
Does R&DI commitment pay off in traditional sectors? The case of the Portuguese Footwear Sector

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Abstract: Low and medium technology sectors' (LMTs) performance is fundamental for the well-being of highly developed as well as developing regions' economies, but their contribution to the "knowledge society" has been overshadowed over the time by the illusive argument that relates knowledge creation to R&D, and thus to high-tech industries. Nevertheless, whereas a broader definition of innovation has enabled LMTs to emerge as innovative, knowledge creative environments, a blind reliance upon non R&D-based indicators to assess LMTs' innovation dynamics may be harmful too, by neglecting LMTs' contribution to the development of cutting-edge knowledge based on R&D activities. The Portuguese footwear sector proves to be a fertile ground for further analysis on the topic of LMTs' engagement to innovation, including to R&D. Through the lens of two footwear companies, we have captured the essentials of their innovation dynamics and assessed whether their R&DI commitment has bore fruit.

Keywords: Research and Development (R&D); Innovation; LMTs; Portuguese Footwear Sector; Knowledge Creation; Networking;

1 Introduction

Europe's industrial landscape is dominated by low- and medium-technology sectors (LMTs) (Hirsch-Kreisen et al., 2003, 4; Robertson et al., 2009, 441). Their pre-eminence in highly developed countries questions the premise according to future economic growth and development is contingent upon the increase of R&D efforts, namely *via* high-tech, research-intensive, and science-based sectors (Hirsch-Kreisen, 2008, 20), pre-announcing LMTs' inevitable *death* in such countries (Hansen and Serin, 1997, 179). In theory, being these sectors comparatively less R&D intensive, policy-makers and managers' attention should be increasingly diverted to push forward (Bender, 2006: 6) those sectors of

economy the premise pointed to as vital to “solve growth and employment problems” (Hirsch-Kreisen et al., 2003, 3) – those where innovations are mainly achieved through R&D activities.

With this paper we expect not only to add to the development of a significant body of work which has refuted uncritical theories supporting a contradiction between innovation and LMTs, but also to explore a still widely neglected issue - that of LMTs’ increasing engagement in “high-tech” knowledge activities (Hirsch-Kreisen et al., 2003, 23; Hirsch-Kreisen, 2008; Mendonça, 2009).

This research is grounded in a set of contextualizing theoretical assumptions. The first one is related to innovation sources and reminds us that R&D is not the only fuel for innovation to occur. The socio-economic discourse has shifted to embrace a wider notion of innovation, and, at this level, OECD’s contribution was extremely important, in particular, with the publication of the Oslo Manual (OECD, 2005). Although the Manual recognized the relevance of R&D for innovation processes, it has *relativized* its centrality, bringing into the light other important innovation pathways. By fundamentally meaning that “all firms are bound to innovate” (Evangelista et al, 1997, 524), it redefined the locus of some actors in the innovation scenario: sectors which would have been considered non-innovative due to the lack of or residual R&D engagement in the past could now emerge as equally potentially innovative within the industrial fabric. More recently, a significant body of works has contributed to deepen our understanding of innovation dynamics in LMTs (e.g.: Hansen and Serin, 1997; Alcaide-Marzal and Tortajada-Esparza, 2007; Robertson et al., 2009), thus providing further support to theories claiming for a more encompassing definition of innovation.

On the other hand, it seems that the debate on innovation in LMTs has gone from one pole to another. Whereas in the past these sectors were prevalently ignored in innovation models (or high-tech models) due to their weak commitment to formal R&D, nowadays a lacuna remains in the majority of empirical works addressing their innovation dynamics. Indeed, as research interest tends to reside in LMTs’ innovation activities beyond formal R&D, R&D commitment of LMTs may be understated. In fact, reducing their role to mere carriers of high-tech sectors’ R&D results and technology changes may oversimplify LMTs’ influence upon scientific and technological frontiers’ onward move (Hirsch-Kreisen et al., 2003; Mendonça, 2009). Innovation is a non-linear, complex process where knowledge flows not only from high to low-tech sectors, but also in the reverse direction. This means that LMTs have significantly contributed to the emergence and development of cutting-edge knowledge which fails, however, to be accounted to them based on current measurement methods.

