increasing energy prices due to lack of competitiveness in energy markets and due to impact of carbon prices ²³ on electricity and gas prices ²⁴

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
					=> increasing production costs • EU largely dependent on third countries for energy supply
III Exogenous conditions					
<ul style="list-style-type: none"> Cost and availability of energy and raw materials 					
<ul style="list-style-type: none"> Clay 	7	>	<ul style="list-style-type: none"> EU (especially UK) 	<ul style="list-style-type: none"> Brick sub-sector 	<ul style="list-style-type: none"> Limited availability of sizeable and suitable quality clay reserves; and where adequate reserves exist, it is easier to obtain permission to expand an existing clay quarry than to obtain permits to win previously unexploited clay reserves clay availability as important barrier to entry [1] first-mover advantage => consolidations and more concentrated structure [1] limited recycling opportunities => need for substitutes? [3]
<ul style="list-style-type: none"> Minerals, eg Feldspar, Calcium, Talc, Carbonate, Kaolin,...) 	7	=	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors 	<ul style="list-style-type: none"> Moving away from traditional sources of raw materials to markets and greater specialisation of SMEs leading to more diverse raw material needs

TABLE 4.1: FRAMEWORK GRID FOR CERAMICS SECTOR AND ITS SUB-SECTORS

Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
<ul style="list-style-type: none"> Refractory raw materials (alumina, Magnesia, Dolomite,...) 				<ul style="list-style-type: none"> Refractories 	<ul style="list-style-type: none"> => increased imports of raw materials into the EU [1] Increased demand for some minerals also from other sectors => increase of input prices [1] Not enough high quality raw material available in Europe, access to Chinese raw material supply markets is crucial.
<ul style="list-style-type: none"> Restricted access to non-energy raw materials (NATURA 2000) 25 	7	=	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors 	<ul style="list-style-type: none"> Limited access to non-energy raw materials increases costs and uncertainty [2] Increased consumption of non-energy raw materials by booming markets (Brazil, China) => disruption in supply and huge price increases [1] => weakening competitive position of EU manufacturers
<ul style="list-style-type: none"> Technological change Technologies and techniques to minimise energy use by kilns already advanced 	8	=	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors 	<ul style="list-style-type: none"> Kiln technology is already mature: major short-term future increases in efficiency are unlikely

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
					=> challenge to comply with emissions regulations [2]
<ul style="list-style-type: none"> New techniques for recycling 	7	=	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> All sub-sectors 	<ul style="list-style-type: none"> Main potential advantages: less reliance on raw materials; potential raw material cost savings; less ceramic waste sent to landfill; product differentiation and 'Green' marketing [2] However rate of re-use in the ceramics sector is relatively low and is restricted by the scientific composition of ceramics and market demands for technical performance and quality. Significant technological advancements are indispensable. [1] <p>=> competitive disadvantage with respect to substitutes where recycling is far more developed [3]</p>
<ul style="list-style-type: none"> Socio-political and cultural developments 					
<ul style="list-style-type: none"> Changing consumer tastes 	8-9	=	<ul style="list-style-type: none"> For tableware: especially UK, Germany, France For wall and floor 	<ul style="list-style-type: none"> Tableware Wall and floor tiles 	<ul style="list-style-type: none"> SMEs are in a favourable position to switch designs and production techniques and quickly respond to changing market demand and new opportunities and this is a sizeable

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			tiles: especially Spain, Italy		advantage => competitive advantage for EU SMEs <ul style="list-style-type: none"> • However, in the tableware sector, changing consumer tastes are also a challenge, in particular regarding the lack of willingness of younger consumers to spend a lot of money on expensive tableware (compared to the older generation).
<ul style="list-style-type: none"> • Distribution channels 	7	>	<ul style="list-style-type: none"> • For tableware: especially UK, Germany, France • For wall and floor tiles: especially Spain, Italy 	<ul style="list-style-type: none"> • Especially fine ceramics • Ceramics tiles 	<ul style="list-style-type: none"> • Transition to new locations closer to the markets => cost reduction, close contact with buyers, possibility to adapt quickly to changes in tastes and fashions, more flexible in their choice of manufacturing location and they no longer necessarily need to locate near to traditional sources of raw materials [2] • Increase in comparable low-cost ceramics imports into the EU from emerging economies such as China has affected the distribution channels and competitiveness of EU producers [1] • Concentration in distribution inside EU (St

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
					Gobain)
<ul style="list-style-type: none"> Global competition 					
<ul style="list-style-type: none"> Consolidations and acquisitions 	2	=	<ul style="list-style-type: none"> EU-wide 	<ul style="list-style-type: none"> Especially brick sub-sector 	<ul style="list-style-type: none"> Brick sub-sector very local => consolidations have low impact on other regions
<ul style="list-style-type: none"> Knowledge based competition (innovation) 	9	>	<ul style="list-style-type: none"> For tableware: especially UK, Germany, France For wall and floor tiles: especially Spain, Italy Refractories: especially in the larger EU member states (e.g. Germany, Italy, France and the UK) 	<ul style="list-style-type: none"> Especially wall and floor tiles, tableware, refractory ceramics 	<ul style="list-style-type: none"> Production of innovative high quality value-added products, difficult to imitate in the short run Flexibility to adjust quickly to changes in consumer demands =>EU SMEs not competing on the basis of low cost, but on quality while other countries (e.g. China) focus on the production of low-cost products! => EU comparative advantage
<ul style="list-style-type: none"> Globalisation and increased international competition from low-cost producers (low labour costs, counterfeiting, ...) 	9	>	<ul style="list-style-type: none"> For tableware: especially UK, Germany, France For wall and floor tiles: especially 	<ul style="list-style-type: none"> Especially tableware and wall and floor tiles 	<ul style="list-style-type: none"> Long-term sustainable competitiveness under threat due to different conditions as competitors (in terms of international trading conditions, social conditions,...) => no international level playing field!²⁶

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			Spain, Italy		
<ul style="list-style-type: none"> • Competition from substitutes (steel, PVC, plastics, glass-ceramics, stainless steel, wood) 	7	>	<ul style="list-style-type: none"> • EU-wide 	<ul style="list-style-type: none"> • Brick sub-sector • Vitrified clay pipes • Tableware • Sanitaryware 	<ul style="list-style-type: none"> • Decline in demand for traditional load-bearing bricks and vitrified clay pipes, ceramic tableware and sanitaryware
<ul style="list-style-type: none"> • Dependency on demand for construction and renovations • Dependency on demand for steel 	7	=	<ul style="list-style-type: none"> • For tableware: especially UK, Germany, France • For wall and floor tiles: especially Spain, Italy • Refractories: especially in the larger EU Member States (e.g. Germany, Italy, France and the UK) 	<ul style="list-style-type: none"> • Wall and floor tiles, bricks and roof tiles, sanitaryware • Refractory products 	<ul style="list-style-type: none"> • Falls/upswings in construction and steel sectors have a significant negative/positive effect on the demand of ceramic products => volatile demand • Threat of temporary overcapacity in the brick sub-sector in periods of low demand: output needs to be constantly high for economies of scale to be earned • Structural changes in demand => excess capacity => increased consolidation and increased price competition
<ul style="list-style-type: none"> • Exchange rates 	7	=	<ul style="list-style-type: none"> • For tableware: especially UK, Germany, France • For wall and floor 	<ul style="list-style-type: none"> • Especially wall and floor tiles and tableware 	<ul style="list-style-type: none"> • Strong Euro has a diminishing effect on export volumes (e.g. US market and competitors in areas with \$-linked currencies such as China) => possibly problematic for fine ceramics

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Ceramics sector	Importance 1-10	Trend < / = / >	Geographical level	Specific sub-sectors affected	Potential effects [1]=empirical literature; [2]=theoretical literature; [3]=own appreciation based on economic theory
			tiles: especially Spain, Italy		exporting firms <ul style="list-style-type: none"> Weak Euro has an increasing price effect on imports of raw materials , whereas a strong euro tends to weaken exports and increase imports.

4.3 Conclusions

Based on an analysis of the framework grid, we identified the key issues for the EU ceramics sector in general and its different sub-sectors. Key issues having an impact on the entire ceramics sector are:

- Environmental regulations (energy use (CO₂ emission), pollution prevention, waste);
- Energy cost and availability;
- Intellectual property right issues and counterfeiting;
- Knowledge and innovation;
- Globalisation (low-priced imports) and trade barriers (EU access to markets of third countries).

These correspond to a large extent with the findings of the EU Mid-term Review of Industrial Policy (EC, 2007f). The Mid-term Review indicated that horizontal policy initiatives with the highest priority were:

- Knowledge: initiatives related to IPR and counterfeiting;
- Environment and energy: initiatives related to climate change, waste, air and intensive energy use;
- Trade: access to markets, trade distortions, subsidies and dumping;
- Structural change: anticipation.

In the following paragraphs we set forth our main conclusions for each part of the framework grid. Hereby, we focus on the relative importance of each part and we describe the key issues having a potential impact on the competitive position of the EU ceramics sector and its sub-sectors.

4.3.1 I. Regulatory conditions

Principally, regulations related to the environment are of high importance for the ceramics sector. The ceramics sector is very energy-intensive. Energy costs account for 10% to more than 30% of the total production costs. The main energy source is gas, constituting more than 80% of the total source of energy, and responsible for a serious share of CO₂ emissions. Regulations imposing the reduction of CO₂ emissions are very costly and they are related to several (nearly all) stages in the ceramics production process. What is more, there is no international level playing field for these environmental regulations. In countries where regulatory measures are less stringent, increases in production costs will be remarkably lower, implying a competitive disadvantage to the EU ceramic producers.

However, environmental regulations also provide an incentive to invest in R&D for improving energy efficiency and diminishing the dependency from traditional energy sources. As a consequence the share of energy in total production costs decreases. Yet, these are long-term effects requiring significant entrepreneurial endeavour and risk-taking. In the short term, the stringent environmental and energy regulations and, in addition, the absence of an international level playing field, put a great pressure on EU SMEs and hinder private funding of innovative investments and R&D.

Intellectual Property Right regulations play a significant role in the ceramics sector as well. These regulations are especially important in the fine ceramic sub-sectors such as the tableware ceramics and wall and floor tiles. The reasons why these regulations are so important are twofold:

1. The majority of fine ceramic producers are SMEs and SMEs do not always have sufficient resources to ensure their IPR to have the correct status;
2. There is evidence of counterfeiting by cheaper non-EU producers (e.g. from China) exporting their products in large volumes to the EU market and the EU export markets. Fine ceramics are easily transportable and therefore much more vulnerable to international competition.

The limiting of lead in waste water and the labour market regulations on the handling and use of crystalline silica are currently not critical regulatory issues. Yet they may gain importance in the future.

4.3.2 II. Other framework conditions

The most important other framework condition is the cost and availability of energy. Ceramics is a high energy-consuming sector. Consequently, energy prices have a high impact on production costs. To counteract price increases, EU ceramics producers have been stimulated to innovate in energy-saving techniques. Know-how becomes more important and a high-skilled labour force is increasingly demanded. This implies a change in EU ceramic production process in the longer term, aiming at a decreased dependency on traditional energy sources and a strengthened position on niche markets with ‘quality’ products (e.g. the eco-label).

Aside from the importance of energy, existing tariff and non-tariff (e.g. quota and certification schemes) trade barriers are also important framework conditions for the ceramic sector. In particular, the tableware sector has already suffered from existing import duties in the US market.

On the contrary, the absence of import tariffs (or low import tariffs) on the EU-market implies stronger competition from low-cost third-country imports on the EU domestic market. Counterfeiting is an additional problem that arises in this context. A possible solution to counteract cheap copies of low-cost third countries is the introduction of Origin Marking. This will lead to more transparency and to better informed purchase decisions by consumers.

4.3.3 III. Exogenous conditions

Regarding the exogenous conditions, the EU ceramics sector is confronted with increased scarceness of raw materials. In the coarse ceramic sub-sectors (such as bricks and refractories) the situation is even becoming dramatic and access to raw materials is becoming one of the major challenges. Furthermore it has been reported by the representative of the refractories sub-sector that the supply of critical raw materials is increasingly being controlled by China. But also in the fine ceramics sub-sectors the availability of raw materials is of major concern. Manufacturers of fine ceramics such as

tableware are increasingly moving away from virgin raw materials to new locations which are closer to the markets. This makes them even more dependent on imports of third country suppliers. However, this shift to consumer markets can be motivated by the fact that fashion trends and consumer preferences can be very local. For example in the Netherlands, there is a consumer preference for larger sizes of tiles, which seems to be more luxurious. These consumer preferences can be very specific with respect to the choice of materials, the quality of the product, the shape, the design or even colour. In Germany, Scandinavia, the Netherlands and the Dutch speaking part of Belgium consumers have a preference for light natural colours, whereas in the UK, the French speaking part of Belgium and the southern, Mediterranean countries pastel and flower decorated designs are more popular. With respect to tableware ceramics, there is a trend towards casual designs in France, Belgium and the Netherlands. By anticipating these large local differences and continuously changing trends, firms can counteract diminishing sales volumes and increase their position vis-à-vis their competitors.

By moving closer to the selling market locations, the cost of raw materials increases (transport costs, increasing bargaining power of third country supplier). However the EU-producers have a closer relationship with end-users and will be in a better position to react on these changing consumer tastes.

