Portugal is ranked eighth in the world for exports of leather footwear. The average price of USD $27 reflects the degree of appreciation that Portuguese footwear has earned in international markets.

Portuguese footwear industry improved its competitiveness through R&D

Over the past decade, the European Union has moved from a scenario of almost total equilibrium in the international footwear trade to a major deficit in this area: in 2001, the balance of trade in the EU27 was -189 million Euros, equivalent to a 99% rate of cover; ten years later, the balance had already risen to -5,545 million Euros – a drop of 81% in the rate of cover.

Over the past decade, the European Union has moved from a scenario of almost total equilibrium in the international footwear trade to a major deficit in this area.

Footwear imports of the 27 members of the European Union (2001-2010)
Importações de calçado dos 27 membros da União Europeia (2001-2010)

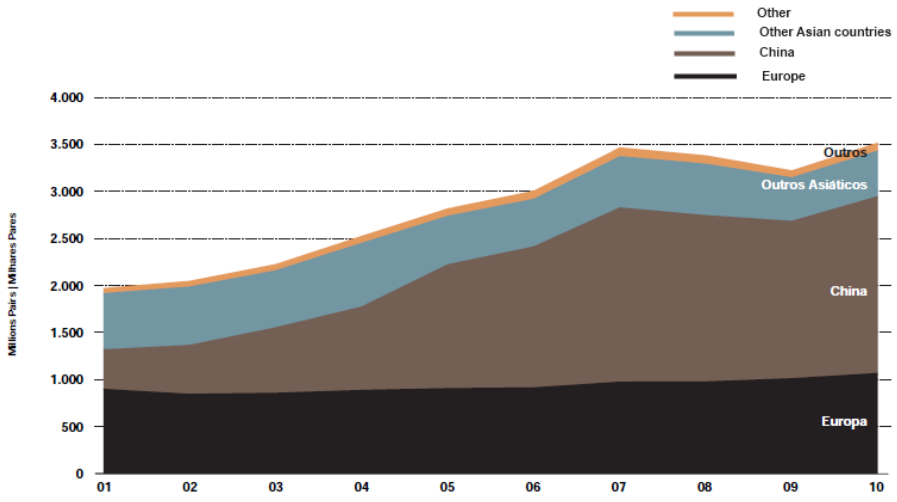


Figure 1 – Footwear imports of the 27 members of the European Union (2001-2010)

Source: *APICCAPS, Footwear Components and Leather Goods, 2011 STATISTICAL STUDY*

Underlying this drop in the trade balance of the EU27 is the fact of China becoming fully integrated into world trade. This becomes clear when footwear imports into the EU27 are broken down geographically. Over the last decade, the amount of footwear imported from China has more than quadrupled, from approximately 420 million pairs to almost 1,900 million. In this ten-year period, China alone represented 94% of the rise of

The amount of footwear imported from China has more than quadrupled. (...)The success of Chinese footwear may be explained by its very aggressive prices.

1,540 million pairs in total imports to the 27 countries of the European Union. Thus, the Chinese share of European Union imports rose from 21% to 53%.

The success of Chinese footwear may be explained by its very aggressive prices: the average price of Chinese footwear arriving in Europe is under 4 Euros – one quarter that of intra-European imports.

