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HOW TO ADDRESS THE NEEDS OF SPECIFIC TARGET GROUPS: A COMPARISON BETWEEN FASHION AND ORTHOPAEDIC FOOTWEAR SUPPLY CHAINS

Authors:
Valentina Franchini
Department of Management and Engineering
University of Padova,
Stradella S. Nicola 3
36100 Vicenza, Italy.
Tel +39 0444 998770 – Fax +39 0444 998884
E-mail: valentina.franchini@studenti.unipd.it

Rosanna Fornasiero
Institute of Industrial Technologies and Automation
National Research Council
Via Edoardo Bassini 15
20133 Milan, Italy
Tel +39 02 23699910– Fax +39 02 23699941
E-mail: rosanna.fornasiero@itia.cnr.it

Prof. Andrea Vinelli (Corresponding Author)
Department of Management and Engineering
University of Padova,
Stradella S. Nicola 3
36100 Vicenza, Italy.
Tel +39 0444 998740 - Fax +39 0444 998884
E-mail: andrea.vinelli@unipd.it

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Abstract
This research is a part of the European 7th Framework Program RTD project named CoReNet (Customer-ORiented and Eco-friendly NETworks for healthy fashionable goods), that aims at implementing innovative tools and methods for supply chain management to meet consumer needs and expectations for specific target groups – such as elderly, obese, disabled, or diabetic persons – by producing small series of functional and fashionable footwear and clothing with the following characteristics: high quality, affordable price and eco-compatibility.
This paper focuses on footwear companies and compares the fashion and the orthopaedic footwear supply chains, through multiple case studies conducted to understand how the production for the target groups mentioned before could be industrialized through an integration of these two supply chains.
Through business processes and requirements analysis, the paper proposes a supply chain topology that maps the most relevant characteristics, procedures and techniques, related to production, customization and supply chain management.

Keywords: Footwear supply chain; Fashion footwear; Orthopaedic footwear.

1. Introduction
This research is part of CoReNet, a European 7th Framework Program project, whose objective is to address the needs and expectations of specific target groups – elderly, obese, disabled and diabetic people – by improving the supply network structure of the European Textile, Clothing and Footwear Industry (TCFI) to supply small series of functional and fashionable clothes and footwear paying particular attention to eco-compatibility.
Nowadays, the EU’s population is 500 million people and project target groups cover an important part of it: elderly persons (over 65) 17%, obese people 26%, diabetics 10% and
disabled people 10%. Furthermore, overweight people are 50% and people with reduced mobility are more than 40% of the population (World Health Organization, 2007).

The combined effects of labour intensity, low entry and exit barriers, and changes in international trade regulations have made TCFI a global industry where competition is planetary and key players are no longer concentrated only in Europe and North America but located in emerging low labour cost countries (Gereffi, Humphrey, and Sturgeon 2005). Small firms have struggled to survive, often unsuccessfully, and have been progressively weeded out (Leonidou 2004). Moreover, the overall performance of this industry is deeply affected by unpredictable and seasonal demand as well as emerging consumers’ needs in terms of comfort, health and environmental attention.

This context forces European Textile, Clothing and Footwear (TCF) companies to rethink their operation strategies. The production of small series of specialized and customized high value added products for the project target groups represents a key opportunity for European TCF SMEs producing fashion products to foster their competitiveness entering new niche markets.

This research particularly focuses on the footwear sector and analyses in which way the European fashion footwear companies could address the project target groups in order to considering them as a market opportunity to face an evermore competitive environment.

In order to achieve this research objective, we first analysed the existing literature on the footwear sector, underlining a gap in the studies of orthopaedic footwear supply chains. Then we conducted some case studies within orthopaedic providers to investigate practices and processes distinctive of this sector. Finally, based both on literature review and within and cross case analysis, we compared the best practices and the most relevant processes of the fashion and the orthopaedic footwear sector to identify the interchangeable best practices of the two sectors.
2. Literature Review

Competition within the footwear sector is nowadays among global networks and key issues are how to develop and implement innovative managerial models and methods to support collaborative practices (Dyer and Singh, 1998; Camarinha-Matos, 2010). The new paradigm of demand-driven supply networks (Childerhouse et al., 2002; de Treville et al., 2004) emerges as a collaborative scheme to better respond to consumers’ direct signals and needs. Moreover, as Adler (2001) effectively discussed, the new enlarged/extended structures, characterized by high cognitive content exchanges, can no longer be coordinated by traditional hierarchy/market instruments as they require trust in order to share knowledge and leverage on external, updated and complementary competencies (i.e. Open Innovation model).