Besides previous issues, the European ceramic sector is also facing competition from substitute materials and a high dependency from the construction and renovations demand. The absence of an international level playing field for environmental, health and safety industry standards puts additional competitive pressure as well as low-cost imports from emerging economies such as China.

4.3.4 Specific Issues in the different sub-sectors

In the following section we present an overview of the key issues that specifically affect each of the ceramics sub-sectors, together with the more general issues described above.

Specific issues in tableware and ornamentalware

- Intellectual Property Right and design protection / Origin marking;
- Sharp employment decline due to strong competition from low-cost importers;
- Very labour intensive sub-sector;
- High value-added ceramics: importance of innovation (regarding design, production, marketing, distribution, ...);
- Regulations for materials intended to come into contact with food;
- Regional clustering of production within EU (Germany, UK, France,...) due to access to skilled and experienced workers and special raw materials;
- Importance of trade barriers (obligatory certification system and import duties (especially the US));
- Increased competition from substitutes (glass-ceramics);
- Predominately SMEs.

Specific issues in wall and floor tiles

- Intellectual Property Right and design protection / Origin marking;
- High value-added ceramics: importance of innovation (regarding design, production, marketing, distribution, ...);
- Strong competition from low-cost importers;

- Strong regional concentration of production within EU (Spain, Italy,...) due to access to skilled and experienced workers and special raw materials;
- Importance of trade barriers (obligatory certification system and import duties (especially the US));
- Dependency on demand for construction and renovations and changing consumer taste;
- Predominantly SMEs.

Specific issues in sanitaryware

- Transport limitations due to high weight;
- Strong competition from cheap sanitary products, e.g. Turkey;
- Dependency on demand for construction and renovation;
- Increased competition from substitutes;
- Highly energy intensive: importance of energy-saving techniques.

Specific issues in bricks and roof tiles

- High unit transport costs, therefore limited trade;
- Economies of scale and high set-up costs;
- Regional concentration (due to high barriers to entry and local consumer taste);
- Dependency on demand for construction and renovation;
- Increasing competition from substitutes;
- Highly energy intensive: importance of energy-saving techniques and innovations.

Specific issues in refractories

- Dependency on demand for steel;
- Consolidated sub-sector;
- Importance of energy-saving innovations.
- Chinese raw materials strategy.

Specific issues in vitrified clay pipes

- Increased threat of substitutes;
- Very concentrated sub-sector.

Specific issues in technical ceramics

- Importance of continuous innovations: high value products;
- Importance of energy-saving techniques and innovation;
- Geographically concentrated in Germany, UK and France.

In the next stage of the work, the findings based on the framework grid are compared with the findings based on the competitiveness grid in order to qualify the significance of the regulatory, framework and exogenous conditions. First, however, we discuss more profoundly the implementation of the EU regulatory conditions in the new Member States.

4.4 Framework conditions in the new Member States

4.4.1 Implementation of the EU regulatory conditions in the new Member States

A consequence of accession to the EU for the new Member States is convergence to EU regulations. This process of convergence started long before actual accession and over

time the Central Eastern European Countries (CEECs) had to implement the *acquis communautaire* by the accession date. The candidate countries had to define realistic national strategies that included priority areas of action, key objectives to be attained by the date of accession, and timetables for the subsequent achievement of compliance. For example with regard to environmental regulations, candidate countries had to fill in the gaps in their legislation and administrative rules to improve the environment while at the same time improving the economy and competitiveness.

This convergence to EU law created two challenges for the new Member States. The first challenge was the adoption of more stringent regulations, resulting in fiercer competition from neighbouring non-EU countries like Russia & Ukraine. The second challenge was the additional investment needed to implement the new rules.

One of the main influencing regulations for the ceramics sector is the IPPC directive. This was already installed by the time of accession and demanded a number of developments from new Member States, both on the authority side and on the industrial side. On the authority side, there was a need for a solid institutional background, information on new aspects like energy efficiency and cost-effectiveness, software development for the data supply, guidance on best available techniques, etc. On the industrial side, the cost of complying with the best available techniques requirements was a primary aspect, next to investments for competitiveness on the international markets. Besides the implementation of the IPPC Directive, the EC is also worried about the implementation of the IPR Enforcement Directive 2004/48/EC. There is serious doubt that the new Member States have the capacity to effectively enforce intellectual property rights.

Regarding environmental regulations in early-2008, Bulgarian companies got the chance to actually join the EU Emissions Trading Scheme. Bulgarian sector representatives felt however that neither the executive bodies' administrative capacity, nor the enterprises' preparedness, was at a level which would allow for successful completion of the first National Harmful Emission Allowances Allocation Plan. While operators were faced with serious problems in reporting and verifying emissions from individual installations, in their view the Ministry of Environment and Water through Executive Environment Agency failed to create the necessary preconditions for launching free allowances trading. Ultimately the companies that fulfilled the procedural requirements did not manage to trade with the saved emission allowances. Others that did not report emission allowances or did not provide internationally recognized verification hardly managed to purchase the required allowances.

The need for capacity building to implement the different aspects of the new chemicals legislation emerged as a priority for both the new Member States and for candidate countries. In particular, there was weak capacity in the field of risk assessment. After the implementation of the *acquis communautaire*, additional efforts were needed to implement the REACH regulation in the new Member States. Yet, in general, the costs of REACH implementation can be passed down the supply chain. The impact of the REACH regulation therefore appears to be relatively small.

In addition to the environmental regulations, the increase in energy prices is also a major concern for the new Member States' ceramic sector, just like in the old EU Member

States. In Bulgaria, for example, gas is the major energy source for the main ceramic production sectors – sanitaryware and ceramic tiles - and for some companies in the brick and floor tiles sub-sector. According to experts, energy costs account for approximately 20-30% of total production and the increase might lead to the closing of some production lines.

As for all Member States, it is an important question whether EU regulation decreases the competitive position of new Member States compared to non-EU countries. The absence of an international level playing field is a major concern for survival in an ever-more globalising world. In this respect, the new Member States face competition in the ceramics sector from neighbouring countries like Russia and Ukraine, but also from more distant countries such as China, that do not need to comply with European legislation.

4.4.2 The effect of accession on the ceramics sector in the Western European Member States

In his study in 1994 on ‘trade liberalisation with Eastern Nations’, Professor Damien Neven analysed the impact of trade liberalisation on specific sectors and regions in the existing EU Member States. With respect to the ceramics sector, he observed that disruptions were rather limited: in parallel with the fall in relative (import) prices, wages and employment rose, production increased and the input mix shifted towards a more intensive use of physical and human capital. One possible interpretation of this evolution could be that trade pressure induced some changes of product strategy by domestic firms and possibly some shifts in technology. Along this line of reasoning, domestic firms reacted by constructing products that the new Member States cannot reproduce and technologies that do not diffuse abroad, a strategy that still stands fifteen years later regarding low price exporting countries like China.

However, even though the Eastern European countries need to comply with EU regulation just like the EU-15, there remain a number of factors that increase the fierceness of competition from these countries. Human capital is generally cheaper and raw materials are well available in the new Member States, resulting in a decrease in production costs as compared to the Western European countries. A long tradition and the development of the ceramic production were determined, besides other factors, by an abundance of basic raw materials, such as sand, kaolin, feldspar and quartz in the Czech Republic. The results of the restructuring process in the Czech manufacturing industries in the period of 1989-1999 showed the tendency of a strengthening of the position of sectors such as the ceramics sector utilising the domestic raw material base and some modern production capacities.

Next to the threat of increased competition, accession of the new Member States also created investment opportunities. Western European producers have taken over production plants in these areas that are cheaper and that can efficiently and effectively supply both Eastern and Western European clients. German ceramic tableware firms involved in significant outsourcing (both final products as well as intermediates) to New EU Member states. Decoration is labour-intensive, so “blanks” are transported from Germany to Eastern Europe for decoration (cheap labour) and then re-imported back to Germany for export (same strategy applied by British firms). This outsourcing trend can

also have advantageous implications for the new Member States. In Bulgaria, for example, the companies with most market share in ceramic production are representatives of worldwide leaders or foreign owned companies. This allows the Bulgarian firms to have access to modern technologies and to invest in processes automatization and certification.

4.5 Effect of the framework conditions on the competitive position

4.5.1 Grid

In what follows, a summarizing grid is drawn up to present potential impacts of the framework conditions on indicators of the economic and competitive position of the ceramics sector in the EU. These impacts are indicated by means of light, medium or dark grey (depending on the intensity of the effect) cross points between the condition and the indicator in question. For each shadowed cross point, the direction of the effect (+ or -) on the indicator and the source through which we have identified the effect is given effect ([1] for effects that are found in empirical literature, [2] for effects that are described as potential in literature and [3] for effects that we find to be a potential consequence of the condition, based on economic theory). If the direction of the effect is unclear, this is shown by a question mark. The data are consistent with the indication in the framework grid.

First, the regulatory conditions are shown, then the other framework conditions and finally the exogenous conditions.

Ceramics sector

		Indicators									
Outcomes	Production and Value added	[3] +		[3] +	[3] +	[3] +		[2] +	[2] +		
	Employment							[1] -	[2] ?-	[2] ?-	
	Productivity	[3] ?						[2] +	[2] +		
	Profitability	[3] -	[3] +	[3] ?	[3] ?	[3] +/-	[3] -	[1] -	[1] +	[2] -	[2] -
	Exports and Trade	[2] +		[3] ?	[3] ?	[3] ?	[3] -	[2] -		[2] -	[2] -
Processes	Intra- and inter-industry relations	[3] -	[3] +		[3] -						
	Production processes							[1] +	[2] +		[3] -
	Organisation		[3]		[3]	[3]		[3] -	[3] -	[3] -	
Structure	Industrial structure	[3]		[1]	[3]		[3]				
	Size of enterprises		[3]	[3]							
	Level of specialisation		[2] +					[3] +			[3] +
	Segmentation					[3] +		[3] +			
Inputs	Labour	[1]									
	Capital	[3] +			[3] +	[3] +	[3] +	[2] +	[2] +	[2] +	[2] +
	Intermediate goods & services*	[3]		[1]				[2] -	[2] -		
	Knowledge & technology	[3] +	[2] +		[3] +			[2] +	[2] +		

* including raw materials

Framework condition:	Labour market regulations: use of crystalline silica										
	Knowledge (e.g. IPR): design-protection, enforcement of IPR, custom actions										
	Competition policy										
	Industry specific standards: lead limits in waste water										
	Industry specific standards: construction products										
	Consumer standards (health & safety): contact with food										
	Consumer standards (health & safety): obligatory certification schemes										
	Energy & Environment: Scheme for greenhouse gas emissions										
	Energy & Environment: IPPC Directive										
	Energy & Environment: REACH										
Energy & Environment: Framework for Community action in the field of water policy											
Regulatory conditions											

Ceramics sector

		Indicators									
Outcomes	Production and Value added		[3] [-]		[3] [+]	[2] [+]					[3] [+]
	Employment		[3] [-]	[3] [-]			[3] [-]	[3] [-]	[2] [-]		[2]
	Productivity	[3] [-]				[2] [+]					
	Profitability			[3] [-]	[3] [+]	[2] [+]			[2] [-]		
	Exports and Trade	[3] [-]	[1] [-]		[3] [+]	[2] [+]			[2] [-]		
Processes	Intra- and inter-industry relations				[3] [+]	[3]			[3]		[3]
	Production processes					[1] [+]					[3]
	Organisation	[3]									
Structure	Industrial structure	[3]	[3]	[3]			[3]	[3]	[3]		[3]
	Size of enterprises						[3]				
	Level of specialisation					[2] [+]					[1] [+]
	Segmentation					[3] [+]					[1] [+]
Inputs	Labour	[1] [-]				[3] [+/-]					[3]
	Capital							[3] [+]	[3] [+]		
	Intermediate goods & services*					[3]			[2]		[1] [-]
	Knowledge & technology	[1] [-]				[1] [+]					
		* including raw materials									
Framework conditions:		Labour force & skills: declining supply of high-skilled workforce EU Market access to third country markets (Trade & FDI): tariffs and quota EU Market access of third country markets (Trade & FDI): absence of import-tariffs EU Market access of third country markets (Trade & FDI): origin marking Knowledge based development: design-, production-, process-, distribution- and marketing-innovation Physical aspects & infrastructure: economies of scale Physical aspects & Infrastructure: high setup costs Energy & Environment: energy prices Access to finance Geographic cohesion									
		Other framework conditions									

Ceramics sector

		Indicators											
Outcomes	Production and Value added	[2] [-]		[2]						[3] [-]	[2] [-]	[2] [-]	
	Employment				[2] [-]		[2] [-]		[2]	[3] [-]		[3] [?]	
	Productivity												
	Profitability	[2] [-]	[3] [+]		[2] [-]	[2] [-]	[2] [-]	[2] [-]	[2] [?]	[3] [-]	[3] [-]	[3] [?]	[3] [?]
	Exports and Trade			[2]						[2] [-]		[3] [?]	[3] [?]
Processes	Intra- and inter-industry relations		[2]	[2]	[1]	[1]	[1]	[1]	[2]	[3]	[3]	[3] [?]	
	Production processes		[2]										
	Organisation												
Structure	Industrial structure	[2]	[2]	[2]	[1]	[1]	[1]	[1]	[2]	[3]			
	Size of enterprises	[2] [+]			[2] [+]		[2] [+]						
	Level of specialisation			[2]						[3]			
	Segmentation			[2]					[2]				
Inputs	Labour												
	Capital					[3] [+]	[3] [+]						
	Intermediate goods & services*		[2] [+]		[2] [-]	[2] [-]	[2] [-]	[2] [-]	[2] [-]	[2] [-]			[3] [?]
	Knowledge & technology		[1] [+]	[2] [+]						[3] [+]			

* including raw materials

Framework conditions:	Mature technologies to minimise energy use by kilns												
	Technological change: new techniques for recycling												
	Changing consumer tastes												
	Cost and availability of energy and raw materials: clay												
	Cost and availability of energy and raw materials: chemical raw materials												
	Cost and availability of energy and raw materials: raw materials specific for refractories												
	Restricted access to non energy raw materials												
	Distribution channels: moving away from raw materials, closer to end-users												
	Global competition: globalization												
	Global competition: competition from substitutes												
	Global competition: dependency on demand of steel/construction and renovations												
Global competition: exchange rates													
Exogenous conditions													

4.5.2 Conclusions from the grid

Outputs

On the output-side, we focus on five indicators that are potentially influenced by the different framework conditions presented in the grid. Often, an impact on one indicator has also derived implications on some of the other output-indicators. For example, changes in production volume and/or value can also imply changes in the employment level, profitability and/or export rate of the ceramics sector. In the following paragraphs, we go deeper into the impacts of the framework conditions on these five output indicators.