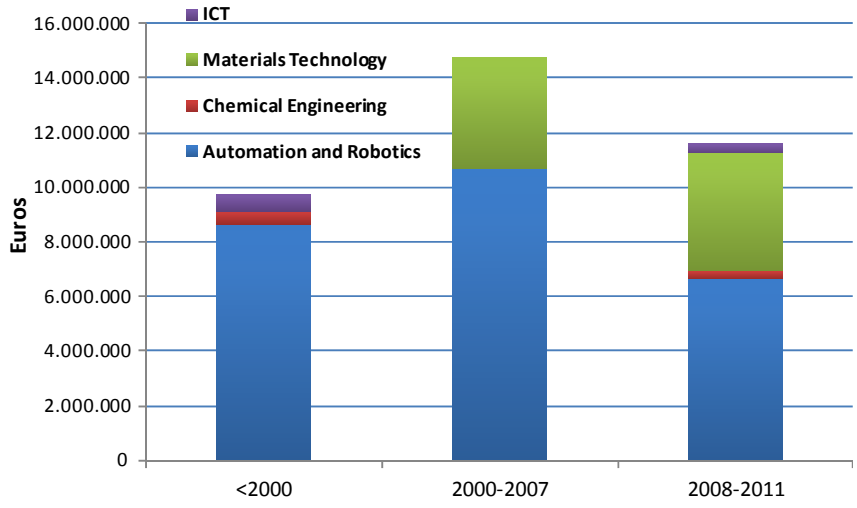
As a result of a deliberate strategy aimed at redirecting the footwear industry to higher value-added niches, Portuguese footwear exports have begun to rise once more - Portugal is now ranked eighth in the world for exports of leather footwear. The average price of USD $27 reflects the degree of appreciation that Portuguese footwear has earned in international markets[1]. The relative price index of exports/imports since 2001 has grown by 65%, which confirms a good level of international specialisation.

As a result of a deliberate strategy aimed at redirecting the footwear industry to higher value-added niches, Portuguese footwear exports have begun to rise once more.

1. Innovation in the production process: from low wages to “flexible automation"

Success in this area was one of the main pillars of technological development, which involved the Technological Center and the footwear cluster, and brought together companies and universities.

The R&D projects which involved a consortium of companies that has been supported by ADI since the mid-90s added significant value, totalling over 36 million euros. Fig. 2 below shows the three development phases of the R&D projects.



Source: *ADI, 2012*

Figure 2 - Consortium R&D Projects - Distribution of Eligible Investment aimed at the footwear sector by application year and technological area

[1] APICCAPS, Footwear Components and Leather Goods, 2011 STATISTICAL STUDY

Initially, the only research projects were those aimed at developing solutions for Automation and Robotics. While the importance of this technological area continued during the second phase, there was a tendency to emphasise the importance of greater materials technologies. To put it simply, we could say that the first R&D phase focused on process technologies, whereas during the second period greater concern is beginning to emerge about innovation in product technologies (the shoes).

When we talk about automation, we usually associate it with the idea of replacing manpower with machines and thus obtaining major gains in physical productivity. However, we can see from the graph below that this was not the case. Although "physical" productivity (the number of pairs produced per worker) did rise slightly, the highest increase was in the value of the productivity, which doubled.

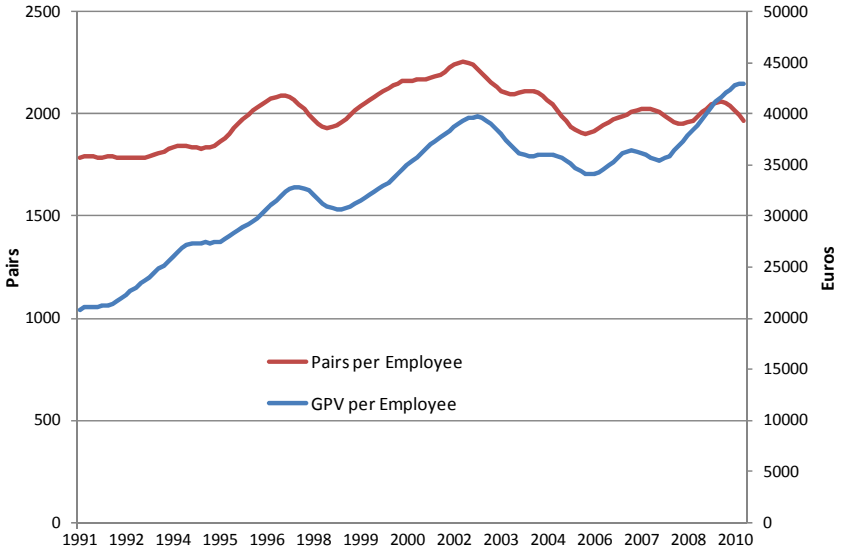


Figure 3 - Footwear production per employee (1991-2010)

