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Challenges and opportunities for the Italian manufacturing industry

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La digitalizzazione di prodotti e servizi procede così velocemente che gli esseri umani faticano a capire che cosa stia succedendo. Ma state certi che questa trasformazione digitale cambierà l'impatto e la portata dell'esperienza personale. (Albert Boswijk – *The Economy of Experiences*)

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ABSTRACT

This thesis raises some questions about the level of innovation in Italian manufacturing companies. The aim of this study is to analyze how much digital technologies are diffused and what kind of impact they are having in these organizations in terms of business model, organizational structure, level of internationalization and business objectives.

Something is happening in the world of manufacturing, someone call it technological progress someone else call it the fourth industrial revolution, but for sure from the time when digital innovation left the world of software to influence the world of hardware it has changed the rules of the game. The digital manufacturing represents, today, the set of technologies with the highest potential, it induces companies to reconsidering their strategic positioning, organization, production and distribution processes and supply chains.

The analysis links seven case studies, they are all companies operating in the mature sectors of Made In Italy such as: furniture – design, fashion – accessories and jewelry. They are characterized by different size and different business model but they all used the manufacturing digital technologies to improve their business. The study observes if and how they take advantage of these technologies and how these technologies had and still have an impact on their businesses.

Subject Areas: Innovation, manufacturing, new technology, strategic decision making, case studies, international management.

INTRODUCTION

The aim of this thesis is to analyze the digital manufacturing phenomenon in the Italian manufacturing industry. The competitive advantages of this country have always been heritage, high quality and creativity of Made in Italy products, but what is the level of innovation of Italian companies and how widespread are digital technologies?

Many scholars argue that the world of manufacturing has reached a turning point, digital technologies are deeply changing our world: the way we perceive relationships, the way we perceive products and services and the way we manufacture and deliver them.

If the past industrialization has led to mass production and product standardization, this new digital industrialization is going in the opposite direction leaving more space for small-scale productions, customized and unique products.

The digital manufacturing represents, today, the set of technologies with the highest potential, it induces companies to reconsider their strategic positioning, organization, production and distribution processes and supply chains.

Given that small productions, customized and unique objects have always been the characteristic of Italian production, it is interesting to ask what the role of Italy will be in the global competitive scenario, if it will be able to renew its business model or if it really runs the risk of permanently losing its competitive edge.

The thesis tries to investigate the impact that digital manufacturing is having in the Italian manufacturing sector through the empirical analysis of a number of manufacturing companies located in the North-East area of Italy.

The analysis links seven case studies, they are all companies operating in the mature sectors of Made In Italy such as: furniture – design, fashion – accessories and jewelry.

Made in Italy and digital craftsmanship have many aspects in common, combining heritage, know how and new technologies it will be possible to overcome the

technical limitations of the ancient crafts, such as time and cost, and open new possibilities of success for a country like Italy, which can not afford to lose competitiveness in this field.

In the first chapter we analyze how this industrial transformation is perceived by scholars and by governments, in particular from the American and German point of view, then we focus on the role of Italy; the analysis continues with the description of the main digital technologies considered in the analysis of the case studies.

In the second chapter the Italian manufacturing industry will be taken into analysis.

In the third chapter will be presented a quantitative research aimed at investigating the current Italian situation and analyzing how widespread digital technologies are and what kind of impact they are having in economic, organizational and social terms.

The last chapter is dedicated to the analysis of the companies' case histories, the interviewed companies are *Arper spa* and *Zordan srl* for the furniture industry, *Fope spa* and *D'Orica srl* for the jewelry sector, *Maison 203 srl* and *Confezioni Barbon srl* for fashion and accessories sector and *Gritti- Pas de rouge* for the shoe industry.