Fashion Footwear

Fashion sector is characterized by volatile product demand and need of quick planning and production. Footwear in particular presents a really fragmented and rigid scenario, constituted by many specialized knowledge intensive companies most of the time grouped in industrial districts. Each phase of their production processes is deeply characterized by traditional approaches always oriented to batch quantities and local maximization (Piller et al. 2003). Carpanzano and Ballarino (2008) support that a huge effort is necessary to drive improvement: major introduction of information technology and automation, on one side, and integration among different actors and technologies in a network of real time collaborating enterprises, on the other, are some key factors to be achieved to respond to daily challenges, and to face the global competition.

Recently there have been published many papers discussing technological innovation in the footwear sector both in terms of automation and in terms of monitoring and real time control (Carpanzano and Cataldo, 2003; Boer and Dulio, 2007), especially with reference to mass
customization. Beside technological improvements in the footwear sector, collaboration mechanisms have been studied in the recent years in order to propose paths to increase value along the supply chain (Fornasiero et al., 2009, Boer and Dulio, 2007) and to implement the mass customization paradigm (Fornasiero et al., 2010).

**Orthopaedic Footwear**

Most of the literature on the orthopaedic footwear is related to clinical aspects of foot pathologies, discussing different types of resolution for them. Referring to CoReNet target groups (diabetics, disables, elderly and obese persons), Pinzur et al. (2005) have dealt with diabetics’ people problems with foot care and shoes. Burnes and Lees (2002) investigated elderly people on a general rehabilitation ward wearing incorrectly sized shoes and looked for the presence of complications. Jannink et al. (2006) effectively studied the use of orthopaedic shoes in patients with degenerative disorders of the foot (disable people).

Van Netten et al. (2010) also investigate the adoption of custom-made orthopaedic shoes and the association between their use and the most relevant aspects of their usability.

An important research field emerged in the last years deals with the improvement of technologies (both hardware and software) that could better address patients needs, and their functional and fitting requirements.

Chen and Lord (1995) compared the trial shoes and the fit shoes techniques for the assessment of the fitting; while Kos and Duhovnik (2002) proposed a fitting measurement system that firstly scans customers' feet and secondly suggests best-fit shoe models from a shoe database. Finally Luximon and Luximon (2009) present a shoe-last model based on foot shape measurement data and foot biomechanics, that includes comfort and fit aspects as well as design aspect, and therefore enables design of aesthetical comfortable shoes. Since the design can be modified instantaneously, the designers could visualize design changes leading to a reduction in shoe-last design cycle.
However, there is a lack in the literature for what regards the study of the processes within orthopaedic companies and the best practices applied along the orthopaedic footwear supply network. This paper starts focusing on their investigation.

**Interconnection between Fashion and Orthopaedic Footwear**

The investigation of the interconnections and interfaces between fashion and orthopaedic footwear is an unexplored research field. Indeed a first step to be implemented in the CoReNet project is to understand what fashion companies can learn from orthopaedic footwear industries’ experience in the sector. This way footwear companies producing fashion products might shift to healthy and eco-friendly products where personalization gains a central role, to challenge sector’s crisis and catch a good market opportunity.

3. Research Methodology

The paper methodology is based on a multiple case study approach as an explorative method to explore a new research field and investigate business processes, practices and requirements of different companies to identify the best “how-to’s”.

The case studies are conducted in Italian companies; the sample was selected adopting theoretical sampling (Glaser and Strauss, 1967). Firstly, we focused on three of the industrial partners of CoReNet, selected because of their particular attention to the project objectives in the development of their business. Moreover, we decided to involve three other companies to conduct in-depth case studies for what concerns the orthopaedic footwear sector, where relevant literature is missing. We also collected information about potentially interested firms from internet and the orthopaedic providers listed by the Italian Ministry of Health and, so we contacted many other companies.