Source: *APICCAPS, Footwear Components and Leather Goods, 2011 STATISTICAL STUDY*

When we analysed the contents of these R&D projects in more detail, we found that "automation" is generally associated with a demand for "flexibility". One of the core instruments in this process was the development of flexible automated "water jet cutting" equipment which was integrated into a growing number of software applications, beginning with CAD, by CEI Industrial Equipment Company, which replaces the metal blades and cuts a large number of equal-sized pieces of leather in a single movement. This "water jet" cutting technique, which developed out of the cutting of composites in the North American aviation industry and was "recreated" with the characteristics of our footwear industry in mind, has afforded us the benefit of many advantages:

When we analysed the contents of these R&D projects in more detail, we found that "automation" is generally associated with a demand for "flexibility".

- Savings on investments in cutting tools;

- Reducing the degree of raw material waste, which is particularly suitable for specialising in footwear made from natural leather (which is more expensive and has non-homogeneous characteristics thus becoming more challenging to optimal cuts);
- Making the production of small series easier, increasing efficiency by taking advantage of the downtimes caused by having to change cutting tools;
- Enabling a quick response to customer orders; this is particularly important for specialising in a variety of short-lifecycle fashion products, with particular emphasis on women's shoes.

The Portuguese industry has managed to survive the "steamroller" of low-cost competition from China by playing on its competitive edge in terms of its "proximity" to European markets, adding value by providing an efficient service.

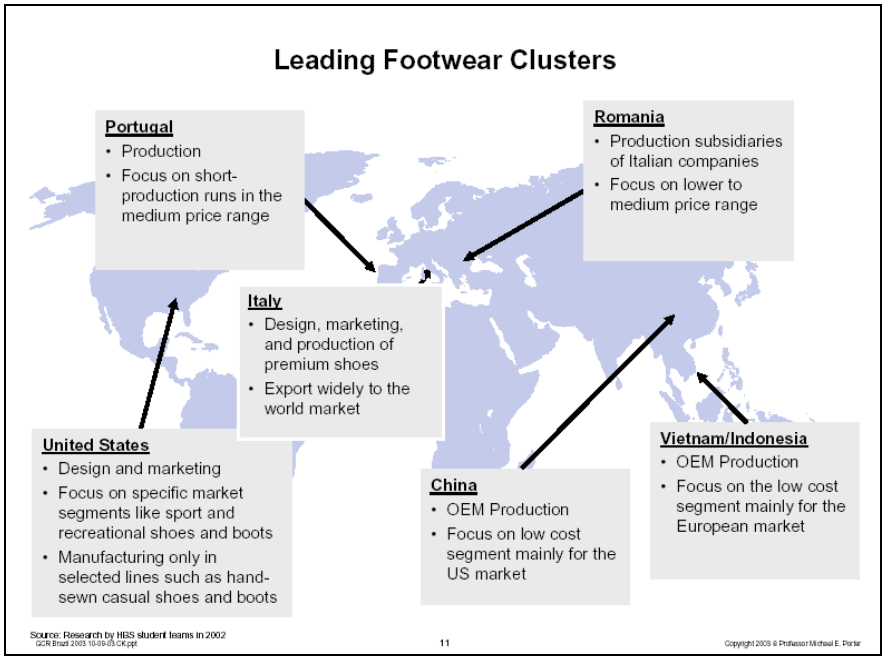


Figure 4 – Leading Footwear Clusters

Source: *Porter, M. (2003), Microeconomics of Competitiveness. Conceptual framework, in Abrantes, LN "Internationalization Strategy for Portuguese footwear companies", UCP, Porto, 2004.*

The ability to respond quickly to small orders has become a differentiating factor in the face of competition from countries with cheaper manpower, even as regards products where the large initial order has been made to China, gambling on the "reassortment" market by taking advantage of price opportunity.