The footwear sector, conventionally a LMT, proves to be a fertile ground for further analysis on these topics, namely the Portuguese footwear sector. The sector’s present performance has resulted quite significantly from a holistic approach, under which several stakeholders along the sector’s value chain were brought together to cooperate. Tight coupling with R&D institutions and technology providers was particularly encouraged, having footwear companies become important co-developers of several scientific and technological fields. Thus, any study on the sector’s innovation behaviour must not discard the role played by R&D in footwear firms’ innovative performance.

On the other hand, the rising significance of fashion and design activities in the Portuguese footwear sector (Vale and Caldeira, 2008) provides an illustrative example of how innovation can emanate from other sources beyond R&D.

These issues will be more thoroughly examined also by understanding the role of networks in Portuguese footwear firms' availability to commit to innovation. Since LMT's knowledge base can be defined as a "knowledge-distributed base", (Hirsch-Kreinsen, 2008, 28), multidisciplinary networks are privileged paths for LMTs' knowledge access, creation, recombination and integration. Based on a case study approach, we thus expect to bring to the fore the impact of networking with relevant stakeholders (such as R&D providers) on the successful creation of innovation opportunities for footwear firms.

2 Theoretical Frameworks

2.1. *Innovation: moving from a stricto to a lato sensu definition and the emergence of LMT sectors as innovation environments*

The recognition that innovation patterns vary across and within sectors of economy is a prerequisite for innovation study (Robertson et al., 2009, 442). Therefore, it is fundamental that indicators built to measure innovation are suitable in order to capture the specific innovation dynamics of a given sector or firm.

This is particularly important when speaking of *traditional* and *mature* sectors, also known as LMTs. For many years, innovation was seen as the outcome of companies' efforts in R&D (e.g. Bougrain and Haudeville, 2002; Drake et al., 2006), meaning that firms which did not conduct any formal R&D would be considered non-innovative. Traditional innovation indicators were biased towards R&D and technological innovation (Bender, 2006), neglecting other forms of knowledge creation where innovation could arise from. R&D expenditure and number of people committed to R&D activities were commonly used to measure a firm's engagement to innovation (Alcaide-Marzal and Tortajada-Esparza, 2007, 36). On the other side of the innovation process were patents (pp. 36), an indicator of a firm's ability to turn its innovation effort into a real opportunity. However, the tendency to apply to a patent may be more specific to certain sectors than to others (Mendonça et al., 2004; Alcaide-Marzal and Tortajada-Esparza, 2007, 36). Take for instance the chemical sector, a more fertile ground for patentable research (Cardoso and Teixeira, 2009, 14) than the footwear sector. For the latter, trademarks can be a far more important innovation output indicator than patents, since patenting may not be as attractive and affordable as other means of protection due to the footwear sector's rate of product change (partly related to fashion cycles which have shortened time for product development) (Alcaide-Marzal and Tortajada-Esparza, 2007, 36). While it is true that novelty is not a prerequisite to register a trademark, being a company's tool for Intellectual Property protection, it can be a potential indicator of a product's distinctive character (Mendonça et al., 2004)

The idea that innovation is much broader than R&D, having gained large support, has made possible to identify other (commonly neglected) sources of innovation. In result, perceptions about firms which either did not carry out any significant R&D activities or performed them outside formal classifications, started to change (Cardoso and Teixeira, 2009, 3). This shift was favoured by a set of works showing that innovation could take place in sectors and firms with residual or no R&D effort (e.g.: Hansen and Serin, 1997; Hirsch-Kreinsen, 2008). In this sense, although R&D-activities were still extremely critical to innovation generation, design, training, consultancy services, even *practical knowledge*