CHAPTER 1

THE DIGITAL TRANSFORMATION

1.1.The fourth industrial revolution: context overview and implications

We are quite aware that the world where we live is constantly changing, it always has been and it always will be. We cyclically experience periods of profound transformation alternating with periods of new standards statement. The historians trace the first big break with the past in the industrial sector and consequently in society to the 18th century in Britain. The first industrial revolution started with the mechanization of the textile industry and invention of the steam engine. From this time onwards energy sources and materials changed, from horses, hands and water to coal, coke and steam. It changed the nature of labor from craftsmen to workers and transport networks started to change as well. The second significant industrial revolution has been traced to the end of the 19th century in USA with Henry Ford and the scientific management. Work started to be encoded, the production became more efficient and faster thanks to the assembly line characterized by interchangeable components and modularity. New materials and resources were discovered such as the Bessemer steel, petrol and electrification. New distribution networks and systems such as railroads and telegraph made people closer and more connected. Mass production reached a mass market.

Many scholars identify the advent of information technology (IT) in the second half of the 20th century as the third revolution. This revolution is characterized by the production of nuclear energy and energy coming from renewable resources, by the spread of biotechnology and nanotechnology, by the digitization of information and by the transformation of telecommunications. It was based on digital technology, personal computing and the development of the Internet. This revolution was peculiar because for the first time in history the world of information took on a

greater economic weight than industry, here comes the concept of "Information society" or "Post-industrial era" theorized by Daniel Bell. (Bell, 2007)

The growing economic importance of the service sector has made many believe that the industrial era for the West was over, but the recent economic crisis and the high unemployment level turned the attention to the importance of manufacturing and to the potential application of new digital technology to industrial processes.

For this reason in 2012 a cover by the Economist[1] announces a new industrial revolution, the third one in its opinion. A new socio-economic framework where manufacturing is rediscovered, goes digital and becomes widespread, democratic and personalized. In the Economist's opinion, the digitization of manufacturing will transform not only how goods are made but also the politics of jobs and the way people perceive products and services.

The article mentioned above says that the first two industrial revolutions made people richer and more urban but the revolution that is under the way will affect many other things beyond business. The main difference from the past is that the line between manufacturing and services is blurring, the factory as we have always perceived it could soon become a thing of the past. The protagonist of this third industrial revolution is the 3D printing, the first machine ever that could potentially make almost anything anywhere. This will change the geography of supply chains because you can design an object at home on your laptop and send it to the other side of the world in the middle of the desert to manufacture it, or you can produce it on your own. There are new materials that are lighter, stronger and more durable than the old ones such as many plastic polymers and carbon fiber. Internet is making many barriers fall, key words for this century are certainly collaboration, open innovation, crowd-sourcing and crowd-funding. This means that people and customers are involved in the design and innovation process of a product disrupting the idea of industrial secrets, intellectual property and patents.

According to James H. Gilmore and B. Joseph Pine II: "Roll over, Henry Ford. Today, you can have any color you want, as long as it's the one you want."

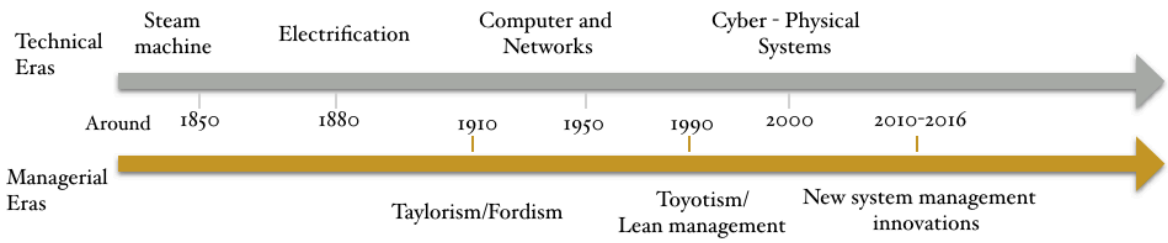
[1] "The third industrial revolution" is an article published in The Economist on 21th April 2012, http://www.economist.com/node/21553017.