The ability to respond quickly to small orders has become a differentiating factor in the face of competition from countries with cheaper manpower (...)

2. Innovation in the Footwear industry: from "flexible automation" to product innovation

Innovation objective	Inquiry on Innovation		
	CIS 2	CIS 3	CIS 6
	1996-98	1998-2000	2006-2008
Substitution of products at the end of cycle	15,7	n.i	21,8
Expand the range of products in the market	17,6	31,5	28,6
Enter new markets or increase investment in the market	17,6	11,8	27,3
Improve the quality of the product	58,4	26	46,2
Increase the flexibility of production	24,5	37,9	38,1
Increase the capacity of production	n.i.	20,6	30,6
Reduce the cost of manpower	41,6	19,7	35,9
Reduce the consumption of energy	8,8	0	25,1
Reduce the consumption of materials	51,8	0	27,8
Reduce environmental damage	10,2	0	31,5
Comply with regulations or rules	24,5	19,7	31,2

CIS – Community Innovation Survey
n.i. - Variable not included in this inquiry

Source: *CIS - Inquiry on Innovation. Disaggregrated special inquiry of the footwear sector.* Office for Planning, Strategy, Assessment and International Relations / Ministry of Science, Technology and Higher Education. *Calculated by Adi*.

Table 1 – Footwear Industry: % of companies with innovation activities that view innovation as "Very Important"

Table 1 summarizes the results of the Community Innovation Survey (CIS) for three different periods. The first survey (1996-98) shows the poor results of R&D projects, which only began to become relevant in the industry in the 1998-2000 survey. In the year 2000, there were thirty companies with water jet cutting systems installed [2], while four years later, this number had risen to 150% [3].

During this first period, investments in footwear innovation were focused on two goals in particular: to cut costs (particularly the costs of materials and manpower) and to improve the quality of production. Between 1998 and 2000, the cost-cutting goal fell dramatically and there was a rise in the importance of increased flexibility of production and the diversity of the product range (associated with it). During the most recent period (2006-08), these innovation objectives continued to be viewed as "very important" in relative terms, based on quality and costs. The importance of innovation and the goals related to product innovation (the first three goals shown on Table 1 above) and image sustainability also increased.

Between 1998 and 2000, the cost-cutting goal fell dramatically and there was a rise in the importance of increased flexibility of production and the diversity of the product range (associated with it).

[2] PNAPRI - National Plan for Prevention of Industrial Waste, Technical Guide - Footwear Sector, Lisbon, 2000
[3] CENESTAP, APICCAPS: RIAT - INFASHIONPT - Final Report, 2004.

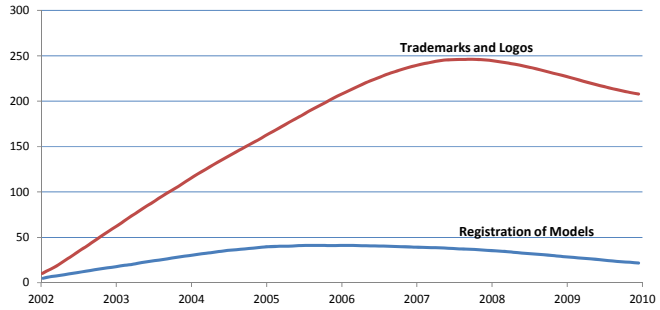


Figure 5 – Number of Requests for registration field with GAPI/CTCP (2002-2010)

Source: *APICCAPS, Footwear Components and Leather Goods, 2011 STATISTICAL STUDY*

The graph above confirms the growing importance of product innovation during the third phase of footwear innovation, as already suggested by the data in Figure 2, with the increase of innovation in materials technologies. The XXI century has already seen a significant rise in the "registration of models" in the footwear industry, which peaked in 2008.