were unveiled as key sources for innovation ability and achievement outside the boundaries of Science and Technology, especially in LMTs (Hirsch-Kreisen et al., 2003; Robertson et al., 2009). The work by Alcaide-Marzal e Tortajada-Esparza (2007) offers an interesting framework to study innovation in the footwear sector. Having built a set of aesthetic innovation indicators for the Spanish footwear sector in order to complement the information deriving from the use of technological innovation indicators, the authors argued that R&D-based innovation indicators, placing a greater emphasis on scientific and technological components, left the sector in a very weak position, as innovation appeared to be more pre-eminently contingent upon aesthetic contents, which could provide too the same kind of novelty to the product as any technological innovation. The authors argued, however, that R&D indicators should not be discarded when analysing innovation behaviour of footwear firms. This remark brings us to another topic of the debate on innovation in LMTs.

The rising of LMTs as innovative environments has been favoured not only by the recognition of other inputs beyond R&D to knowledge formation and, consequently, to innovation. The more encompassing definition of innovation comprises the perception that this is not a one-way process, where knowledge production is supplied by a single knowledge-producing sector to a group of sectors (Hirsch-Kreisen et al., 2003, 24) but instead a set of multiple interactive processes involving a myriad of knowledge-producing actors. In this sense, LMTs are no longer regarded as passive receivers of high tech-based knowledge from high-tech sectors; they are also active contributors to the development of new technological fields. Rather frequently, LMTs' input to innovation formally reported to other locations of the economy's fabric takes the form of ideas and analysis which are then subsumed into their partners and suppliers' formal R&D processes (Robertson et al., 2009, 442-443). The results of these processes are then transferred either directly or indirectly to LMT sectors which again may actively promote the refinement of those results (encouraging further R&D commitment) and are themselves pushed to develop new capabilities in order to interact with partners and suppliers and then use the scientific and technological-based knowledge resulting from that interaction. According to Mendonça "the rising complexity and ever widening range of technology inputs employed by lower-tech firms demand some degree of endogenous capabilities" (2009, 476) which has, to some extent, dictated the pursue of technological paths which are far distant from their old domains of technological expertise. In this sense, OECDs' taxonomy which relates high-tech knowledge to high-tech sectors not only fails to apprehend LMTs' direct contribution to high-tech knowledge formation, but also blurs the knowledge distributed-base LMTs rest upon (Hirsch-Kreisen et al., 2003; Hirsch-Kreisen, 2008, 28; Mendonça, 2009). The concept of knowledge distributed-base implies that knowledge formation and management is directly and indirectly contingent upon several actors, so the knowledge base of LMTs also encompasses high-tech knowledge, which just like knowledge coming from any other source is incorporated, adapted, recombined and transformed by LMTs.

2.2. Networks: bridges to innovation

The "knowledge society" (Nonaka, 1994, 14) has transformed the way individuals and groups relate and interact with each other. Being complex, multidimensional, and made of multiple layers which illustrate its cumulative and dynamic character (Nonaka, 1994; Bougrain and Haudeville, 2002), knowledge is scattered and fragmented (Bougrain and Haudeville, 2002, 735), which means it cannot be mastered in its various dimensions by

single individuals or single groups. Knowledge is the cornerstone of successful performance (Grimpe and Sofka, 2009). Therefore, in many spheres of social life problem-solving is highly contingent upon “communities of interaction” (Nonaka, 1994, 15), upon multidisciplinary knowledge inputs brought together by people from different backgrounds of knowledge (Bougrain and Haudeville, 2002, 735).

The recognition of this fact has produced significant changes at firm level. In today’s society, firm survival is very much related to knowledge-based strategies (Grimpe and Sofka, 2009). A firm must know how to efficiently deal with multiple sourced-information flows and, more importantly, to be able to select useful bits of information and transform them into valuable knowledge.