- *Production and value added*

In certain sub-sectors, such as tableware and wall and floor tiles, there is already a competitive advantage in producing value-added ceramics. However, due to increased competition from low-cost third countries, it will be important for the EU producers to stay ahead of these countries and to improve quality, time after time. This is where innovation and R&D play an important role. Both direct and indirect regulatory conditions related to innovation have a major impact on a product's value added.

- The **IPR** legislation and its enforcement and **design protection** regulation play a crucial role in protecting and enhancing the value added of European products, and thus ensuring investment takes place. However, SMEs are challenged to bear the administrative costs connected with these regulations;
- Besides these direct regulatory conditions, also more indirect regulations such as the **European energy and environmental policy** like IPPC and consumer and product standards regulations stimulate the European firms to invest in energy-saving techniques, or healthier and safer products. Acquiring this label of safe, healthy and/or energy-saving products will increase the value added of the EU ceramics, attracting new customers which are willing to pay more for these qualitative ceramics.

However, the **relatively limited supply of a high-skilled workforce** may form an important barrier to be able to keep up this high level of innovation in the future, especially when third countries are catching up. Investments in education and an optimal recruitment policy will therefore be indispensable.

Production, expressed in volume, is negatively influenced by low-cost imports from counterfeiting imports (declining demand for EU ceramics in domestic market), by EU import restrictive measures in the form of quota and tariff barriers (declining demand for EU ceramics in export markets) and by enhanced competition from substitutes (declining demand for EU ceramics both in domestic and export market). In addition, in the bricks and roof tiles, wall and floor tiles and sanitaryware sub-sectors production volumes are highly dependent on the demand of construction and renovations.

- *Employment*

The major concern for the employment situation in the EU ceramics sector is the absence of an international level playing field in several areas. First, most of the imposed regulations are very costly to fulfil and do not have a similar counterpart in third countries, or at least not that stringent. As a result of these cost differences, firms are

relocating production more and more to non-EU countries. Especially to countries where also labour costs are lower. Further, trade barriers (tariffs and quota) imposed on EU exporters and not on low-cost exporting countries have a negative impact on EU export. This may indirectly lead to serious EU production cuts, and consequently to job losses. Finally, also increased competition from substitutes and boosts in energy prices may lead to declining production, and therefore to a decline in employment.

- *Productivity*

Globalisation and increased international competition have forced the EU ceramic manufacturers to evolve to a more efficient production process, resulting in increased labour productivity. This trend of increased productivity will presumably continue in the future. In particular, the imposed **energy-saving regulations** are pushing the EU manufacturers to a more economic, energy-saving production process, implying an increase in productivity.

- *Profitability*

Profitability can be influenced in many ways. Here we focus on the influence of changes in production costs and of changes in the competitiveness of the EU ceramic manufacturers.

In order to comply with the imposed regulations like the energy-saving regulations (e.g. IPPC and the Directive establishing a framework for Community action in the field of water policy), certain costs have to be made in the form of capital equipment costs, in-house administration costs, testing costs, etc. This leads to an increase in production costs, and subsequently tends to diminish a firm's profitability.

These regulations, however, will also have a positive influence on profitability in the longer term. For instance, investments in innovation and R&D to comply with these regulations may lead to a more efficient production process and to upgraded products. The ETS-directive, for example, forces EU manufacturers to be more energy efficient and to be less dependent on expensive energy-sources (substitution of heavy fuel oil and solid fuels with clean fuel).

As mentioned before, profitability can also be influenced by changed competitiveness. A better position for a firm vis-à-vis its competitors will have a positive impact on its profits (in the form of an increased mark-up and/or increased sales volume). Investments in higher quality and more exclusive design give EU manufacturers the opportunity to distinguish their products from those of low-cost third countries and to target customers who are willing to pay a higher price for these refined, value added ceramics. However, the diminishing availability of raw materials, makes EU manufacturers increasingly dependent on imports from third countries, and therefore has a potentially negative effect on the firms' profitability. Furthermore, a higher product price does not necessarily translate as high or increasing margin. In the context of increased global competition and rising input costs, margins have been coming under pressure in the ceramics sector. It must also be remembered that there is a limit to how much customers will pay (hence, how much ceramics manufacturers can charge) for the finished product. This sensitivity to price can be expected to intensify as the EU economy slows over 2008-10, and put margins under pressure.

- *Exports and Trade*

Exports and trade depend on the relative competitive position of the EU producers vis-à-vis non-EU ceramic producers and vis-à-vis EU and non-EU producers of ceramic substitutes.

Increased investments in innovation and R&D and the consequential improvement of EU ceramics' quality and value added have had a favourable impact on EU exports. This is the case for the export of hotelware to the US. The EU manufacturers' strategy is to focus on the high value added segment in the US consumer market. EU ceramic imports slightly exceed Chinese imports on the US market in terms of **value**.

However, the increased competition of low-cost third countries on the US market is a serious threat for the EU exporters. In terms of **volume**, Chinese ceramics already overshadow European imports. In addition, the absence of an international level playing field regarding trade hampers EU exports even more. Mexican producers of hotelware ceramics are not subjected to import duties on the US market and Chinese low-cost exporters are facing lower import duties than their EU competitors.

Export and trade are also **indirectly** influenced. First, as a consequence of the absence of an international level playing field, EU producers are in a weaker competitive position compared to their non-EU competitors. This has negative implications on export volumes. Second, some of the regulations such as the energy-saving regulations have a negative impact on a firm's profitability due to increased production costs. These increased production costs are deteriorating the EU manufacturers' competitive position regarding low-cost third countries even more.

Processes

- *Intra- and inter-industry relations*

A different impact of the imposed regulations or framework conditions can influence the **horizontal intra-industry relations** (relations between the different ceramic sub-sectors). The labour market regulation concerning the use of crystalline silica, for example, will have a higher impact in sub-sectors that are more labour-intensive and that have a higher use of powdered crystalline silica. Also the cost of energy will have more implications on the more energy-intensive sub-sectors, such as refractory ceramics.

Also the **vertical intra-industry relations** (relations between the EU ceramic producers, suppliers, traders and end-users) are influenced by some of the conditions of the grid. In the wall and floor tile sub-sector, ceramic manufacturers are increasingly moving to new locations which are closer to the markets. By moving to the markets, the producers have a closer relationship with end-users, and are in a better position to react on changing consumer tastes (increased downstream bargaining power). On the other hand, this location shift has implications for the transport costs of the delivery for shipment of raw materials (lower upstream bargaining power).

The **inter-industry relations** (relations between the EU ceramics sector and other substitute sectors) are influenced by regulations that apply to the ceramic sector and not to the substituting sectors (e.g. the Social Dialogue regarding the use of crystalline silica and products containing it). Furthermore, changes in the price of raw materials (e.g. clay)

will have an impact on the inter-industry relations between the ceramics and substitute sectors, e.g. by leading to disadvantages for ceramic producers vis-à-vis their competitors in the substitute markets.

Finally, in the bricks and roof tiles, wall and floor tiles and the sanitaryware sub-sectors, demand for ceramic products depends on the demand for construction and renovation. Falls and upswings in the construction sector can therefore have serious implications for the ceramics sector.

- *Production processes*

Changes in the production process are mainly due to the technologic adaptations in order to comply with the new imposed requirements or in order to stay competitive vis-à-vis competitors. However, also regulatory conditions such as the lead limits in waste water and the ETS-directive will have an indirect influence on some steps in the production process.

- *Organisation*

The organisation of ceramic manufacturers in the EU is mainly affected by the increased administrative burden resulting from the imposed regulations such as the lead content standards, the greenhouse gas emission legislation, the IPPC directive and the REACH regulation. For example, in order to comply with the REACH requirements it has been reported that large firms recruit new positions specifically focussed on REACH compliance. The administrative burden increases and therefore incentives arise to produce at a larger scale. From this perspective it is quite obvious that the compliance costs are relatively higher for SMEs than for large companies, especially in the light of competition from outside the EU where less stringent regulations prevail.

Structure

- *Industrial structure*

Competition policies refer to the regulations on mergers and acquisitions. Except for the brick sub-sector, which is already concentrated, this policy seems not to be a major issue for the industrial structure of the EU ceramics sector. Most sub-sectors are populated by a large number of SMEs and there are no signals of a forthcoming wave of mergers.

The availability of raw materials and energy, however, forms an increasing barrier to enter the market. Many ceramics sub-sectors rely on virgin raw materials. The possibilities of recycling ceramics are limited. Furthermore, there is increased competition of third countries with sufficient clay reserves. The increased dependence on imported raw materials forces some of the EU manufacturers to outsource production to non-EU regions where the prospects of economies of scale are higher. In addition, these regions are mostly characterised by a low-cost labour force, enhancing this relocation movement even more.

Furthermore, distribution channels play an important role for the EU ceramics structure. Especially in fine ceramics sub-sectors, there is a transition to new locations closer to consumer markets, away from the sources of raw materials. The reason behind this movement is to be able to adapt faster to changes in tastes and fashions and to be more flexible in the choice of manufacturing location. Transport costs connected with the

delivery for shipment of raw materials increases, but the delivery to customers becomes cheaper.

Finally, technological changes, for example regarding recycling, will have an impact on the future structure of the ceramics sector. Here also, the new imposed regulations, such as the energy-saving regulations, play an important role. They stimulate EU manufacturers to invest in new techniques and improvements in the production process, potentially leading to serious technological changes resulting in a changed sectoral structure.

- *Size of enterprises*

Most ceramics sub-sectors in the EU are dominated by SMEs. Up to now, there are no clear indications that this situation will change. However, the stringent regulations such as the IPPC Directive and the ETS may force smaller firms to leave the market or to collaborate in more concentrated, enlarged structures.

Brick production, which is a very local sub-sector, is already very concentrated. Until now, the European Commission has never prohibited any mergers in the brick sub-sector.

- *Level of specialisation*

Due to fiercer international competition from low-cost countries, EU ceramics producers are encouraged to specialise in high quality products. Also regulations such as the one on greenhouse gas emissions and the lead content standards have led to increased investments in innovation and R&D and consequently to increased specialisation in more qualitative ceramics (e.g. in the field of energy saving ('eco'-products), health and safety).

- *Segmentation*

Segmentation in the ceramics sector is closely related to increasing levels of specialisation. The regulations concerning eco-design and greenhouse gas emissions contribute to the development of niche markets for energy-efficient products. In these markets, the EU has a comparative advantage thanks to its strong knowledge base.

A key feature and strength of the EU ceramics sector is that the majority of output is produced by a large number of SMEs that are better geared towards meeting regional demand and towards consumers throughout the world that are willing to pay high quality ceramics with a distinguishable and unique design. This is especially the case in the tableware and wall and floor tile sub-sector.

Globalisation and increased competition from low-cost third countries is forcing EU producers to increasingly focus on well-targeted market segments.

Inputs

- *Labour*

Due to increased investment in technology and all kinds of innovation, there is an increased need for highly-skilled workers. However, the negative image due to upheavals in the ceramics sector is deterring young recruits. In the future, the declining supply of highly-skilled workers may create a major problem for the survival of the ceramics sector

in certain regions. To counteract this potential supply shortage, serious investment in education and better recruitment will be necessary (e.g. enhanced cooperation with universities that offer study courses which are relevant for the ceramics sector).

- *Capital*

Capital needs are mainly affected by regulations such as the IPPC Directive and the lead content directive and other framework conditions which require important investments in for example new machinery or production plants. Also, technological progress has increased investment in new equipment.

- *Intermediate goods & services*

Here, we focus on the effect of the analysed framework conditions on raw materials and energy inputs. The production of ceramics is very energy intensive. Because of this, changes in energy prices have an important influence on production costs. In order to lower production costs, EU manufacturers are increasingly substituting heavy fuel oil and solid fuels with clean fuel. In addition, some of the regulatory framework conditions have led to more **energy-efficient production processes**.