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3. Flexible automation and emergence of a new generation of production company resources

Sectors	Year in which the companies were incorporated						
	<1975	1975 <1985	1985 <1990	1990 <1995	1995 <2000	> = 2000	Total
Shoes	31%	27%	15%	4%	19%	4%	100%
Tanneries	40%	0%	40%	0%	20%	0%	100%
Components	63%	13%	13%	0%	0%	13%	100%
Chemistry	4%	0%	29%	14%	0%	14%	100%
Processing equipment	10%	30%	10%	10%	20%	20%	100%
Software	0%	17%	0%	17%	17%	50%	100%
Health	0%	0%	0%	0%	0%	100%	100%
Total	30%	19%	16%	6%	14%	14%	100%

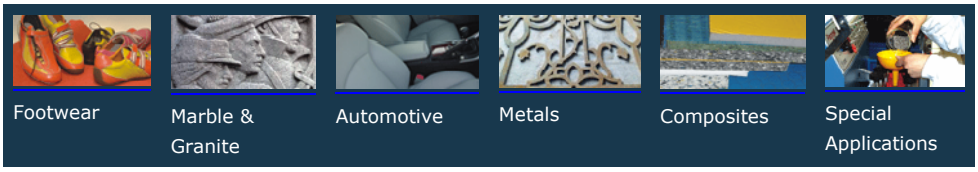
Table 2 – Distribution ages and sectors of companies that participated in R&D projects related to the Footwear Industry

Source: *ADI, 2012*

Table 2 above highlights the sectors that play a key role in this process of flexible automation which has been underway since the latter half of the 90s. These are essentially more recent companies, such as production companies, particularly of the software industry. As regards production equipment, the older companies were

originally mechanical, while the more recent companies were set up as automated companies. This means that the very process of flexibly automating the footwear industry led to the development of an automated industry that will become international, with Portugal being the exporter of these means of production, and diversify into other sectors of automation. This is the case with CEI / Zipor Group, which currently sells flexible automation systems for a wide range of "discrete manufacturing"industries:

(...) the very process of flexibly automating the footwear industry led to the development of an automated industry that will become international, with Portugal being the exporter of these means of production, and diversify into other sectors of automation.



In the niche market of water jet cutting systems used in the footwear industry, CEI holds a prominent place in the world, with a market share of 30% in the ornamental rocks sector, as well as large-scale exports to the Middle East, where its market share also stands at 30%.

In the last decade, CEI, which is located in São João de Madeira, has sold over 800 high-tech equipment items. Currently, 70% of these tools are destined for foreign markets, and the cutting systems, namely **waterjet CutterJET, SampleJET**, and **SintexJET ZICutter**, are solutions that have made its name widely known. In addition, **Pegasil** laboratory equipment, which is produced by **ZIPOR**, a company with links to CEI, has had an impact beyond the borders of Portugal, providing training and technology centres in Slovenia, Italy, Poland, Turkey and Lithuania. CEI is a large national SME which international brands like Nike, Adidas, Reebok and Timberland know very well. The Nike shoe factories in China, for example, use CEI-manufactured machines to produce their shoes.

Apart from CEI, other companies also participated actively in the process of developing new "means of production" for the footwear industry including, as regards the production of equipment, such companies as Lirel, TECMACAL, Silva Ferreira and, more recently, FLOWMAT.

With regard to software, we can also mention the companies **Mind, Expandindustria, INOCAN, WowSystems** and **Oficina de Soluções**.

Portuguese universities too have contributed to this process of technological development, most notably, INESC Porto.

The pressure to cut drastically the average size of the order, the diversity and sophistication of the models, and the reduced deadlines in various industrial sectors meant that it was no longer viable to use traditional tools to plan and control production lines. This gave rise to uncontrolled processes and a resulting loss in productivity. The two national projects, **SABE** (Product Support Systems for Balancing / Scheduling) with JEFAR, which began in 2001, and **SIBAP** (Automatic Balancing System for Production Lines) with FLOWMAT, which began in 2010, helped to bridge the gap and provide support tools to balance and schedule production lines. This generated a considerable increase in productivity and created an effective balance between all the operations being conducted on the production line.