Though firms are not expected to develop competencies in every domain of knowledge (Bougrain and Haudeville, 2006; Grimpe and Sofka, 2009) they are expected to have access to a wide range of information to complement their core competencies. Formal and informal networks provide this access to firms. Referring to SMEs, (which form the basis of the Portuguese footwear fabric, our object of study), Bougrain and Haudeville state that networks are particularly important for companies suffering

“[...] from an information gap. Networks allow SMEs to decode and appropriate flows of information. They reinforce SME’s competitiveness by providing them with a window on technological change, sources of technical assistance, market requirements and strategic choices made by other firms” (2006, 739).

Innovation is, by definition, pervaded by a sense of uncertainty and risk (Bougrain and Haudeville, 2002, 739). One of the reasons accounting for the conventional resistance of SMEs (in LMTs) to engage in innovation projects is that, in general, they struggle with financial and human resources constraints which inhibit their potential availability to deploy part of those resources to projects with a higher degree of uncertainty and risk (pp. 739). All this justifies the need for firms not only to establish a myriad of links between all its internal areas but also to reach out for other external actors and to engage in cooperative projects where costs, risks and the uncertainty related to the innovation contents of the projects may be shared and minimized (Bayona et al., 2001, 1291).

Being able to manage a complex and vast net of relationships, platforms of knowledge *par excellence*, has become even more crucial for footwear firms as in order to survive many of them were forced to take over stages of their value chain which had been once under other’s control (Vale and Caldeira, 2008). The introduction of new functions in footwear production (as a reaction to the increasing critical role assumed by fashion in the sector’s innovation processes and to changes in the sector’s competitive environment and in consumption patterns) have altered the sector’s internal organization of knowledge as well as relation powers across the entire value chain. For a sector which had traditionally relied upon tacit local based knowledge the introduction of new functions changed the notion of proximity and the stakeholders involved (Vale and Caldeira, 2007). Access to critical knowledge for process and product innovation implied a move far beyond the boundaries of the production stage itself and also far beyond local networks. The Portuguese sector’s association, APICCAPS¹, recognized, however, that such an upgrade in the sector’s value chain could not be achieved by individual firms alone due to their diminutive size and scarce resources availability, but by the creation of a trustful long-term collective environment (APICCAPS, 2007a; APICCAPS, 2007b).

¹ Portuguese Footwear, Components, Leather Goods Manufacturer's Association

3 The Footwear Sector – an insight into the Portuguese Case

Economic literature has traditionally fitted the footwear sector within Pavitt's *supplier dominated sectors*' category, which means that their innovation behaviour is expected to be significantly dependent upon suppliers from other sectors (e.g.: equipment suppliers) and mainly focused on the production stage (e.g.: technology embodied in machinery) (Pavitt, 1984; Hirsch-Kreisen, 2008, 22-23; Vale and Caldeira, 2008, 65).

Looking through the lens of the Portuguese footwear sector, Pavitt's classification of the sector may be challenged. Despite some severe setbacks in the late 90s and more recently, current statistics reveal a national sector which has managed to perform far better in international markets than any other manufacturing sector within the Portuguese economy (APICCAPS, 2008).

Pavitt's categorization presupposes that innovation in LMTs occurs more pre-eminently through equipment upgrade and, more importantly, that they are passive receivers of their suppliers' technological knowledge. Although it is undeniably true that LMTs are key users of innovations developed by high-tech industries, innovation in the Portuguese footwear sector cannot be subsumed to equipment upgrade applied to production processes. Here, innovation was tackled by its most relevant stakeholders as a complex phenomenon, with many linkages and interactions extending beyond a firm's boundaries, highly contingent upon different sources, and inducible at all stages of the sector's value chain. Indeed, even though the sector's competitive performance was first enhanced via technology upgrade at production level, subsequent actions were directed towards other stages along the sector's value chain (APICCAPS, 2007b). Actions directed to set the ground for the creation of a more integrated and cooperative industrial environment were systematized in a number of Plans and ultimately translated into specific projects. The formula behind them pointed to the importance of strengthening the footwear sector by fostering intra- and inter-industrial cooperation, enabling the sector to move from a restricted focus on productive processes (where innovation had been almost exclusively contingent upon production equipments, fundamental, however, at first, to allow firms to move to other stages of their value chain) to a focus on all the strategic areas of its value chain from industrial to non-industrial stages.