A number of regulations have had a noticeable impact on the use of raw materials. The **lead content standard** has decreased the use of lead and the **Social Dialogue on the good handling and use of crystalline silica** has limited the use of this carcinogenic chemical.

Finally, we have to mention the diminishing availability of crucial virgin raw materials such as clay, leading to an increased reliance on the import of raw materials from outside of the EU – especially for technical ceramics and the refractory sub-sector. An alternative to imports is investing in recycling techniques. However the rate of ceramics re-use is relatively low and is restricted by the technical composition of ceramics and the market demands for technical performance and quality.

- *Knowledge & technology*

First of all, knowledge and technology are driven by increased international competition and the consequential need to distinguish EU ceramics from cheap ceramics produced in low-cost counterfeiting third countries. The directive on the legal protection of design and the enforcement of IPR are established to protect EU manufacturers from these counterfeiting competitors. This security encourages EU firms to undertake crucial investments in knowledge and technology. However, not all firms can afford the costly necessities to comply with these regulations.

Secondly, EU **environmental regulations and regulations regarding consumer and industry standards** have led to increased innovations concerning energy-efficiency and the optimisation of products in ecological and health and safety terms. New techniques regarding recycling are also developed. Nevertheless, further progress in ceramics recycling is rather limited due to the nature of the product.

5 Strategic outlook

5.1 Introduction

This chapter contains a medium- to long-term strategic outlook of the EU ceramics sector based on an in-depth assessment of underlying trends, future competitiveness drivers, and challenges. The chapter identifies the main implications for development of investment strategies and industrial policies to maximise the future competitiveness of the EU ceramics sector.

This strategic outlook is based on the challenges and trends identified in Chapters 2-4 in the report and on discussions with stakeholders and sector experts. The chapter is divided into two parts:

The *first part* of the chapter identifies the strengths, weaknesses, opportunities, and threats in a SWOT analysis of the competitive position of the EU ceramics sector. The ceramics sector is divided into seven sub-sectors and this means that some issues are more relevant in some sub-sectors than in others. We provide an overview of the relevance to sub-sectors in the presentation of the issues.

The *second part* of the chapter uses the SWOT analysis to point to possible strategic responses for the sector and policy makers in the Member States and at EU level. Again, there might be differences between sectors or geographical locations within the EU, which we will address wherever data allow it.

5.2 SWOT analysis

This section presents a SWOT analysis regarding the competitive position of the EU ceramics sector as a platform for discussing strategic options to meet the identified challenges. SWOT is an abbreviation of Strengths, Weaknesses, Opportunities, and Threats.

The four dimensions provide a framework for conducting a structured analysis of the competitive situation of the EU ceramics sector.

The ceramics sector has very different sub-sectors in terms of markets, products, distribution channels, etc. Large firms tend to dominate the coarse ceramics sub-sectors due to the need for economies of scale in production and high transportation costs. SMEs are less able to compete in these markets. SMEs dominate the fine ceramics sub-sectors that very often supply high-quality, high-value specialised products to selected markets.

The SWOTs affecting the competitive position are set out in the boxes below and each bullet is commented on and whenever possible related to specific sub-sectors.

Table 5.1: SWOT analysis. Overview of the competitiveness of the EU ceramics sector

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> ▪ Innovation. The EU is a world leader in producing value added ceramics products – manufactured by flexible and innovative SMEs. ▪ High-quality producers. The EU remains a major player in the high value, high-quality end of the markets. ▪ Design and branding. In some sub-sectors, EU firms brand and sell high-value unique designs; in some cases exploit country of origin marking. ▪ Fast response. SMEs can respond quickly to changing market demand and new opportunities ▪ New technology in production process. The use of automation technology and environmental technologies are widespread in ceramics manufacturing. ▪ Knowledge clusters. The clustering of SMEs in the sector fuels product and process innovations and increases competitiveness. 	<ul style="list-style-type: none"> ▪ Low production flexibility. The demand in the refractory sub-sector and in the brick and floor tile sub-sector is subject to changes in demand and there is only little flexibility in the utilisation of capacity. ▪ IPR – Protection of property rights and instigating legal proceedings against cheap “copies” is difficult and expensive for SMEs in some sub-sectors. ▪ Image. Low ability to attract skilled employees. Attracting technically competent employees is a problem. ▪ Mature production process. The ceramics production process is at a mature stage and close to its limits, whereas the ability to improve efficiency and reduce CO₂ emission further in the short term is limited. ▪ High entry barriers for new companies due to high set-up costs, economies of scale and tied distribution channels may hinder innovation ▪ High sunk-costs due to capital-intensive production facilities may hinder a shift in production from low-price to high-price products. ▪ Weight of the product. The high weight of some sub-sector products increases products cost and reduces access to customers. ▪ Difficult to install. Floor and wall tiles are more difficult to install than substitutes such as carpet or paint.

OPPORTUNITIES

- **Mergers and acquisitions.** The firms in the ceramics sector can merge to achieve economies of scale.
- **Specialisation.** Specialisation in selling high value-added ceramics suits the capabilities of many SMEs.
- **Access to new markets.** New markets are emerging in growing economies and firms must position themselves to exploit opportunities.
- **Brand and loyalty.** Being closer to the customers (geographical location nearer customers – for instance retailers)
- **Getting closer to customers.** Getting closer to customers by using the Internet.
- **Improvement of services.** Just-in-time and time-to-market are important especially in the b2b markets.
- **Developing cleaner technology.** There might be a scope for developing cleaner technologies in the ceramics sector.
- **Increased RTD activities.** Technical tiles and ceramics; smart materials, use of lasers in decoration, nanotechnology, automation of processes.
- **Labelling and communicating advantages.** Certifications, origin marking, and eco-labelling are opportunities for communicating advantages

THREATS

- **Low-cost competition.** Sharp rise in the import volume of low-cost ceramics from emerging economies – particularly in ceramic tableware.
- **Volatile demand.** Dependency on demands in other markets such as construction and for steel.
- **Emergence of China.** China is a serious competitor to the EU on the world ceramics markets – especially in terms of delivering low-cost products.
- **Increasing prices on energy.**
- **Raw materials.** Reliance on import of virgin raw materials from non-EU countries – especially for technical ceramics and the refractory sub-sector.
- **Environmental and Health and Safety regulation.** High levels of EU environmental regulation and emission control create a competitiveness challenge to non-EU countries where environmental legislation is less strict but primarily increases cost of European based production facilities.
- **IPR.** Intellectual property rights are infringed for fine ceramics sub-sectors.
- **Substitution.** In the long term, substitute materials and the relatively high dependency on the construction and renovation sectors may challenge the competitive position.
- **Trade barriers.** The EU faces high import duties into many export markets, e.g. the US compared to China and Mexico. Non-tariff barriers are also increasingly important.
- **Dwindling workforce.** A dwindling workforce can be a threat to the sector if not enough people can be recruited.

5.2.1 Strengths for the EU ceramics sector and its sub-sectors

Table 5.2: Strengths of the EU ceramics sector

Strengths	Tableware and ornamentalware	Sanitaryware	Technical ceramics	Vitreous Clay pipes	Refractory products	Wall and floor tiles	Bricks and Roof tiles
Innovation	●	●	●	●	●	●	●
High-quality	●	●	●	●	●	●	●
Design and branding	●	●	●			●	●
Quick response to market demands	●	●	●				
New technology in production process	●	●	●	●	●	●	●
Knowledge clusters	●					●	
No substitution					●		

Innovation

EU is a world leader in producing value added ceramics products manufactured by flexible and innovative SMEs. The review has showed how high levels of SME technological innovation and productivity shield the EU's global competitiveness in ceramics markets. Technical ceramics are often innovative and of high value. The EU supplies about a tenth of the world market but lags behind Japan and the US.

High quality

The ceramics sector delivers products of high-quality and high value. One indication of this strength is the competitive situation in the US hotelware market where cheap Chinese imports have a much higher volume in the US market than those from Europe. However, in terms of value the total value of European import to the US is still higher than import of Chinese products. It seems that Europe - at least in this area - can maintain a competitive advantage by competing on quality and not on price. The competitive advantages are thus in some instances more associated with knowledge than traditional factors of productions such as land, labour and capital. However, it should be noted that in sanitaryware, and perhaps other sectors as well, competitors from China or India produce high-quality products as well.

Design and branding

Design and uniqueness is important for consumer-oriented products such as tableware or tiles. EU, and in particular Italian, tile producers are world leaders in design. Producers are very often regional SMEs in close contact with the market and able to produce distinguishable and unique ceramics. The challenge is for EU producers to maintain, and even strengthen, this advantage. Brick producers are somewhat shielded from global competition partly because of the cost of long-distance transportation of bricks and

because differences in climate and culture demand different, technically distinct types of bricks. However, facing bricks can be traded at high values and transported over long distances. Clay blocks are usually not transported more than 200 kilometres and bricks might be transported for significantly longer distances. There are examples of glazed roof tiles being exported to China. Brand awareness among customers is important for exploiting the medium and upper ends of the market.

Country of origin marking is considered an important tool for consumers to differentiate between domestic and imported goods, to make informed purchasing decisions as it can be the determining factor in the purchasing decision. However, some consumer groups believe such marking can be misleading. The challenge therefore is for the ceramics sector and policy makers to work on developing meaningful and beneficial COO markings that are inexpensive to implement and police, and the enforcement of associated trade/product laws.

Quick response

The ceramics sector is dominated by SMEs that are geared to meet regional demand and provide a flexible production. The flexibility is associated with simplicity in the internal organisation – and by being fast at introducing new products and adapting to the demands of the customers. This is important even to tile producers, where product cycles have dropped from ten to four years and fashion and consumer tastes dominate the demand.

New technology in production process

The use of automation technology is widespread in ceramics manufacturing and investments in new technology and automation increase production flexibility to better suit customer demands. New technologies can help improve quality and create unique ceramics for specific differentiated markets. Most SMEs have invested heavily in new technologies including automated casting and decoration equipment as well as more environmentally friendly technologies.

Knowledge clusters

The clustering of SMEs in the ceramics sector fuels product and process innovations and increases competitiveness. This is especially seen in Spain and Italy where the close geographical proximity of ceramic wall and floor tile producers means that news of product or process improvements spread quickly. Proximity is also an advantage for the tableware producers in Bavaria (Germany), Staffordshire (UK) and Limousin (France) because the high number of enterprises also provides a source of skilled and experienced workers. The brick and roof tiles sectors are clustering.

No substitution

There is no known alternative or substitutes to refractory products and this gives the refractory sector a major strategic importance to other EU sectors such as i.e. steel, cement, glass, aluminium, copper and other ceramics sub-sectors, which *cannot be produced* without refractory products in the kilns.

5.2.2 Weaknesses of the EU ceramics sector and its sub-sectors

Table 5.3: Weaknesses of the EU ceramics sector

Weaknesses	Tableware and ornamentalware	Sanitaryware	Technical ceramics	Vitreous Clay pipes	Refractory products	Wall and floor tiles	Bricks and Roof tiles
Low production flexibility		●			●		●
Protection of IPR	●					●	
Image of the ceramics sector	●	●	●	●	●	●	●
Mature production process	●	●	●	●	●	●	●
High entry barriers	●	●	●	●	●		●
High sunk costs	●	●	●	●	●	●	●
Weight of the product		●				●	●
Difficult to install the product						●	●

Low production flexibility

The demand in the refractory sub-sector and in the sub-sector of bricks and floor tiles is volatile to changes in demand and there is little flexibility in the utilisation of capacity since the output needs to be constantly high for economies of scale. This has forced the closure of the least efficient plants and stimulated consolidation in a very price-competitive market.

IPR

Low-cost non-EU ceramics producers make counterfeits of EU ceramics designs and the cost of protecting property rights and the pursuing of cheaper “copies” through the court system can be impossible to meet for many SMEs. Tableware, in particular, has problems with infringements of IPR.

Poor ability to attract skilled employees

The sector depends on a highly skilled and flexible workforce. Attracting technically competent employees is a problem and the sector is experiencing image problems. With such image problems in combination with an ageing workforce, the EU ceramics sector may experience problems with maintaining its value-added competitive advantage as it requires a highly skilled workforce. However, increased automation in production may offset this weakness to some extent. The image of a technical sector should not be confused with the image of the products from the ceramics sector. The image of the products is very positive and this might be an asset in attracting employees. Moreover, large companies with good career opportunities will find attracting new employees easier than SMEs.

Mature production process

Over time, technological innovation has increased the efficiency of energy usage in production, and given the relatively high energy intensity of ceramics producers it has led to considerable savings and has also served to cut carbon dioxide emissions. Much of Western Europe's ceramics manufacture seems, however, close to the physical limits of efficiency and the limitations of the modern materials available for furnace construction. This limits the ability of EU ceramics producers to reduce use of energy and carbon dioxide emissions through efficiency, in the short term at least.