The web has also enlarged markets, thanks to it, it is now possible to aggregate consumer demand from all over the world. It allowed markets to be found for products that otherwise would not pass the traditional distribution. Chris Anderson, one of the leading spokespeople of the maker movement, calls it "the long tail of things" (Anderson, 2012, p. 80); in a global market there is space for many customized niche products. The makers are the protagonists of the revolution described by The Economist and theorized by C. Anderson, they are the new digital manufacturers born small and global thanks to the web. They use digital desktop-tools, they are open source and they use standard project file. The maker culture is based on the idea that if you need something you can make it on your own or you can somehow contribute to the project.

However, although representative of a transformation in place, the makers are not the main symbol of the current digital revolution that is a more complex and widespread phenomenon.

It is interesting to notice that it is possible to define separately technological eras and managerial eras, this distinction may sometimes arise some confusion. (Hartmann, Halecker, 2015)

Fig1.1. Technological Eras and Managerial Eras throughout history.

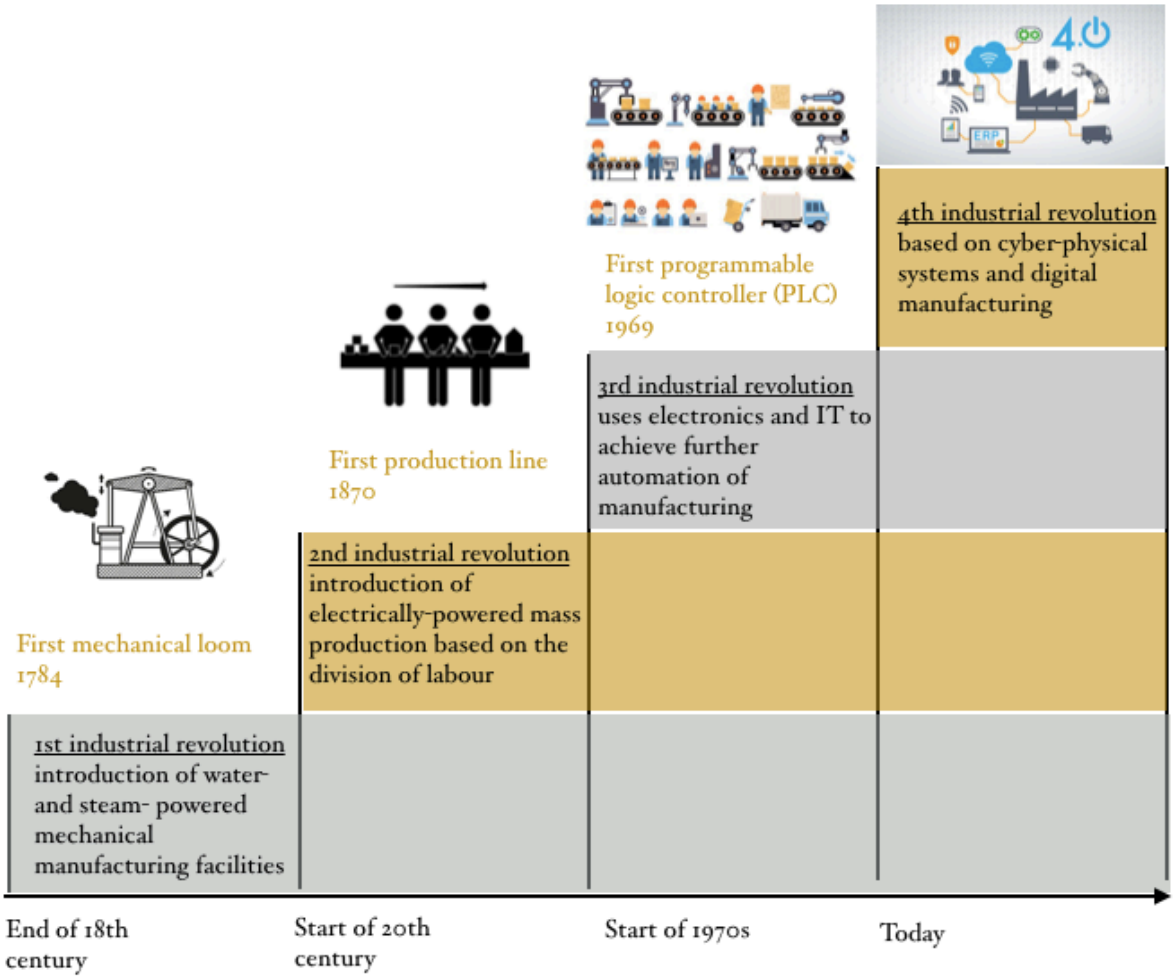


source: Hartmann and Halecker (2015)

Sometimes Fordism is considered the second industrial revolution after the introduction of the steam engine and the electrification era is not considered. From another point of view Fordism and Toyotism would occupy the same chronological place in industrial history. Bryjolfsson and McAffee (2014) give another

interpretation: in their opinion we are living "the second machine age", the first one was based on the steam engine and lasted from 1776 until 2000. Another perspective is the German one which defines the era that we are living as the Industry 4.0 (Kagermann et al. 2013), so going back the invention of the steam-engine is defined as industry 1.0, Fordism as industry 2.0 and the era of Communication and Information management as industry 3.0. In this research the latter interpretation will be considered.

Fig1.2. The four industrial revolutions



Source: German Resource Center for Artificial Intelligence (2014)

The fourth industrial revolution or Industry 4.0 refers to a new evolution stage in the organization and management of the entire value chain process involved in manufacturing industry; some also call it "Internet of things" or "Internet of Everything" but one point in common is the recognition that traditional manufacturing and production methods are going through a digital transformation.

Information and communication technologies are now widely common in manufacturing industry, they are increasingly blurring the boundaries between the real world and the virtual world in what are known as cyber-physical production systems (CPPSs) [Fig. 2]. Connected Cyber-physical systems (CPSs) influence all aspects of social and business life and have high influence in many areas due to the application of CPSs in different ecosystems (Hartmann, Halecker, 2015). Cyber-physical systems are the evolution of automation technologies and have the function of handling and translating data from the physical to the virtual world and vice versa using sensors and actors.