In our case studies we analyse the focal company’s supply network structure according to the perspectives of the manufacturer, supplier, technology provider, distributor and assembler, to identify what type of practices could be adopted, how these may be integrated and, finally,
how they can contribute to increase the firm’s overall performance.


Data collection and data analysis

In this paper we chose to analyse and compare fashion and orthopaedic footwear supply networks by adopting an in-depth case study approach and developing a research protocol by following a theoretical framework (Yin, 1994).

The aim of our protocol was to shed some light on the following research issues for which there are literature gaps, as underlined in the previous paragraphs:

1. Analysis of orthopaedic footwear supply chain management to understand which are the best practices of the sector both within the companies and along the supply network;

2. Comparison between fashion and orthopaedic supply chains to identify the interchangeable best practices

We developed two research protocols for fashion industries and orthopaedic providers. We used multiple investigators as a way to reduce bias and create more reliable data (Eisenhardt 1989, Yin 1994, Pagell 2004).

First of all, an “as is” business process analysis was conducted through focus interviews and BPMN (Business Process Modeling Notation) tool was used to collect and formalize rich set of data, both qualitative and quantitative. This first step results in company-specific supply network topologies, which describe types of business partners and flows (i.e. materials, information and knowledge). Furthermore, the requirements of each partner in terms of business and collaborative processes are pointed out and analysed in detail to draw the relevant characteristics, procedures and techniques along their own supply network (company information and business networking practices). For each sector we analyse in detail two
selected processes (production and customization) and the supply network configuration as significant processes for the purpose of the CoReNet project.

Moreover, we analyse future business scenarios of each sector, where new networking strategies and practices are defined. These future scenarios are built in an iterative way through several meetings and brainstorming sessions with the companies involved. These sessions were prepared including all the information collected from prior interviews, and the ideas coming from state-of-the-art and experiences of other business cases. The following categories are used to foster discussion and brainstorming: qualification of potential partners, network formation and network operations.

To analyse and formalize the data collected from the interviews, we firstly developed a within-case analysis trying to draw preliminary observations. Secondly, we moved to cross-case analysis to probe whether the relationships identified in one project could fit also the others. As suggested by Eisenhardt (1989), we compared pairs of cases to investigate the similarities and the differences among our cases. Finally, we compare the within- and cross-case analysis results with the existing literature to provide a further validation of our findings.

4. Case analysis

Within-case analyses

This section presents a detailed analysis of the two sectors (fashion and orthopaedic footwear) focussing on three main dimensions identified as significant for the purpose of the CoReNet project:

- Production process
- Customization process
- Supply Network configuration

4.1 Orthopaedic Footwear
The orthopaedic footwear market in Italy is normed by the National Nomenclature, dated 1999. The Nomenclature gives the guidelines for the regulatory of the orthopaedic footwear market; it defines the typologies of shoes distributed and reimbursed to the patient that can benefit of a medical prescription:

1. Standard orthopaedic shoes
2. Customized orthopaedic shoes

The normative also defines the lead-times for the supply of the orthopaedic shoes (maximum 40 days), the warranty and the renewal of the medical prescription for each patient (1 year for customized shoes and 6 months for standard ones).

Referring to the CoReNet target groups (diabetics, disables, obese and elderly people), as emerged from our case studies only diabetics and disables persons with motor disability can benefit from the National Health Service distribution of shoes, under a medical prescription.

**Production Process**

The production process of orthopaedic shoes is deeply affected by the rules given by the Nomenclature, and there is a specific path that all the supply chain actors have to respect to obtain (for patients), or produce and distribute (for orthopaedic providers) the shoes as a medical device reimbursed from the government.

Hereafter we refer to the production process of the customized shoes since the production process of the standard orthopaedic shoes is very similar to the fashion footwear production.

Instead in the customization process, structures and materials are chosen to address to specific functional requirements (as explain in the following paragraph).