High entry-barriers

The ceramics sector is characterised by high entry-barriers due to the importance of economy of scale, high set-up costs, skills needed and required length of investment. The high capital intensity and associated financial and economic costs and risks together act as a significant barrier to entry. This may hinder new firms in starting up and hereby hinder the innovative input from these firms. Entry costs in the wall and floor tiles sub-sector are relatively low with a plant costing about €6 million and the sector has in fact seen many newcomers in the past 20 years. In the sanitaryware sub-sector, new plants are very costly for new investors and one expansion strategy is to buy existing plants and modernise them.

High sunk costs

In order to achieve significant economies of scale in production, output needs to be on a mass scale and high labour and capital productivity is usually required. Whilst this supports effectiveness and low prices, it may hinder restructuring in production from low-price to high-price products due to the high sunk-cost of abandoning existing infrastructure. The tile sub-sector is more flexible in its production and can more easily convert since high-cost and low-cost products are produced using the same equipment.

Weight of the product

The high weight of some sub-sector products increases product costs and reduces access to customers. The logistics part of the price of the final product is rather high.

Difficult to install

Floor and wall tiling is more labour-intensive materials than other substitutes such as carpet laying or painting. The price for tiling a wall can be 2 or 3 times higher than the product price and laying a carpet or simply painting the wall are cheaper options that can substitute for wall and floor tiles.

5.2.3 Threats to the EU ceramics sector and its sub-sectors

Table 5.4: Threats to the EU ceramics sector

Threats	Tableware and ornamentalware	Sanitaryware	Technical ceramics	Vitreous Clay pipes	Refractory products	Wall and floor tiles	Bricks and Roof tiles
Low cost competition	●	●			●	●	
Volatile demand		●	●		●	●	●
The emergence of China	●	●			●	●	
Increasing prices on energy	●	●	●	●	●	●	●
Import of raw materials			●		●	●	
Environmental and H&S regulation	●	●	●	●	●	●	●
IPR	●	●				●	
Substitution	●			●		●	●
Trade barriers	●	●	●		●	●	
Increased transport costs					●	●	●
Dwindling workforce	●	●	●	●	●	●	●

Low-cost competition

Imports of low-cost ceramics from emerging economies, particularly in the ceramic tableware sub-sector, is a sign that the competitive advantage of EU producers, based purely on cost, is diminishing. This is the main competitiveness problem to the EU ceramics sector and it has forced the closure of a number of EU ceramics manufacturers. EU output of tableware has dropped by 50% since 1990 in response to the low-cost tableware products flooding the EU market. One consequence of the closure of EU manufacturers could be a reduced capacity for innovation because of the loss of skills and talents in the ceramics sector.

Bricks and roof tiles are mostly produced for local markets due to relatively high unit transport costs associated with transport of raw materials and finished products. The weight of sanitaryware limits the scope of long distance international trade, but cheap imports from Turkey are hurting EU manufacturers. Turkey is the largest sanitaryware producer in Europe. Even China is entering the import market for sanitaryware despite the long distance. In some sectors, a consequence of the low-cost competition is a demand evolution from middle-range products to low-range products. Since the production costs are almost the same the profitability decreases causing producers of sanitaryware either to delocalise production outside Europe or to abandon the market completely. The high end of the market is less affected by this trend.

Volatile demand

A large part of ceramics production is a derived demand from the construction sector. The demand for bricks, tiles, and sanitaryware depend on the construction sector in the region, on the type of housing in demand. Moreover, the demand is seasonal. The volatile demand makes it difficult for producers to manage capacity, as there is little flexibility in the utilisation of capacity. In order to achieve economies of scale output needs to be constantly high. The demand for refractory products is derived from demand for steel, glass, ceramics and concrete in the construction sector and growth in demand has almost stagnated in Europe. With high growth outside Europe and the higher costs of imported raw materials as well as energy, transport, environmental regulation costs, a cost/benefit evaluation could cause parts of the refractory sub-sector to relocate outside Europe.

The emergence of China

China has experienced a rapid entry into the market in the past years and is a competitive threat to EU exporters. It should be noted, however, that while Chinese exports of hotelware ceramics to the US are high in volume the value of these products is not as high. The evidence in the hotelware sub-sector shows that the EU maintains a competitive advantage over China by competing on quality and uniqueness not on price.

Increasing prices on energy

The dependency on fossil fuels is one of the biggest threats to the ceramics sector and the cost and availability of energy are the most important framework conditions for the sector because energy costs make up 10 to 30% of production costs. Especially the production of bricks is highly energy-intensive and accounts for about half of the energy used by the whole ceramics sector. There is a need to improve efficiency but this remains a major challenge to the sector in the short term since kiln technology is already at a mature state. Energy prices are expected to continue to increase, and furthermore energy prices vary across countries as the energy sector is protected and energy consumption subsidised in some countries.

Raw materials

Raw materials account for around one fifth of total manufacturing costs and more and more raw materials are imported into the EU. The ceramics sector is in competition for the raw materials with other sectors and rising prices will be a challenge to the competitiveness of the sector – especially in sub-sectors where end-users can substitute ceramics products with other materials. The refractory sub-sector is highly dependent on imported raw materials such as high quality magnesia, bauxite, graphite. High-purity raw materials are found in very few places in the world and 90% of high-purity magnesia comes from China. High-quality bauxite mines are also found in Guyana, but these sources are now controlled by Chinese companies. In 2007, the price of bauxite went up 102% and the price of magnesia between 27% and 40%.

Environmental legislation

The ceramics sector faces environmental regulation in its energy use, on CO₂ emissions, on pollution prevention, and on waste. Environmental legislation is a major cost component in more sub-sectors. Energy efficiency has improved over the years and at least in the short term it is difficult for ceramics producers to comply with the IPPC directive. The ETS is without doubt very important to EU ceramics producers due the

energy intensity of production. Ceramics are energy intensive in the production phase but it is worth noting that, from a lifecycle perspective, the sector produces products that last for a very long time and this increases the overall energy efficiency of the products.

IPR

Intellectual property right regulations are gaining in importance, especially in fine ceramics sub-sectors such as tableware and wall and floor tiles. Fine ceramics are traded worldwide and to SMEs fighting counterfeiting and the defence of IPR will be a big challenge. One example is counterfeit Chinese tableware and ceramic tiles with designs copied from the designs of EU ceramics makers.

Substitution

Substitution of ceramics for other materials might be a problem in the long term. The demand for bricks depends on the type of building and the style of buildings. Substitutes such as steel, glass, and concrete can result in falling demand. The use of vitrified clay pipes is threatened by the use of non-ceramic substitutes such as PVC. For the bricks sub-sector lightweight, timber frameworks are a competitive threat in some Member States. Carpets and paints are a substitute for floor and wall tiles since the installation costs of the latter are very high.

Trade barriers

The US government poses up to 26% tariffs on EU-produced hotelware. Not all trade barriers are fiscal. Non-fiscal trade barriers such as quotas, testing and certifications have been identified in the study. In the refractory sub-sector, all growing markets are protected by import taxes. In Brazil, 60% import taxes make exporting impossible and other growth markets such as China, India, and Russia are protected as well. To import raw materials from China European manufacturers have to have a license and pay export tax and VAT. Chinese producers do not and this gives Chinese producers a considerable cost advantage in comparison with European producers even when considering the almost 40% anti-dumping duty on Chinese refractory products (magnesia bricks) introduced by the EU in 2005.

Dwindling workforce

The aging EU workforce, a dwindling workforce with traditional skills and a declining number of students in higher education, is a challenge to the competitive position of all firms in the ceramics sector.

5.2.4 Opportunities to the EU ceramics sector and its sub-sectors

Table 5.5 Threats to the EU ceramics sector

Opportunities	Tableware and ornamentalware	Sanitaryware	Technical ceramics	Vitreous Clay pipes	Refractory products	Wall and floor tiles	Bricks and Roof tiles
Mergers and acquisitions		●			●		●
Specialisation	●	●	●	●	●	●	●
Access to new markets	●	●				●	●
Developing brands	●	●	●	●	●	●	●
Getting closer to customers	●	●	●	●		●	●
Improvement in services		●				●	●
Cleaner technologies and products	●	●	●	●	●	●	●
Increased RTD activity	●	●	●	●	●	●	●
Labelling and communicating advantages						●	

Mergers and acquisitions

Consolidation through mergers and acquisitions is one possible strategy followed by the bricks and roof tiles sub-sector in particular to obtain economies of scale in the production process, specialisation of factories, sharing of parts and to be present in more markets. There seems to be room for an even stronger consolidation process. Mergers and acquisitions could also be an opportunity in other sub-sectors.

Specialisation

Specialisation in selling high value-added ceramics suits the capabilities of many SMEs. In many ways, the competitive advantages are shifted from traditional factors of production such as land, labour, and capital towards more knowledge-based economic activities. In comparison with low-cost competitors, European SMEs in the ceramics sector are producing innovative, high-quality value-added ceramics that are difficult to imitate in the short run.

Access to new markets

Certain markets in the world will experience high growth rates incl. Eastern and Central Europe, China, India and other Asian markets as well as several South American countries. These growth markets concern both key end user markets like construction, but especially consumer markets as middle to high income groups are growing significantly in these markets. European Ceramics companies need to position themselves in terms of creating production capacity, sales and marketing and distribution channels aimed at these new growth markets.

Developing brands

Uniqueness and design in high value ceramics is another opportunity for the ceramics sector in brand and design conscious consumer markets. Tableware and other sub-sectors are increasingly seeking to coordinate design efforts with other style-driven companies. Consumer life styles are changing and with an increased affluence tableware, sanitaryware and tiles are subject to fashion trends and the products can be expected to have a shorter lifecycle as consumer tastes are changing – in contrast to the elder generation with one or two lifetime dinner sets and new sanitaryware or the tiles only were bought when broken. However, in order to fully exploit the value of the brand, firms must engage with customers, to make them fully aware of its benefits, and new developments.

One example is a tableware producer that cooperates with a clothing company. Innovative decorators may find new business models. Another important reason for developing brands would be to raise the image of the ceramics sector to attract a highly skilled workforce. Many SMEs are located close to their customers and are able to work with brand and customer loyalty. Developing the brand does not only apply to the b2c market – also the professional market appreciates strong brands.

Getting closer to customers

IT technology and the internet give access to markets and customers in new ways and this leads to new business opportunities for manufacturers. Web shops and internet sites let consumers design their own products – even if it is mass produced products. One example is <http://www.diago.com> that invites consumers to create their own designs on the website. Doing business this way of course means that companies in the ceramics sector have to attract new skills and competences in web design or form new alliances with web design companies. Another opportunity to getting closer to customers is to think in new ways of presenting products in stores and DIY markets and letting the customers get a hands on feeling of the design and possibilities with the product. This helps to reinforce the brand.

Improvement in services

On the b2b market, sub-sectors such as sanitaryware, floor and wall tiles, bricks and roof tiles can develop their products by developing the services in connection with their products such as just in time deliveries, after-sale services, or fast attention to complaints. Delivering just in time reduces the need for holding stocks for customers such as construction firms and reducing stocks means more working capital for the customers. However, more flexible production methods are necessary for the ceramics firms to deliver just-in-time.

Develop cleaner technologies and cleaner products

There might be a scope for developing cleaner technologies and cleaner products in the ceramics sector. Cleaner technologies could focus on development of new techniques for recycling of raw materials, which would reduce the reliance on raw materials from non-EU countries. Other possible research and innovation areas are technologies or processes to help to reduce energy consumption or handling and recycling of wastewater.

Energy management and energy optimisation in all production processes could reveal energy-saving potential. Applying cleaner technologies thus has benefits in reducing the dependency and costs of input from materials and energy. One area could be reusing or recycling the energy that is currently let into thin air at up to 150°C. This heat might be used to heat up nearby houses, be put into other nearby industrial processes in an industrial symbiosis or perhaps it could be turned into electricity delivering to the public grid. Another important focus will be to research the use of renewable energy sources such as wind or solar energy to achieve a more sustainable production focus and to reduce the dependency on fossil energy sources.

A focus on cleaner products could result in more environmentally friendly products. In the brick and tile sub-sector, an example could be development of roof solutions with built-in solar panels or development of highly energy efficient clay blocks with strong insulation effects.

Increase RTD activities

Research and technological development is important for constant process and product innovation. Examples are technical tiles and ceramics, smart materials, ceramics used to create cleaner technology in other sectors, use of lasers in decoration, nanotechnology, automation of processes. As mentioned above, it is closely linked to cleaner technologies but the continuous investment in RTD is necessary to maintain a competitive advantage in high-quality products.

One important RTD activity will be to reduce the time-to-market for new products. In the sanitaryware sub-sector even Chinese producers are able to respond to market needs as fast as EU producers.

Labelling and communicating advantages

Certifications, labelling concerning country of origin and eco-labelling are product strengths. Labelling and certification schemes such as the EMAS, CE and the European Ecolabel enhance the credibility of products and make counterfeiting more difficult – even though counterfeiting cannot be stopped through a mere label or certification process. Labelling schemes can be an important way to support the communication of the brand profile to customers. Reports from manufacturers that already use eco-labelling confirm that type 3 eco-labelling, such as the European Flower, gives them a competitive advantage in the market. However, sector representatives criticise the European flower as being complicated, bureaucratic and only including a limited scope of environmental factors and for being disregarded by consumers or public purchasers.

5.3 Possible strategic responses

The SWOT analysis shows that the challenges to the production and logistics systems of the ceramics sector are the same across the different sub-sectors, whereas the competition, the markets, the distribution channels, and the structure of the market vary to such a degree that different strategic responses may be suggested to different sub-sectors.