Marc Andreessen, in his essay "Why software is eating the world" asserts the growing importance of software, which is emerging as the connective tissue for value creation even for those companies that sell physical goods.

The digital technology is progressing at a pace that no one had expected, surpassing even the predictions of Moore's law[2], Raymond Kurzweil proved that Moore's law can be applied to many other technological development such as 3D printing, sensor technology, artificial intelligence, robotics and drones, and that technological change is exponential, not linear. (Kurweil, 2001) Some of these technologies are not new but the recent boost in computer power, the reduction of costs and the miniaturization make them more suitable for industrial use.

The massive and generalized digitization is one of the most important current phenomena. Cisco System forecasts global Internet traffic will reach 1.3 zettabytes in 2016, which is more or less the amount of information contained in 250 billion DVDs.

[2] Gordon E. Moore, the co-founder of Intel and Fairchild Semiconductor observed that the number of transistors in a dense integrated circuit doubles approximately every two years influencing the evolution of digital electronics.

Internet Business Solutions Group (IBSG) of Cisco defines IoT (Internet of Things) the point in time when more "things or objects" were connected to the Internet than people (Evans, 2011), in fact, if in 2003 there were roughly 6.3 billion people living in our planet and 500 million devices connected to the Internet [3], in 2010 there were 6.8 billion people and 12,5 billion devices connected to the Internet.[4] So, Internet is, by now part of our daily life and our habits are evolving faster than we can understand. Forecasts for 2020 estimate that there will be 6.58 connected devices per person. (Cisco IBSG, 2011)

Not all, however, commit to the positive and, in a way, utopian vision of Anderson and The Economist, Tyler Cowen is uncertain about the social implications of this global transformation for the American economy (Cowen, 2013). If technologies open a world of opportunities, a progressively smaller number of people would be able to take advantage of these opportunities. The big question for those who support the theory of "The average is over" is what the role of man will be in a world dominated by technology, and in particular what will be the role of the unskilled workers, the protagonists of the first and the second industrial revolution, who represent a significant portion of the population. Cowen argues that this technological progress is increasing the disparity, it broke a balance where the effects of progress are not distributed evenly, the rich are getting richer the poor are getting poorer.