The steps identified and the actors involved in the production process of customized shoes are:

1. Medical Prescription – Doctor and customer
2. Price estimation – Orthopaedic provider and customer
3. Permission and approval – Orthopaedic provider and National Health Service

4. Foot Measurement – Orthopaedic provider and customer

5. Design and Production - Orthopaedic provider and suppliers

During step 5, the orthopaedic technician starts to design the shoes (and generally the insoles related) and to produce both of them, to address the needs collected from the patient and the medical prescription according to the following flow:

- Design of the shoes consistently with the specific requirements of the customer
- Creation of the personalized last (plastic or wood)
- Creation of shoe funds
- Creation of production patterns basing on patient’s measurement
- Creation and cutting of the upper
- Stitching and manual assembling of the orthopaedic shoes

6. Trial with the patient – Orthopaedic provider and customer

7. Delivery and Testing – Orthopaedic provider and customer

Historically, the production of customized orthopaedic shoes is handmade, and the craftsmanship is an important value-added for an orthopaedic footwear producers to obtain the best quality for the shoes and the best results from the patients. Nowadays, in the analyzed companies roughly 30% of these shoes are produced using milling machine for last production. Technologies could be involved in different stages of the process: the measurement can be taken using 3D scanners, instead of the traditional foam used; the plaster cast technique is anyway used for the most serious case. Information from 3D scanners can be sent directly to the milling machine for the production of the last. Thanks to innovative technologies, efficiency increased, lead-time for last creation decreased and precision of the production process improved.

**Customization Process**
The customization process is the most important in the production of the orthopaedic shoes, particularly for the requirements side to answer effectively to the patients’ needs. All the customized shoes are adapted according to customer’s measurement.

We identify most important categories of customization according to the checklist used by the orthopaedic providers to collect customer’s functional requirements:

- Circumferences (patient’s measurements)
- Upper – height, spurs, padding and need of an external spring
- Tips – type
- Lacing – type
- Toe – structure
- Sole – structure and material
- Fund - type
- Heel – height, structure and material
- Increases – height, structure and material
- Insoles – type and material

In addition to the above categories, customers can choose their favourite model and the materials for the production of their orthopaedic shoes, coherently with their pathology and functional requirements. Moreover, the orthopaedic technician also collects other qualitative observation from the patient, such as if they have pain and which kind. Then, merging patient’s measurement and requirements with medical indication, the orthopaedic technician designs the specific shoes for the customer according to the models available.

For what concern the standard orthopaedic shoes, both structure and materials are chosen by the producers to better address customer’s functional requirements, based on their different pathologies. The shoes are produced according to data collected year by year from past
customers and to detailed studies of the pathologies and functional requirements related, to obtain the best corrective effect from the using of those shoes.

**Supply chain configuration**

The supply chain of the orthopaedic producers and providers is organized to compress at the best response lead times and to improve quality of the products. Considering that patients show specific and complex needs due to their particular condition, partners should guarantee the best level of service in terms of response time and quality of materials. Important supply network actors are: raw material suppliers and technologies suppliers. Generally, orthopaedic producers establish partnerships with the latter, to improve and innovate their production processes in terms of lead-time and quality of their products.

Costs are not a critical issue for the orthopaedic providers because of the fixed reimbursement defined by the government. Neither a particular attention is given to the organization of the market side, because of the monopolistic advantage that orthopaedic providers can benefit in their territory, together with the continuous needs that patients show in the distribution of orthopaedic shoes and the reimbursement by the National Health Service (NHS) paid only to the orthopaedic shops registered at the ministry.

Generally orthopaedic providers do not outsourced any phase of production; if they do not produce the shoes inside their company, they buy the final product from another supplier according to available standard models.

**4.2 Fashion Footwear**

For the analysis of the fashion footwear sector we refer to both existing literature and to direct case studies covering a producer of highly refined women shoes, a producer of special shoes components (like customized insole) and a producer of customized shoes. Indeed in this sector, the most important competitive advantage seems to lie on the design and know-how owned by the company in the footwear fashion market and by close collaboration with
fashion stylists and generally with suppliers which are involved from design to production.

Production Process

The manufacturing process starts with the internal production of prototypes and samples: for each model fashion footwear companies produce a shoe number 37, whose main feature is to show the aesthetic aspects of the shoes.