Secondly, through the creation and reinforcement of ties with other important knowledge producers, such as R&D institutions, the Portuguese footwear sector has been actively involved in knowledge-building activities, some of which account for high-tech knowledge production. Specifications, aims and needs of the sector have driven and shaped several R&D lines, sometimes in frontier areas such as ICTs and materials. The ShoeMat project can be referred to as a project which brought together footwear companies, material, chemical and components producers, and R&D and Technology institutions. It can be said that part of the underlying knowledge of that project rests upon advanced and research-based knowledge in areas such as that of polymers, nanomaterials, or mechatronics. The changing and more competitive environment footwear firms operate in forces them to have at least a window open on R&D as one among other interesting pathways to achieve market differentiation.

4 Case Study

4.1. Research Design

We have assumed that an empirical approach to the research questions here raised based on quantitative methodologies would provide us with a very limited comprehension of the innovation process in the footwear sector. In order to better understand how this process occurs (what sources can be relevant for footwear firms to innovate and to what extent networks are critical for footwear firm's innovation capability) and whether commitment to R&DI has proved relevant for footwear firms' performance, our research method was based upon qualitative data collection and analysis through in-depth face-to-face interviews with two footwear companies' representatives. Robertson and al. (2009: 442-443) have underlined the importance of "detailed studies" to clarify our understanding of complex issues underlying innovation in LMT sectors. Indeed, although our conclusions cannot be scientifically assumed to be representative, case study approaches offer a deeper comprehension of the processes prompting R&DI commitment of footwear firms and how this commitment may relate to better performances.

For sample construction, we selected 2 companies from a list of small and medium-sized footwear enterprises (SMEs) provided by APICCAPS. These companies have been involved in some of the most important R&DI projects from the sector's Action Programmes and prove to be economically successful.

An interview with a technology supplier was also carried out, as one of the topics of discussion in our study was that of LMTs' often neglected contribution to innovation, including to R&D. With this interview we expected to capture the supplier's perspective in what comes not only to its involvement in the innovation process of footwear clients, but also to footwear clients' role as new technologies co-developers.

4.2. General Characteristics of the Companies Studied

Table 1 summarizes the main characteristics of the two footwear companies studied. Established both in the 80s, they have managed to build more recently an international pathway, namely after the creation of their own brands – though it must be said that their success cannot be subsumed to the creation of a strong market image. A set of measures targeted at earlier stages of their value chain has been crucial too for a more independent international take off. They have become medium-sized companies exporting most of their production to high-value markets.

Company A is part of a holding that runs several other companies, some of which operate in different stages of the footwear value chain. In this way, the holding's business model allows for company A to have an indirect extended control over other stages beyond those of conception and industrial manufacturing, namely distribution and retail. Company B's activities include subcontracted production for other companies, but, more recently, they have embraced a strategy to avoid selling their original branding with their clients private labels, by investing in the creation of two brands. Distribution and retail agreements with key-agents and distributors are part of the company's strategy to guarantee that they have a foot on the final stages of their value chain.

Both companies have no in-house designers, but the design process is centralised by them via tight collaboration with national and international freelance designers, some

working under an exclusivity regime, and via permanent interaction with clients for needs and aesthetic demands identification.

The technology provider (Table 2) is one of today's most recognised worldwide developers, manufacturers and exporters of highly sophisticated technological equipments, some of which were developed and improved in intimate interaction with the Portuguese footwear sector, such as the water jet cutting solutions and the laser roughing, engraving and cutting systems. Founded in 1995, primarily "to manufacture water jet cutting solutions applied to the footwear sector"- the sector which gave the boost for the company creation and growth – company C has hardened its technological capabilities, succeeding in areas sharing synergies with the footwear sector production base.