Using the SWOT analysis, we have looked for ways to use the strengths of the ceramics sector to enhance opportunities and face the weaknesses and on how to use opportunities to strengthen weaknesses. The SWOT analysis illustrates that the ceramics sector is facing a large number of challenges in the coming years and many of the challenges are rooted in increased globalisation and the challenge of climate change.

The challenges from globalisation are illustrated by new low-cost competitors, increasing prices for energy and raw materials and market imperfections with tariff and non-tariff barriers and IPR issues. The European ceramics sector will find it difficult to maintain low-cost production and will need help to secure a more level playing field with its competitors.

Country of origin (COO) marking is used to inform the purchaser of the origin of the product and by helping to enforce trade laws can be used to protect domestic producers. However, the globalisation of production and procurement has, in some cases, led to increased uncertainty or confusion about the accuracy of such marking. The challenge is to provide accurate product information for consumers that is not so detailed that it confuses them, and to ensure the associated laws and regulations reflect commercial and economic realities. Country of origin schemes can be a burden on firms, especially SMEs. Such costs can include: physical marking; administrative costs; accounting; tracking; start-up costs, marketing/advertising costs. While such costs are often low, it can be hard to pass the cost on to customers for competitive reasons. The major issues and concerns associated with marking schemes include:

- the technical difficulty of marking products;
- the administrative burden and overhead costs related to imported goods that are finished in the EU;
- uncertainty about the marking requirements;
- markings that are unclear that the product has or has not been produced in the EU.

The benefits of COO marking are hard to measure and study results have been ambiguous. Nevertheless, COO marking is considered an important tool for consumers to differentiate between domestic and imported goods, to make informed purchasing decisions. While this is often only one of many features considered by consumers (along with price, quality, features etc) it can be the determining factor in the purchasing decision. However, given the complexities of globalised production and procurement, some consumer groups believe such marking can be misleading. The challenge therefore is for the ceramics sector and policy makers to work on developing meaningful and beneficial COO markings that are inexpensive to implement and police, and the enforcement of associated trade/product laws.

The climate is changing and the result will be environmental regulation in the EU and in the Member States. This is a serious challenge to the ceramics sector with a production process at a mature stage and with only limited ability to improve energy efficiency in the short term.

The challenges from globalisation and climate change are presented separately here but the challenges are closely interlinked, i.e. increasing prices on energy are rooted in an

increased demand for fossil fuels which at the same time is one of the main causes of the climate challenge. The simple solution for one challenge is in many cases worsening the challenge from the other. Globalisation and climate change are framing the agenda for businesses and policy makers now and in the years to come. Both issues must be addressed at the same time in a balanced way in the business strategies of individual ceramic companies and sub-sectors. To policy-makers in the EU and in Member States the task is no different.

Turning to the strengths and opportunities of ceramics and its sub-sectors, the EU has a good chance to exploit its position as a market-leader for high-value ceramics.

In the face of the challenges from globalisation the ceramics sector is well positioned with new technologies, high quality brands, a tradition for innovation and knowledge intensive enterprises which must be exploited in the future. The ceramics sector will have to give high priority to new technologies, strengthening brands and developing services to maintain the competitive advantage. Constant improvement in technologies to increase flexibility and efficiency must be encouraged.

The challenges from climate change must be met with a constant development of cleaner technologies, introduction of alternative energy sources and reduction of total energy use in production processes, in management systems, in products, in transportation and services. Policy makers can focus on improving framework conditions such as a more level playing field, improvement in the skills of the workforce and direct R&D resources in cleaner technologies and yet more efficient production processes.

Below we have indicated 5 themes for strategic responses pointing to possible roads of future development for the sector. The five themes are:

1. The strong position in the high-quality products should be exploited – again and again;
2. Engage in the environmental challenge;
3. Investment in technologies and systems;
4. Creating a level playing field;
5. Improve the skills base.

Below each theme, there are a number of possible strategic responses at all levels from the individual firms and stakeholder organisations to policy makers at Member State level or EU level. Many of the responses are interlinked since the thematic issues of exploiting strengths, being innovative and creating a level playing field are repeated in several of the responses.

It should be noted that some of the strategic choices companies can make are already being undertaken by sector leaders looking for new ways forward, or by companies in other sectors.

5.3.1 The strong position in high-quality products should be exploited – again and again

There is no doubt that all sub-sectors of ceramics are facing increasing international competition from non-EU producers, both within the EU and in third-party export markets. The EU ceramics sector risks losing the battle with low-cost high-volume products from non-EU producers. However, at the same time the sector has a strong competitive advantage in delivering high-quality products to specialised markets. Producing high quality and high value products is a platform for the competitiveness of the ceramics sector.

Thus, we have looked for ways to exploit the competitive advantage of the EU ceramics sector to take up the opportunities presented on the market. The opportunity to advance into a more fashion-oriented market or to present high-quality advanced solutions in direct co-operation with consumers or the end user constitutes an important lead for many companies who cannot compete with non-EU producers on price.

Adapt strategies to consumer needs

“Again and again” is added to the headline of this section to underline that the ceramics sector is part of an ever-changing world, with ever changing consumer tastes and needs and the successful company in the ceramics sector will have to rethink its position, business strategy and products very frequently and be prepared to reposition and adapt to new market opportunities at short notice.

A strong position can otherwise be eroded very quickly with competitors or consumers moving on to alternative solutions. The demanding and changing consumer market is a threat only to inflexible companies over-relying on tried and trusted technologies and organisation. The changing of consumer tastes and the growth in diversity should be seen as opportunities for companies to differentiate and to discover new market opportunities.

Brand awareness and communication are interlinked and communication of brands to customers is crucial to companies delivering to the high end of the market.

Developing brands

To companies in the ceramics sector it will be important to develop brands and to ask the question: “*what is the character of the solutions we are selling to our customers?*” The answer has consequences for marketing strategies, markets approached, development of business models, localisation strategies, globalisation strategies, organisation, management, technologies and products.

Different strategies could be followed:

- *The technology company.* The technology leader delivers state-of-the-art products and technology and delivers the most advanced products in the world. Customers will know that they are buying world-class products. The technology company focuses on technology and ensures that customers are themselves technology leaders by using the products;

- *The customer-oriented company.* The customer-oriented company takes its lead from the needs of the customer and develops individual or highly specific products or services designed to suit the individual customer in b2b or b2c markets;
- *The price-performance company.* The price-performance leader focuses on delivering high-volume, highly-standardised, products efficiently and at attractive prices. Companies focusing on delivering low-price products can be successful depending on the market but competition from low-cost non-EU companies is fierce.

Communicating brands

Even if companies have a clear vision of the character of the solutions they sell, or produce world-class products, it is of limited commercial value if the customers do not know about the advantages. To create or maintain a brand it is crucial to communicate its strengths and advantages. Very often, the material difference between low-cost products and high-cost products is only the brand. In the tiles sub-sector high and low-cost products can be produced on the same machines, in the sanitaryware sub-sector low-cost producers can change their production and produce high-quality products at relatively short notice.

Thus, companies have to invest in communication of their brand and have a clear vision of their customers' preferences and needs. Supportive instruments from the EU could be various labelling schemes, certification schemes, and standards that companies in the ceramics sector can use as third party documentation of the validity of their claims of excellence.

Fighting counterfeiting

In a market dominated by SMEs, many firms find it difficult to fight counterfeiting and low-cost "copies" of products originally developed in the EU, i.e. the counterfeiter and traders "steal" the original investment in innovation. It is not the responsibility of firms to control imports at the border and monitor the market for illegal copies. Member States and the EC could increase their efforts to take action against illegal traders and counterfeiters and also increase their efforts to make enforcement agreements with the countries of origin. It is also important for ceramic manufacturers, in particular for SMEs, to register their trademarks in third countries, especially in China, in order to be able to successfully take legal action against counterfeiters. The new Helpdesk for China established by the European Commission aims at supporting European SMEs with the protection of their IPR in China.

One measure against counterfeiting could be to provide ceramics products with origin marking. Origin marking provides clear information to consumers and helps the image of the ceramics sector, and it could be an important support for manufacturers in building a brand for their products.

The fact that non-EU firms find it attractive to make illegal copies of EU brands and sell them is a testimony to the strong position of EU ceramics brands and the value of having a brand.

Table 5.6: Possible strategic responses at political and sector level

	Level of response		
	Sector	Member State	EU
Adapt strategies to consumer needs	●		
Developing brands	●		
Communicating brands	●		●
Fighting counterfeiting	●	●	●

5.3.2 Engage in the climate change challenge

The climate change challenge is one of the most important issues on the political agenda in the EU and in the Member States, which is also reflected in the increased environmental legislation. It therefore does not seem as an option that the environmental regulation might decrease in the future. Furthermore energy prices are expected to increase due to increased demand for energy. Sector reaction should be to engage in the climate challenge and enhance energy efficiency and reduce the environmental impact by investing in cleaner technologies and environmental management systems.

Individual companies cannot change the framework conditions, but introducing cleaner technologies, energy management, and branding environmentally sound practices will create not only a sounder environment but also better business opportunities. Sector leaders have accepted this, and the mission statement of one leading brick and tile producer reads:

“... we regard the economy as an integral part of society. Its duty is to serve people and generate benefits for all. Our goal is to create sustainable values with natural products: a residential environment of life-long quality and safety for our customers, a sound investment for our shareholders and attractive jobs for our employees. We take our role as a responsible member of society seriously and act in accordance with economic, ecological and social principles – in order to remain successful in the future.”²⁷

Increase efforts on developing cleaner technologies

Cleaner technologies and energy efficient production methods might be key elements for companies who wish to position themselves towards consumers who are increasingly prosperous, informed, environmentally conscious and socially aware. Delivering cleaner technologies and products can be an important competitive advantage if a company can demonstrate a better environmental performance than that of its competitors. However, cleaner technologies must not be seen only as a marketing tool, since cleaner technologies and energy efficient production are necessary to comply with environmental and energy legislation and to drive down costs from buying increasingly expensive fossil fuel-based energy.

Eco-innovation and cleaner technologies can compete with, or are superior to, their conventional counterparts. Cleaner technology can be defined as the efforts made to eliminate pollution and waste resulting from the production, use, and disposal of products, or to limit it as close to the source as possible. This involves changing the product or the production process so that the total environmental impact from the circulation of materials through society is reduced as much as possible.

Energy and environmental management systems

Environmental management systems, energy management systems and a lifecycle perspective on products are important tools readily available to firms in the ceramics sector.

In view of the challenges to the energy-consuming sectors from environmental legislation and emission control, part of the answer for the ceramics sector could be to apply cleaner technology processes and management. The sector could exploit existing environmental management systems and ask for help in the Member States or the EU to identify the best available technologies or to provide a more diverse eco-label scheme. One option open to ceramic firms is the EU EMAS scheme. The Eco-Management and Audit Scheme (EMAS) is the EU voluntary instrument which acknowledges organisations that improve their environmental performance on a continuous basis. EMAS registered organisations are legally compliant, run an environment management system and report on their environmental performance through the publication of an independently verified environmental statement.

Cleaner product development

Developing more energy efficient and sustainable products is another important area for cleaner technology. Once produced, most ceramics can have a long life and many ceramic products require no further maintenance. But further research can make ceramics even more attractive as the cleaner alternative. One example of recent products is clay blocks with improved thermal isolation by using expanded perlite in the hollows of the clay block. Clay blocks are a good example of ceramics that are energy intensive in production and can help save energy when used in construction. Other examples could be the use of ceramics in automobiles where ceramics may be the enabling technology for many critical components in engines of the future because of their unique heat, wear, and corrosion resistance, light weight, and electrical and heat insulating properties. Cars of the future may have ceramics integral to their engine structures and in wear-resistant applications in fuel systems and in additional components in valve trains, such as valves and valve seats. Futuristic cars may use ceramic fuel cells for near-emission-free operation.

Creating tools for communication of environmental performance

Eco-labels exist for tiles and having an eco-label inspires consumer trust because it emphasises claims of high quality and thus provides a competitive advantage to the company with an eco-label. Sector representatives debate the benefit of using eco-labels for individual firms. Other options to convey reliable information on environmental performance and advantage of certain products to consumers can be considered. Without an efficient communication tool on environmental advantages of certain products it will

be difficult for manufacturers to translate the investment in environmental innovation into competitive advantage.

Researching new energy sources

Today the ceramics sector is dependent on access to fossil based fuels sources with increasing prices and high CO₂ emissions. However, the scope of radically improving energy efficiency in production is limited in the short run and it is therefore important to invest in the development of new energy sources, renewable energy, more energy-efficient production etc. The EU and the Member States could consider strengthening research and development programmes (e.g. the Framework Programmes) within energy efficiency toward the ceramics sector. The aim of the research should be to obtain radical new solutions for energy savings in production.

Table 5.7: Possible strategic responses at political and sector level

	Level of response		
	Sector	Member State	EU
Increase efforts on developing cleaner technologies	●	●	●
Energy and environmental management systems	●		●
Cleaner product development	●		
Tools for communication of environmental performance	●	●	●
Researching new energy sources	●	●	●

5.3.3 Investment in technologies and systems

Thus, constant investments in high quality and efficient production processes, cleaner technologies, logistics systems and innovative products, while maintaining a trained and motivated workforce, must be continued and encouraged.