We can divide the production process into different phases:

1. Modelling (internal or external): ideas for the sampling, realization of 2D drafts and digitalization in CAD. Then, through the identification of landmarks, CAD translates drawing into operations that the industrial machinery has to carry out.
2. Creation of the last (either wood or plastic material)
3. Creation of the insole
4. Creation of the sole: the company that produces the soles brings the necessary die (if it is a new one, the company has to create a last to produce the die, otherwise the last from previous collections are used )
5. Cutting, Sewing and stitching of the upper
6. Assembly of all components for sample production
7. Scale development
8. Production of the full collection

Production phases generally internalized are:

- Design
- Sampling
- Laser cutting for small series (2/3 hundred pairs, for which quantitative is not worth realization of die cutting)
- Final assembly for strategic lines

Customization Process
Innovation is strongly customer driven, and especially in these last year companies pay great attention to the customization process both based on aesthetic and functional features. Also evolving customer needs, which are increasingly attentive to details and personalization, influence the context. To face competitively the market, recently companies started to work smaller lots with a higher level of customization.

In order to implement customization process fashion footwear companies apply a modularized production paradigm based on product platforms where each possible component variants is planned. Generally customization regards not the structure of the products but the components or the materials; anyway the customization process greatly affects the production process.

However the customization process starts from customers’ needs and requests.

From analysed cases and generally from other previous studies it emerges that customization options that companies offer to their customers are:

- The possibility to have half-sizes for particular models (this is the only customization features offered for the shoe structure). In this case components like sole and insole don’t change and are the same ones used for the full size, while the last is different.
- Choice of materials for the upper/lining.
- Possibility to realize a customized variant of an already available article. The new design is in charge of the customer, where the new shoe variant is designed by CAD starting from an existing product structure (same last, sole and insole) and is produced in the agreed quantity.

Unfortunately, there are frequently some limitations that still affect the full application of customization process:

- The customization process does not include changes in the structure of the shoe which implies the development of the personalized last;
- The possibility to customize products is offered only to the most important customers (i.e. long-term partner, strategic customers).

- Customers are not supported by any technological instrument to develop customized products.

**Supply Network configuration**

Generally fashion footwear companies establish long-term relationship to improve collaboration with suppliers (excepted for particular collection’s requests, for which companies search for new suppliers with specific experience). Design is the key process and strong collaboration of stylists and modellers in supplier selection is critical to choose the best suppliers for their shoe lines. Suppliers are involved already during design phase and during the industrialization phase, since each of them has to develop its own component according to the information received from the shoe producer. Suppliers’ selection occur on the base of specialization to obtain innovation and high-quality at a right price. Main categories of suppliers are:

- Tanneries
- Last makers
- Soles-producers
- Heels-producers
- Insoles-producers

Generally suppliers do not work exclusively for a company, but they supply both standard products and products in exclusive (i.e. soles and heels can be covered by a patent).

Most of the suppliers are regional, located in the different footwear districts (i.e. Macerata, Vigevano, Riviera del Brenta) while tanneries are generally located in the leather districts (i.e. Veneto). Component and material suppliers often have a strong influence on final product definition.
Several phases of the production process are commonly outsourced: cutting, stitching and sometimes also final assembly. Companies develop a strong relationship with their outsourcers, to guarantee the highest quality to their customers. Third-party companies are generally dedicated to produce only for one company, that monitors (often with technical persons in charge on-site) production status and progress of each order for what concerns materials and accessories. Most of the time, at the beginning of each season framework agreements are taken with most important partners in order to establish a certain amount of production for which the suppliers have to give availability along the season according to the collected orders.

Cross-case analyses

Cross-case analyses within the orthopaedic footwear sector

This section analyses the orthopaedic footwear sector to understand which are the best practices both within the companies and along the supply network (Research issue 1.)

First of all we highlight the most important phases in the production process:

- Design: strictly link with the customization process and the collection of information from customer
- Production can be considered mainly of three types: industrial (for standard orthopaedic shoes), semi-industrial or handmade (for customized orthopaedic shoes)
- Distribution: provided only for the companies registered as orthopaedic providers.

Basing on the previous mentioned phases, we identify four principal categories of producers/distributors of orthopaedic shoes:

1. Industrial Producers
2. Producers/Distributors (Large Orthopaedic providers – turnover: 3-5 m€)
3. Craftsman/Distributors (Medium Orthopaedic providers – turnover: 1-2 m€)
4. Distributors (Small Orthopaedic providers – turnover: < 1 m€)

Table 1 shows how the four categories act in the 3 main phases and their cross-relationships.