Table 1 - Main features of the studied footwear companies

Firm	Year of foundation	No. of workers	No. of pairs produced	Average price per pair (in €)		Turnover (in €)	Exports (in €)	R&D investment (in €)	Design investment (in €)	No. of own trademarks	No. of registered styles
		(2009)	(2009)	2000	2009	2009	2009	(3 years-average)	(3 years-average)		
A	1981	130	387.884	19,60	30,23	9.277.079,17	9.073.306,44	53.651,22	40.000,00	4	5
B	1984	360	650.000	25,00	37,50	24.200.000,00	17.200.000,00	*		9	>200

Source: interviewed companies

*The firm did not separate R&D from design expenses, arguing that much of their design expenses corresponded to R&D expenses. They affirm to have invested per year around € 600.000,00/650.000,00 on R&D and design-related expenses.

Table 2 - Main features of the technology provider

Firm	Year of foundation	No. of workers	Main segment markets	Turnover (in €)	Exports (in €)	R&D investment (in €)	No. of patents	No. of registered models
		(2009)		2009	2009	(3 years-average)		
C	1995	42	Footwear Automotive Stone	3.760.855,34	675.155,00	614.155,00	8	17

Source: interviewed company

4.2. Main findings

Founded in the 80s, companies A and B had to wait almost a decade (and more, in company B's case) to embark on a strategy where branding creation and design would prove fundamental to tackle the challenges of a globalized market characterized by new

consumption patterns which ultimately affected scale orders and demanded flexibilized responses from footwear companies. This move upon the value chain – related to an increasing concern with the company’s image and proximity to the market – namely to higher-segment markets - which earmarks a gradual shift from a culture of production to a culture of marketing and an escape to the premise low cost/low price – was preceded, and in company A’s case, accompanied, by a strengthening of their productive basis through the transfer of technological knowledge embodied in machineries, equipment and software from R&D and Technology providers via market exchange or rather frequently, thanks to APICCAPS and CTCP²’s mobilization efforts, via joint cooperation in R&DT projects with those stakeholders.

This seems to be partly in line with the assumption that LMTs’ technological innovations – namely innovation processes - stem quite significantly from their suppliers. The assumption ignores that footwear firms can be active co-developers of innovations formally generated by their suppliers and neglects that knowledge transfer from their suppliers requires from end-users an exercise of adaptation, integration and recombination with the practical knowledge accumulated throughout the years by the company’s personnel. In this sense, though they may not even have a formal R&D department, they can actually conduct R&D, perhaps more developmental rather than research-oriented.

In relation to footwear firms’ push towards science and technology-based knowledge creation – usually correlated to higher-tech sectors - and just to mention one example, both interviewees agreed that their role in projects focused on the development of cutting-edge solutions for footwear production, such as the adoption of the water jet cutting technology in the 90s, has not been subsumed to mere adopters of the projects’ technological results; they claimed to have helped their partners with the definition of technological problems, as well as in the refinement of the technologies. They see themselves as “*idea promoters*”. The same holds true when dealing with other innovation agents, such as designers. This is confirmed by the Portuguese technology supplier, who recognised that “*people got used to sit together and chat*” (alluding to the collective and integrated innovative environment the Portuguese footwear sector rests upon and which clearly differed from the automotive sector, apparently less engaged with open collaboration formulas) having added that some of the technologies developed *for*, or more appropriately, *with* the footwear sector were later transferred to other sectors, including the automotive and aerospace sectors.

The FACAP³ programme was often referred to as the catalyst for a change in the modes of relation between different actors along the sector’s value chain, not only because it set the ground for the emergence of both a group of Portuguese footwear firms ranking among the world elite and a stronger national manufacturing equipment industry, with leading technologies, but also because it gave an impetus to further cooperation between groups along the footwear value chain, including partners from the scientific and technological system.