The EU ceramics sector already has a strong position in using advanced technologies and though the production processes are very mature, technologies with only a little extra energy-saving potential might provide opportunities for more energy-efficient production, more flexible ways for mass production or more advanced management systems.

Efficient and flexible production will be needed in the future for successful ceramics companies. An increase in R&D-investment in product technology must first of all be the sector's responsibility. But the EU and the Member States could consider strengthening research and development programmes (e.g. the Framework Programmes) to develop more efficient and flexible automation technologies for the ceramics sector and related activities.

Improve sector capacity for efficient manufacturing and services

One keyword is *efficiency*. *Efficiency* will be needed to drive down costs, energy use, transport costs, environmental impact in order to deliver fast and cost efficient to customers. The sector will have to invest in energy efficiency and efficient use of materials while simultaneously reducing the cost of processing. Enhanced efficiency will be important to maintain competitiveness and profitability. There are already considerable investments in improving efficiency through automation and more efficient production technology throughout the sector. The strategy to increase capacity by improving the efficiency of existing production facilities rather than expanding through building new facilities seems to be a rational choice.

One possible advanced avenue for the bricks and roof tiles sub-sector could be to develop prefabricated building elements or even complete houses which could be produced by processes that are more automated and delivered at a lower price. Building houses is a complicated process and ceramics manufacturers will have to look for strategic partners in the construction sector to handle the process. Another example is the development of polyurethane foam as a substitute for mortar. This makes masonry cheaper and faster and cuts labour costs in the production phase.

Improving sector capacity for flexible manufacturing and services

Flexibility is the other important keyword. Flexibility, customisation, or even personalisation, will be in demand, and firms with flexible production and distribution systems, which can deliver high-quality products to many different customers in different places on time, will have a successful technology. Successful technologies will be based on modules that can be rapidly reconfigured and seamlessly integrated in automated processes. The low flexibility of the production in the ceramics sector is a weakness and an important area for research and development. Moreover, flexibility should be seen in a wider context and any area uncovered where there is still flexibility to meet customers will be of value to the competitive position of the company.

Research, development and technological development – in new ways

Closely connected to cleaner technology is the need for investment in research, development, and technological developments in the ceramics sector. Technological innovation in products and processes are required to maintain competitive advantage in producing high-quality products that the EU ceramics sector already has. It is important to continue these investments, and fiercely competing SMEs may find it difficult to find the necessary resources in the future.

The EU and the Member States could consider increasing their support in establishing and investing in research and development programmes. Moreover, the establishment of research and development programmes would attract interest from highly skilled academics and thus strengthen the sector's knowledge base.

A brief search for projects containing the word “ceramics” at cordis.europa.eu reveals 4 projects under the FP7 programme, 55 projects under the FP6 programme and 94 projects under the FP5 programme. Looking across all the research programmes registered by Cordis the word “ceramics” is found in 165 projects in 1990 – 1994, 168 projects in 1995 – 1999, 124 projects in 2000 – 2004 and 49 projects since 2005. This very simple

indicator of research activity in the ceramics sector from the EU programmes has many shortcomings but it may be indicative of a need to prioritize and focus more on research and development in the ceramics sector.²⁸

Many companies in the ceramics sector are localised in clusters and they already benefit from access to a common skills base. It is important for companies to exploit new knowledge and research capacities in local research institutions and to monitor and try new technologies promoted internationally.

Attention to new technologies in untraditional sectors

However, the most important strategy is perhaps to be attentive to new technologies and demands in sectors where the ceramics sector has not traditionally been involved. In these sectors, new business opportunities can be created if the ceramics sector can produce new types of solutions.

It will be important to engage not only with ceramics technology experts but also to engage actively in for example collaborative research with end-user companies or partners in other sectors to discover new applications for ceramics technology. Collaborative research and a user-oriented focus on solutions can lead to strong competitive advantages with products deeply integrated into the value chain and consequently production processes can be customised even more precisely and individually.

Table 5.8: Possible strategic responses at political and sector level

	Level of response		
	Sector	Member State	EU
Improve sector capacity for efficient manufacturing and services	●		●
Improve sector capacity for flexible manufacturing and services	●		●
Research, development and technological developments	●	●	●
Attention to new technologies in untraditional sectors	●		

5.3.4 Creating a level playing field

There is a need to improve the competitive environment for the ceramics sector in EU markets and in export markets so that EU and non-EU companies have equal opportunity to compete. Currently, the playing field is not even with non-EU competitors often producing their products with OHS and environmental standards well below EU standards, with lower energy prices and perhaps better access to raw materials and thus delivering products at a much lower cost. Moreover, the ceramics sector is facing problems with counterfeiting and will have problems finding a skilled workforce.

If the playing field for the sector gets to be more level then EU ceramics sector will stand a better chance to compete with non-EU competitors and can bring all its qualities into an even better competitive position. Not only on the internal EU market. Perhaps more importantly a level playing field would open opportunities in new and growing export markets. In India, 400 million consumers will demand new housing in the next 20 years – the same will be true for other non-EU high-growth markets.

The perspective of exploiting the strengths of the EU ceramics sector on a level playing field could create new business opportunities in markets with a growing appetite for quality and a growing willingness to pay for high quality and environmentally friendly products. Even if many SMEs are national companies today they could be integrated even more into global structures tomorrow without losing the agility of a SME.

The use of the internet to have a market presence in non-EU countries with online web shops, localisation in other parts of the world, mergers and acquisitions, partnerships or co-branding with global companies are opportunities waiting to be exploited by SMEs in the ceramics sector and certainly by the larger companies.

[Improve the functioning of the EU energy markets](#)

Energy is a very important input factor to the EU ceramics sector, and increasing energy prices will have an effect on the sector's product prices and profits. Energy security and reliability in terms of prices is of strategic importance to the competitiveness of the ceramics sector. In many non-EU (competitor) countries, energy prices are still protected and energy consumption is subsidised. This is reducing the competitiveness of the EU ceramics sector, and the EU should increase its efforts to improve the functioning of its energy markets by lowering prices and increasing stability.

A successful improvement to the energy market would remove an important threat to the ceramics sector by creating a more level playing field with non-EU producers – though the high prices on energy based on fossil fuels can be expected to continue and this might lead some market segments to look for substitutes for ceramics anyway. As shown above, a more level playing field will enhance the ability for companies to compete not only within the EU but also in non-EU markets.

Thus, with a more level playing field with non-EU countries this could compensate or even more than compensate the turnover lost from the competition from substitutes by expanding the market to a wider and more global consumer base.

[Environmental regulation](#)

Environmental regulations such as the scheme for greenhouse gas emissions (ETS) and IPPC regulations have a significant impact on the competitiveness of the EU ceramics sector by imposing higher production costs than those faced by non-EU producers due to the energy intensity of the production process. The EC needs to work to ensure international coordination of CO₂ regulation beyond the EU borders.

Unilateral environmental regulations are putting the sector under pressure and the EU and its Member States could increase their efforts to establish a global CO₂-emission trading scheme and perhaps find other ways to offset the competitive disadvantage of the sector.

One possible instrument could be to explore a trade policy where it is possible to act within the framework of the WTO agreement. To the sector, the challenge is to manage an increasing number of environmental requirements from the EU. The Copenhagen Climate Summit in 2009 might be a good opportunity to strive for multilateral ETS.

Levelling competitive conditions with non-EU producers

In competing with non-EU manufacturers, the EU ceramics sector is not on a level playing field. The EU could increase its efforts in a number of areas such as promoting ILO social conventions in other countries since OHS standards are usually required at higher level within the EU.

Improve access to markets

Access to export markets must be improved to create equal opportunities for competitors in the market and the EC could increase its efforts to get reciprocity with main trading partners. For instance, import trade tariffs in China are twice as high as the EU tariffs. The EC and the Member States should work for a reduction in tariffs and actions on non-tariff barriers in the ongoing WTO Doha Round where the question of IPR should also be pursued. Other important tools which may help to improve access to third country markets:

- close cooperation of the ceramics sector with the Commission in order to tackle market access barriers of third countries, e.g. better information flow, complaints etc.
- better use of the WTO Dispute Settlement System
- free Trade Agreements (FTAs) with third countries, now for example with Ukraine and the Andean Community (Colombia, Ecuador, Peru, Bolivia)

Finally, improvements in infrastructure – especially cross-border railway freight transportation and short sea shipping would improve access to markets for heavy weight products such as bricks and roof tiles.

Table 5.9: Possible strategic responses at political and sector level

	Level of response		
	Sector	Member State	EU
Improve the functioning of the EU energy markets		●	●
Environmental regulation		●	●
Level competition conditions with non-EU producers			●
Improve access to markets		●	●

5.3.5 Improve the skills base

Improve the skills base of the ceramics sector

Access to skilled labour is already a challenge, and it may be an even bigger challenge in the future with an ageing workforce and competition for skilled labour from other sectors.

If the ceramics sector cannot find the skilled workforce in needs, part of the solution could be more automation. However, it is perhaps more likely that more of the sector will be outsourced to non-EU countries.

SMEs tend to cluster in regions with a skills base, and the EU, its Member States and sectors could increase their efforts to maintain and develop a base of highly skilled employees – for instance via targeted training programmes for low-skilled workers, investment in new education and training programmes or RTD programmes attracting designers or engineers to the sector. Establishment of formal network or other forms of enhanced cooperation with universities that offer study courses which are relevant for the ceramic sector.

A highly-skilled workforce will be in demand in production and they must have the tools and skills needed to operate the technologies and to collaborate across different departments regardless of localisation. This will be a challenge for SMEs looking for global opportunities as well as large companies operating in several countries as can be seen in the bricks sub-sector.

If the ceramics sector had sufficient access to a skilled workforce, an important threat would have been overcome and the companies in the ceramics sector could then concentrate on strengthening their competitive position by exploiting opportunities in the market. If advancing on a global market is an opportunity to the SMEs then strategic competencies and especially global experiences will be in demand at managerial level.

[Improve life-long learning](#)

The number of employees in the European ceramics sector has dropped, partly due to investment in automation technology. The demand for low-skilled labour has decreased as well. However, it may be expected that the ceramics sector will still need skilled labour to carry out jobs associated with a flexible and specialised production. Both the EU, the Member States and the sector could increase their efforts to maintain and develop a base of highly-skilled employees, for instance via targeted training programmes for low-skilled workers, investments in new education and training programmes, and efforts to improve the image of the sector among young people.

[Improving the image of the ceramics sector in the workforce](#)

Improving the image of the ceramics sector is a challenge that the sector shares with other sectors demanding a technically skilled labour force. Improving its image is a complex task and both individual firms and the sector as a whole have a role to play.

Branding and design of products, investment in technology programmes, and development of cleaner products will be significant inputs to the process of improving the image of the sector to a workforce that is increasingly oriented towards more creative and knowledge-intensive education and career opportunities.

Individual firms and trade organisations will have to cooperate to improve the image of the sector as a whole, and with individual firms competing for the employees in the same skills base this has to be carefully planned, probably at a more general level.

Table 5.10: Possible strategic responses at political and sector level

	Level of response		
	Sector	Member State	EU
Improve life long learning	●	●	
Improve the skills base of the ceramics sector	●	●	●
Improve the image of ceramics sector to the workforce	●		

6 Conclusions

The ceramics sector as defined in this study is made up of a diverse set of sub-sectors including Tableware and Ornamentalware, Sanitaryware, Technical Ceramics, Vitreous Clay Pipes, Refractory Products, Wall and Floor Tiles, and Bricks and roof tiles. Accordingly, the sub-sectors vary in terms of concentration, geographical clustering, and the degree to which low-cost competition from outside of the EU is limiting production and employment gains. The wall and floor tile sub-sectors, for example, tend to be quite fragmented, although this is to some extent compensated for by the existence of clustering in areas such as Emilia-Romagna in Italy and Castellón in Spain. Conversely, the brick and roof tile sub-sector is becoming increasingly concentrated as a result of the need to gain economies of scale to help manage high energy prices. Low-cost tableware and sanitaryware are most at risk from low-cost competition, although globalisation is an opportunity as well as a threat with sub-sectors such as wall and floor tiles exporting around the world and competing successfully at the high value-added end of the market.

The main competitiveness challenges and prospects of the EU ceramics sector are listed below in Table 6.1.

Table 6.1 Challenges and prospects facing the EU ceramics sector

Challenges	Prospects
The growth in imports of comparable low-cost products from emerging economies.	Major global player in ceramics production, especially wall and floor tiles.
Outsourcing of ceramics production outside of the EU.	A competitive advantage in producing value-added ceramics.
High dependency on raw materials (including Non-EU ones).	Few very dominant producers contributing to intra-EU competitiveness.
Low ceramics re-use and recycling in manufacturing.	High number of SMEs that can serve a wide range of markets.
Soaring energy prices.	Globalisation has created greater specialisation, which has suited SMEs.
The EU is not on a level playing field in the global market in terms of Health and Safety, emissions and quality standards.	Increasingly diverse, consumer-driven market.
A marked decline in the ceramic tableware sub-sector.	Unique products through high levels of continuous innovation.
Increasing production efficiency to comply with emissions regulations, when kiln technology is already mature.	Some high value ceramics products are difficult to imitate.
Proportionately high administration costs of emissions regulation for SMEs.	Skilled and experienced workforce.
Tariff and non-tariff international barriers to trade.	Majority of trade within Europe, hence close to most markets.
Continuous innovation to prevent imitation from foreign competitors.	Upward trend in employment productivity.
Substitutability of ceramics with less energy-intensive innovations that are more environmentally friendly.	Scope for environmental product innovation and opportunities.