<table>
<thead>
<tr>
<th>Phases</th>
<th>Categories</th>
<th>INDUSTRIAL PRODUCERS</th>
<th>PRODUCERS / DISTRIBUTORS</th>
<th>CRAFTSMAN / DISTRIBUTORS</th>
<th>DISTRIBUTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGN</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRODUCTION</td>
<td>Industrial (standard shoes)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semi-industrial (Customized shoes)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Handmade (customized shoes)</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>DISTRIBUTION</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*Table 1 – Activities of the four main actors within the orthopaedic footwear production steps*

Industrial producers generally are not registered to the ministry as orthopedic providers and for this reason they do not sell directly to the final users but just produce standard orthopaedic shoes for preventive reasons. So the industrial providers supply to all the other categories of actors the standard orthopaedic shoes (red arrows), produced through industrial technologies and sold according to the requirements of customers in terms of comfort and general functionalities. In case of customized shoes, the production can be both semi-industrial – using technological instruments such as 3D scanner and milling machine – or handmade. Generally the industrial producers and the category “producer/distributors” provide to the small distributors the customized shoes (blue arrows), produced referring to the measurement and the specific requirements of each patient.

**Cross-case analysis between the fashion and the orthopaedic footwear sectors**

In this case we compare fashion and orthopaedic supply chains to identify the interchangeable best practices (Research issue 2.).
<table>
<thead>
<tr>
<th>Orthopaedic footwear</th>
<th>Production process</th>
<th>Customization process</th>
<th>Supply Chain configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customized shoes</strong></td>
<td>Craftsmanship Semi-industrial (3D scanner and milling machine for lasts creation)</td>
<td>PURE CUSTOMIZATION Structure made for measurement Materials Upper Tips Lacing Toe Sole Fund Heel Increases Insoles</td>
<td>SUPPLIERS Raw materials Components Technologies DISTRIBUTORS Orthopaedic providers (often property)</td>
</tr>
<tr>
<td><strong>Standard shoes</strong></td>
<td>Industrial</td>
<td>BEST FIT Structure Materials</td>
<td>SUPPLIERS Raw materials Components Technologies DISTRIBUTORS Orthopaedic providers</td>
</tr>
<tr>
<td><strong>Fashion footwear</strong></td>
<td>Industrial</td>
<td>CONFIGURATION Upper design Materials</td>
<td>SUPPLIERS Raw materials Components Technologies OUTSOURCERS Producers Components producers Assemblers DISTRIBUTORS Retailers</td>
</tr>
</tbody>
</table>

*Table 2 – Summary of within-case data*
Production process

The differences in the production processes consist predominantly in the level of automation and industrialization implemented in the process. As for the orthopaedic footwear, the two production processes to obtain customized and standard shoes diverge significantly. The first leverages on craftsmanship and manual skills to best address customers’ functional requirements, needs and expectations. However, lately, a great effort has been spared to increase the level of automation: the development of foot-scanning tools (such as 3D scanners) and milling machine for last production are important steps in this direction.

The second is closer to the fashion footwear production process, mainly because the higher level of industrialization.

Customization Process

Referring to Yeung, Choi and Chiu (2010), we can consider three different categories of customization when mapping the different kinds of shoes produced by orthopaedic and fashion footwear companies:

- “Pure customization” – customized shoes, completely based on direct measurement (with 3D scanners or manual measurement), for which customers can fully personalize their products, on the base of their specific needs, functional requirements and aesthetic preferences. This is based on the personalized last production and the process is very much diffuse in the orthopaedic companies than in the fashion companies, in terms of percentage of companies applying this process.

- “Best fit” – Standard orthopaedic shoes, created appositely for best addressing specific functional requirements (generally modifying structure and materials); the customer’s foot is measured and the last is chosen among models already available according to the parameters that match better the foot measurement. This process can be applied both to standard orthopaedic and to fashion shoes with a matching between standard
lasts and foot measurements.

- Configuration – in this case only aesthetic features are personalized based on a product platform available for the customer choice. The product platform is pre-defined and all interchangeable shoe modules are settled. This case started to be diffuse in the fashion sector (see NikeID, and MiAdidas). This kind of configuration may be extended towards target groups enlarging the number of modules to be adaptable and giving the possibility to the customer to choose not only aesthetic but also materials choice (transpirant, waterproof, flexible materials...), particular production processes (no internal stitching for diabetics, ...) or particular components (personalized insole).