Engagement in high-tech and scientific knowledge-building activities goes on in other areas beyond equipment and machineries, such as materials and ICTs. Although one of the footwear companies’ representative argued that - at least for the time being - his company’s core activity is not to carry out R&D⁴ activities on soles or any other

² Footwear Technology Centre of Portugal

³Footwear Factory of the Future

⁴Literature has reported that low-tech and small-medium sized companies fail to apprehend their engagement in R&D activities due to the informal character of the latter (e.g. Kleinknecht, 1987; Bougrain et al., 2002, 744)

components to be applied to shoe production, they closely interacted with their partners/suppliers to conceive, test and develop products which can best meet their markets requirements either through R&D or design inputs incorporation. This goes in line with the premise that firms are not expected to develop competencies in every domain, so reliance upon expanded, multidisciplinary networks can guarantee companies access to complementary assets and their specialization in core competencies. This interaction widens the knowledge base of footwear companies which not only have to rely upon the knowledge inputs from other stakeholders but also are pushed to encompass new capabilities to deal with the changes resulting from knowledge transfer via those stakeholders. One of the companies alluding to the introduction of technological innovations at production level argued that technology transfer could not succeed without the company's own learning processes, under which the company's personnel absorbs and accommodates the new knowledge into the existing one and transforms it. The process spans the company's knowledge base and becomes fundamental for subsequent product and process innovation.

Product conception and development in footwear firms can provide a paradigmatic example of how innovation is speeded up by interactive relationships. Both footwear companies stated that linkages to external sources of knowledge had been decisive for their innovative capability and competitiveness. At the same time, it can be said that the companies' openness to regular communication with local and far distant external sources of knowledge has made them more aware of knowledge opportunities, supporting their decision-making processes better, and may even play a part in reducing initial resistance to engage in projects with a degree of uncertainty. One of the companies stated that although they forced themselves to keep a permanent eye on R&D lines and state-of-the-art technologies, tight connections to APICCAPS and the CTCP had been pivotal for footwear firms to keep permanent track of key-knowledge, to be in the know.

Referring also to aesthetic design as a key element for the companies' products, "*the dorsal spine of product differentiation*", both footwear representatives pointed out that the design features of their products were the result of their ability to identify and interpret customers' needs and preferences (sometimes even anticipating fashion trends) and fuse their knowledge market with the design expertise of the staff they work with. In this sense, costumers were perceived too as important triggers for innovation in footwear companies.

Another remark to be made about both footwear companies is that their innovation capability seems to have boosted from the very beginning they embraced new functions beyond that of production. The creation of brands – a strategy pursued by both firms – could not have been successfully carried out if increasing attention had not been paid to up- and downstream stages of footwear value chain, from conception to distribution and retail. This move forced them to open up to new stakeholders (innovation sources) to gain access to knowledge they did not master, amplifying their opportunities to innovate at different stages and at different levels, including at the organizational level.

5 Final remarks

The Portuguese footwear sector challenges the notion of a traditional, low-tech and non-innovative sector, some of the attributes the sector is usually coined with - and not only by common sense.

With this paper, we have tried to demystify that notion, by analyzing two major Portuguese footwear companies. The routes taken by both of them in the 90s indicate an increasing commitment of their managerial boards to innovation, including to R&D. On the one hand, gradual extended control over other functions beyond that of production

has prompted further commitment to R&DI. On the other hand, companies' increasing control over their value chain could have been nothing but a mirage if they had not relied upon R&DI. This reliance often meant to be actively involved in the creation of cutting-edge, high-tech knowledge. The foundation and growth of the company representing the footwear technology providers' perspective have been highly contingent upon the impetus given by the footwear sector's demands.

Although this study fails to scientifically demonstrate a causative relationship between the companies' performance and their R&DI commitment, it still has the merit to point to the innovation opportunities that may derive from coupling with different stakeholders, and how those opportunities may end up benefiting each one of them. The case of the Portuguese footwear sector, brought to this paper by the lens of three companies - which have persistently evoked how bridging ties between different knowledge holders has been decisive for the sector's performance, impacting also upon stakeholders from other sectors (company C is a good example) - should be looked at as a privileged *milieu* for further research on R&DI payoff in low-tech sectors – a classification increasingly more refutable.

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