Another example of successful software from INESC Porto is **Agilplan**. This project, which began in 2009, consists of a production planning system for footwear companies. The system is more flexible and can continue production in uncertain conditions, which differentiates it from more traditional systems. It was designed for small and medium-sized companies (SMEs) that produce footwear and similar components. The system allows for a smoother development of plans for scenarios of manufacturing to order and when the company's task of developing coherent and up-to-date plans is even more difficult due to the degree of uncertainty and shortage of information.

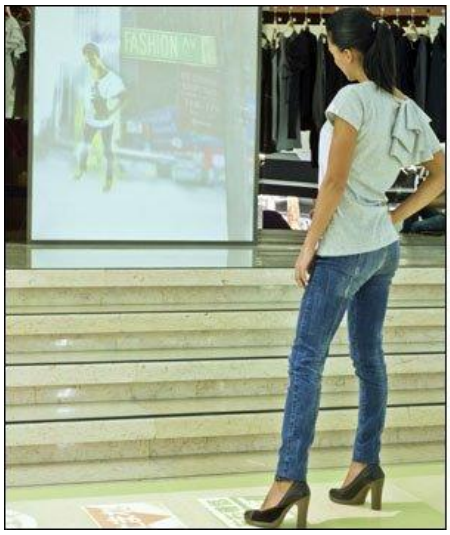
The variety of models and materials and the increase in small orders of each model can prove difficult to organise, manage and plan. This tool was designed and developed in partnership with "**Oficina de Soluções**" and was capable of responding to these needs. Agilplan has a user-friendly interface which is easy to use, incorporates drag and drop techniques, and the software automatically readjusts and re-plans the production plans as new information becomes available. Proof of the quality of this system is clear from the fact that it was the winner of the 2010 "Innovation Awards in the Footwear Sector", in the software category.

The **One-Step system** (a new production system aimed at the production of small orders of customised shoes) was one of the most significant results of the CEC-made-shoe project and is really relevant for the industry. This project was innovative as the various operations were brought together in one linear sequence. This means that shoes can be produced in just one step (cutting, sewing, assembling and finishing). Starting with the EUROShoe project, the One-Step project brought together the skills of UESP and INESC Porto and confirmed their international reputation. Focusing on the production of smaller orders means that companies can avoid the need to maintain high stock levels. For small production orders, this meant a 15% rise in productivity. It made it possible to produce smaller production lots, increase production capacity and flexibility, and reduce production time. The CEC-made-shoe project was confirmed as a landmark in European competitiveness in this area as it introduced radical improvements to the production process and to the design of new products. The project led to the development of

biodegradable shoes, intelligent shoes (shoes that are able to adapt to the environment) and seamless shoes.

The Portuguese company **Kyaia,** owner of the brands **Foreva and Fly London**, was the first to embrace the technology, which led to productivity gains in excess of 15% and a halving of production time.

The **ShoeID** solution was developed with **Creative Systems** for **FLY London** with the aim of improving efficiency in the supply chain. In addition to optimising processes and helping to avoid losses in the logistics chain, it adds value in terms of storage. The innovation is incorporated into the RFID (Radio Frequency Identification) Smart Floor, whereby the customer can try on a pair of shoes and look at his own image, recorded by a video camera and projected onto a screen. The image, however, will not show the customer standing in the store itself, but rather in front of busy street scenes in Tokyo, London or New York. This innovation was vital to winning the RETA Europe award, an award that has brought much recognition for the relevance of the project and, consequently, for INESC Porto and Creative Systems, both responsible for the development of the solution and project partners.



At the Fly London store, an RFID reader on the floor identifies the type of shoes the customer is trying on and the system then projects a video of a street scene in London, Tokyo or New York.

To know more about the Portuguese footwear sector:
Please contact APICCAPS – Portuguese Footwear, Components, Leather Goods Manufacturers' Association
http://www.apiccaps.pt/

Do you wish to find a Portuguese partner for a technology innovation project?
Please contact AdI http://www.adi.pt/uk/indexuk.htm