**Supply network configuration**

According to the information collected with the case studies we can draw the supply chain configuration for both the orthopaedic and the fashion footwear sector, Figure 1 and 2 depict the two situations.
As one can observe, several actors are the same in the two supply networks. In particular the supply side, upstream the producer is very similar. It comprises raw material suppliers (leather and tanneries, synthetic materials, components) and technological suppliers. However, many are the differences between the two networks too.

Outsourcing is relevant only in the fashion footwear supply chain, where cutting, stitching and also assembly are generally externalized. Instead as for orthopaedic providers, their production process is either fully vertically integrated or fully externalized (i.e. they buy standard final product).

Distribution networks, downstream the producers, are also very different. In fact orthopaedic shoe distribution strongly depends on National Health Service (NHS), and retailers and consumers’ behaviours and relationships are deeply shaped by this circumstance.
Findings and Future Research

As results of the within- and the cross-case analysis these findings can be summarized:

• direct interaction with final customer is fundamental to collect information about both functional and aesthetic shoe’s requirements and many companies both in the orthopaedic and in the fashion sector are working to improve this relationship both with direct means (interactions with shop assistants, 3D scanners foot measurement) and with indirect means (as web based product configurators).

• most of orthopaedic production is still based on craftsmanship practices, while just few producers are implementing innovative tools and methodologies for customers’ data gathering and data processing for design and production.

• insole is one of the shoe components which requires the greatest degree of personalization and reconfiguration and which can be used also in the fashion sector to make shoes more comfortable and to apply a first level of customization.

• there are some innovative companies that are trying to merge the two kinds of production (i.e. fashion and orthopaedic products), levering on their supply network that can support both productions. This give a competitive advantage to them in terms of competencies and knowledge from one application to the other. Usually the two production processes run in parallel but companies are studying how to merge some production steps to increase the overall system efficiency.

• in this view, some activities and equipments are similar in the production process of both orthopaedic and fashion shoes, see, for example cutting machines for the upper or stitching activities.

• according to National Nomenclature orthopaedic shoes belong to two categories: standard and customized. Case studies showed how, particularly for the production of
standard orthopaedic shoes, sharing the upstream fashion footwear supply network could offer greater efficiency and larger scale economies. At the same time, fashion companies could gain great advantages sharing the orthopaedic distribution network to distribute healthy and fashionable shoes.

- Orthopaedic providers address target groups only if they hold rights to get a medical prescription (i.e. diabetics and some categories of disables can benefit from reimbursement by National Health Service). So, addressing needs and requirements of target groups especially for prevention reasons and not covered by the benefit of the medical prescription represents an interest opportunity for fashion footwear companies to enter a new market.

Along this vein, future research will focus on developing a collaborative consumer-driven network reference model (RM), where concepts and organizational structures currently applied in practice are combined and adapted with approaches proposed by the literature to enable the organizational flexibility required from the collaborative supply networks targeted in the project.

The RM will be developed along three main dimensions:

1. Organizational – to provide the specifications of the organizational practices for supply networks with small series production;
2. Information & Communication Technologies (ICTs) – to support the requirements for the development of new ICT services at different process levels;
3. Knowledge – to cover and map partner competencies and knowledge to be shared in the network regarding products and processes.

This way, the RM will effectively support footwear companies in their production of small series of healthy and fashionable products particularly directed toward the project target
groups. Involving final customers and understanding their roles in the business processes are fundamental steps in the design of final supply network configurations.

In particular, the RM will highlight sustainable methods and tools for product design, planning, production and distribution activities, rapid manufacturing technologies and processes for small series industrial production. The RM should also face trade-offs between costs and lead-times, flexibility and service quality along the supply networks and throughout the product's life cycle.

Finally RM will facilitate footwear supply networks in obtaining and managing consumers’ data to know their needs, involve consumers in product design and configuration, exchange consumers’ data through adequate data models and secure systems, collaborate with suppliers, implement innovative manufacturing machines, monitor quality and sustainability of products.

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