Regarding the horizontal aspects affecting competitiveness of the European ceramics sector, the two most fundamental conditions are the imposed environmental regulations and the increased international competition.

Many of the environmental regulations have led to additional investments and to an increase in the administrative burden for firms. Moreover, regulations that only apply to EU producers tend to worsen the competitive position of these firms as compared to their non-EU competitors, due to the absence of a global level playing field.

Environmental regulations increase the entry barrier further when they increase set-up costs. A producer has to be efficient enough to produce output in a profit-gaining way, under the limitation of more stringent regulations. The fact that R&D can become necessary to survive is similar to an increase to entry barriers or of higher set-up costs.

Yet the sector also partly benefits from these restrictions and requirements. Regulation has led to increased research on energy-saving production processes and energy-saving products, on recycling and on alternative raw materials. Thanks to these developments, EU production has not only become more environment-friendly, but also more cost-effective and less dependent on raw material imports.

EU producers have reacted to the increasing imports from low-cost countries by specialising in high value and niche products that leave more space for profit margins. The production of high value products leads to better profit margins, and the EU is performing relatively well in this market, thanks to its solid knowledge base and continuous further research. The enforcement of IPR legislation and the design protection Directive are however crucial to the specialisation in high value and niche products.

The price competitiveness of ceramics products has also been damaged by the strong increases in energy prices since 2004. To the extent that this is driven by market forces and increases power generation costs, all producers should be equally affected. However, the lack of competition in EU energy markets appears to have contributed to the increases, and has disadvantaged EU ceramics producers compared to non-EU producers and other EU producers in different countries. This is compounded by the fact that, in some countries (EU and non-EU), the environmental taxes imposed on power consumption are lower. It is unlikely the ceramics sector will be able to receive any special exemption from energy taxes to lower its power costs. A more fruitful strategy will be to push on with promoting competition in energy markets and the fuller development of a pan-European electricity grid.

The strategic outlook has used SWOT analysis to point to possible strategic responses for the sector and policy makers in the EU Member States. The SWOT analysis illustrates that the ceramics sector is facing a large number of challenges over the coming years and many of the challenges are rooted in increased globalisation and the challenge of climate change.

The challenges to the production and logistics systems of ceramics are the same across the different sub-sectors, whereas the competition, the markets, the distribution channels,

and the structure of the market vary to such a degree that different strategic responses may be suggested for different sub-sectors.

In the face of the challenges from globalisation the ceramics sector is well-positioned with new technologies, high quality brands, a tradition for innovation and knowledge intensive enterprises which must be exploited in the future. The ceramics sector will have to give high priority in new technologies, strengthening brands and developing services to maintain the competitive advantages. Constant improvement in technologies to increase flexibility and efficiency must be encouraged.

The challenges from climate change must be met with a constant development of cleaner technologies, introduction of alternative energy sources and reduction of total energy use in production processes, in management systems, in products, in transportation and services. Policy makers can focus on improving framework conditions such as a more level playing field, improvement in the skills of the workforce and direct R&D resources in cleaner technologies and yet more efficient production processes.

Five themes for future development of the sector are highlighted:

The strong position in the high-quality products should be exploited

The sector has a strong competitive advantage in delivering high-quality products to specialised markets. Producing high quality and high value products is a platform for the competitiveness of the ceramics sector. Delivering high quality in products and service, continuous development, strengthening and communication of brands are important strategic options for the sector. However, especially SMEs in some sectors need help from policy to take action against illegal traders and counterfeiters infringing on their brands.

Environmental challenge

The climate change challenge is one of the most important issues on the political agenda in the EU and in the Member States, which is also reflected in increased environmental legislation. It therefore does not seem an option that environmental regulation might decrease in the future. Furthermore, energy prices are expected to increase due to an increased demand. Sector reaction should be to become more involved in the climate challenge issue through enhancing energy efficiency and reducing environmental impact by investing in cleaner technologies and environmental management systems.

Investment in technologies and systems

Efficient and flexible production will be needed in future successful ceramics companies. An increase in R&D investment in product technology must first of all be the sector's responsibility. But the EU and the Member States could consider strengthening research and development programmes (e.g. the Framework Programmes) to develop more efficient and flexible automation technologies for ceramics and related sectors.

Creating a level playing field

Currently, the playing field is not even, with non-EU competitors often producing their products with OHS and environmental standards well below EU standards, with lower

energy prices and perhaps better access to raw materials and thus delivering products at a much lower cost.

Unilateral environmental regulations are putting the sector under pressure and the EU and its Member States could increase their efforts to establish a global CO₂-emission trading scheme and perhaps find other ways to offset the competitive disadvantage of the sector. One possible instrument could be to explore a trade policy where it is possible to act within the framework of the WTO agreement, eg by making use of the WTO Dispute Settlement System in order to tackle unfair trade practices/rules of third countries. To the sector, the challenge is to manage an increasing number of environmental requirements from the EU.

Improve the skills base

A highly-skilled workforce will be in demand and must have the tools and skills needed to operate the technologies and to collaborate across different departments, regardless of localisation. This will be a challenge for SMEs looking for global opportunities as well as large companies operating in several countries, as can be seen in the bricks sub-sector. The skills base can be improved by a focus on life-long learning, by making the sector more attractive and through targeted training programmes.

7 References

7.1 Reports and articles

Aragon-Sanchez, A., Sanchez-Marin, G., (2005), Strategic Orientation, Management Characteristics, and Performance: A Study of Spanish SMEs, *Journal of Small Business Management*, Vol. 43, 2005.

Bain, J. S., (1956), *Barriers to New Competition*, Cambridge, Harvard University Press, US.

Barney, J. B., (1991), “Firm Resources and Sustained Competitive Advantage”, *Journal of Management*, Volume 17, pp 99-120.

Bonavia, T., and Marin, J. A., (2006), An Empirical Study of Lean Production in the Ceramic Tile Industry in Spain, *International Journal of Operations and Production Management*, Volume 26, No.5, pp 505-531

Carroll (1984), *The Specialist Strategy*, *California Management Review*, 16 (3), pp 126-37.

Cérame-Unie (2007), *The European Ceramics & Glass Industries on the World Stage: A Pro-Active Role in Setting the Scene*, Speech Notes by Mr. Ian Dudson (President Of The European Federation of Porcelain and Earthenware Manufacturers FEPP, CEO of Dudson Ltd) [Downloadable from http://ec.europa.eu/enterprise/steel/conference_glass-ceramics/2007/speech_dudson.pdf].

Cook, M., and Faquharson, C., (1998), *Business Economics: Strategy and Applications*, Pitman Publishing, UK.

EC (2007a), *Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry*, August 2007.

EC (2007b), *Draft Analysis of the Competitive Situation in The European Ceramics Industry*, Directorate-General for Enterprise and Industry, Working Document, February 2007.

EC (2007c), *Conference: “From 2007 on: The Principal Challenges Facing the European Glass and Ceramics Industries”*, Directorate-General for Enterprise and Industry, May 2007.

EC (2007d), Analysis of the Competitiveness of the Non-Energy Extractive Industry in the EU, Commission Staff Working Document (SEC{2007} 771), 04.06.2007.

EC (2007e), Raising Productivity Growth: Key Messages from the European Competitiveness Report, Commission of the European Communities (SEC (2007) 1444), October 2007.

EC (2007f), Mid-term review of industrial policy. A Contribution to the EU's Growth and Jobs Strategy, SEC(2007)917, COM(2007)374, Brussels 04-07-2007.

EC Press Release 06/159 (2006), Neelie Kroes, Member of the European Commission in charge of competition policy, Competition in the Energy Sector: Preliminary Results of The Commission's Inquiry and next steps in Anti-Trust Enforcement, Speech at the first Annual Seminar and Conference on Energy Law and Policy, March 2006.

EC Technical Update (2006) European Industry: A Sectoral Overview Technical Update, Enterprise and Industry Directorate-General, European Commission, August 2006.

GHK (2007), Energy Efficiency and Use of Low Carbon Technologies in Energy Intensive Industries (EII) in the European Union and in the rest of the world, DG Enterprise And Industry, Draft-Final Report, 12/12/2007.

Gregory, R. J., Hughes, T. G., Kwan, S. K., (2004), Brick Recycling and Reuse, Proceedings of the Institution of Civil Engineers, Engineering Sustainability 157, September 2004, Issue ES3, pp 155-161.

Hassard, J., Carroll, M., Cook, F. L., Marchington, M., (2001), The Strategic Management of Outsourcing in the UK Ceramics Industry, Working Paper Number 17, ESRC Future Work Programme, Manchester Business School, December 2001.

ICEX (2006) Spain: The Machinery and Equipment Sector for the Ceramics Industry, Sector Reports [Downloadable from <http://www.spainbusiness.com>].

Eurostat (2008)

IPPC (2001), Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry, European Commission, December 2006.

Liesch, P. W., and Knight, G. A., (1999), Information Internalization and Hurdle Rates in Small and Medium Enterprise, Internationalization, Journal of International Business Studies, Vol. 30, No. 2. (2nd qtr., 1999), pp. 383-394.

Lipczynski, J., and Wilson, J., (2001), Industrial Organisation: An Analysis of Competitive Markets, Pearson Education Limited, UK.

Mascarenhas, B., (1996), The Founding Of Specialist Firms In a Global Fragmenting Industry, Journal Of Business Studies, 27 (1), pp 27-42.

Meyer-Stamer, J., Maggi, C., Seibel, S. (2001), Improving upon Nature: Creating Competitive Advantage in Ceramic Tile Clusters in Italy, Spain, and Brazil, INEF Report 54 at <http://www.meyer-stamer.de/2001/Tiles.pdf>

OECD (2000), Enhancing the Competitiveness of SMEs in the Global Economy: Strategies And Policies - Workshop One “Enhancing The Competitiveness Of SMEs Through Innovation”, Conference for Ministers responsible for SMEs and Industry Ministers, Bologna, Italy, 14-15 June 2000.

Office for National Statistics (2007), Quarterly Energy Prices December 2007, A National Statistics Publication.

Peterson (2003), S. H., the Craft and art Of Clay, A Complete Potter’s Handbook, Fourth Edition, Laurence King Publishing.

Porter, M. E., (1996), ‘What is Strategy?’, Harvard Business Review, Nov-Dec 1996, pp 61-78.

Ringshaw, G., (2006), Austria’s Wienerberger to Acquire Baggeridge Brick for £89.2m Cash, The Daily Telegraph, 18/08/2006 [Downloadable from <http://www.telegraph.co.uk>].

Rowley, C., (1996), Flexible Specialisation: Some Comparative Dimensions and Evidence from the Ceramic Tile Industry, New Technology, Work And Employment, Volume 11, Number 2, pp 125-136.

Schumpeter, J. A., (1950), Capitalism, Socialism, and Democracy, Third Edition, Harper, New York.

Sutton, J., (1991), Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration, The MIT Press.

Tangram (2004), Energy Efficiency in Ceramics Processing Practical Worksheets for Industry Energy Worksheets 1 - 8. [Downloadable from <http://www.tangram.co.uk>].

The Carbon Trust (1998), Energy Efficient Operation of Dryers in the Ceramics Industry, Good Practice Guide 248

UK Competition Commission (2007a), Wienerberger Finance Service BV and Baggeridge Brick Plc: A Report on the Anticipated Acquisition by Wienerberger Finance Service BV of Baggeridge Brick Plc, 10 May 2007, UK.

UK Competition Commission (2007b), Inquiry Proposed Acquisition by Wienerberger Finance Service B.V. Of Baggeridge Brick Plc, 9 January 2007.

United Nations (2001), Economic and Social Commission for Western Asia Potential of Manufacturing SMEs for Innovation in Selected ESCWA Countries.

Review of the laws, regulations, and practices applicable to country-of-origin markings for US House Committee on Ways and Means, Executive Summary: PUB 2975, <http://hotdocs.usitc.gov/docs/pubs/332/ES2975.HTM>

Waste & Resources Action Programme (WRAP), The Recycled Products Guide, <http://www.wrap.org.uk>.

7.2 Websites

www.actd.co.uk

www.cerameunie.eu

www.crh.com

www.confindustriaceramica.it

www.ekwc.nl

www.euroceram.org

www.europa.eu

www.ima-europe.eu

www.johnson-tiles.com

<http://mkaccdb.eu.int/mkaccdb2/indexPubli.htm>

www.unido.org/doc/4309

www.wienerberger.com

The Association for Ceramic Training and Development

Cérame-Unie

CRH plc

Confindustria Ceramica

European Ceramics Work Centre

EuroCERAM, Réseau Céramique (Ceramic Network)

The EU Online

IMA Europe - Industrial Minerals Association

H&R Johnson Tiles Limited

Market Access Database of the European Commission (DG Trade)

United Nations Industrial Development Organization

Wienerberger Corporation