Also Erik Brynjolfsson and Andrew McAfee from MIT tried to analyze this "Second machine age" (Brynjolfsson, McAfee, 2014) under its potential point of view, this technological process is exponential, digital and combinatorial. They liken computers to steam engines: computers and other digital innovations are doing for our mental strength what the steam engine and its successors did for our muscle strength.

[3] U.S Census Bureau, 2010; Forrester Research, 2003.
[4] U.S. Census Bureau,2010; Cisco IBSG, 2010.

The challenges and risks of this fourth industrial revolution are one principal discussion topic of the world economic forum, skills required of workers are changing and the collaboration with machines is inevitable[5].

Since machines are becoming more intelligent and autonomous they will likely replace human force in more and more types of work situations. People will be free to focus on the more human elements of their jobs such as creative problem solving and collaboration.

It seems to be a tradeoff between humans versus machines and humans with machines.

The World Economic Forum research maintains that this revolution will blur industry boundaries by growing new hybrid industries such as digital medicine, precision agriculture and smart manufacturing.

These kinds of industries will generate new jobs, but they will require new skills and digital abilities, in this scenario educational institutions will play an important role in this revolution.

The big deal, now, is to explore its potential. Digitalization has brought a new and extensive way to acquire knowledge and it has strong economic significance: the information is not rival and it has a marginal cost of reproduction equal to zero.

The table 1.1 shows the SWOT analysis of industry 4.0 carried out by CSES for the European Parliament.

Tab1.1: Industry 4.0 – SWOT analysis

STRENGHTS	WEAKNESSES
• Increased productivity, resource efficiency, competitiveness, revenue. • Growth in high-skilled and wellpaid jobs, • Improved customer satisfaction – new markets: increased product customization and product variety, • Production flexibility and control	• High dependence on resilience of technology and networks: small disruptions can have major impacts, • Dependence on a range of success factors including standards, coherent framework, labor supply with appropriate skills, investment and R&D,

[5] World Economic Forum in collaboration with Accenture: *Industrial Internet of Things: Unleashing the potential of connected products and service.*

	• Costs of development and implementation, • Potential loss of control over enterprise, • Semi-skilled unemployment, • Need to import skilled labor and integrate immigrant communities.
OPPORTUNITIES	THREATS
• Strengthen Europe's position as a global leader in manufacturing (and other industries), • Develop new lead markets for products and services, • Counteracting negative EU demographics, • Lower entry barriers for some SMEs to participate in new markets, links to new supply chains.	• Cybersecurity, intellectual property, data privacy, • Workers, SMEs, industries and national economies lacking the awareness and/or means to adapt to industry 4.0 and who will consequently fall behind, • Vulnerability to and volatility of global value chains, • Adoption of industry 4.0 by foreign competitors neutralizing EU initiatives.

Source: EP, "Industry 4.0 Analytical Study", Study for the ITRE Committee (Committee on industry, Research and Energy), 2016.

1.2.The industry 4.0 and industrial policies

The term Industry 4.0 was used for the first time in 2011 by the German Engineering federation at the Hannover Mess, this new concept of manufacturing production was theorized at the Fraunhofer Institute in Stuttgart and so named by the German consulting firm Roland Berger.

About a decade ago Germany was facing several challenges from the rising of labor costs to the need to renew infrastructure and business strategies, the "locomotive of Europe" feared that its competitive potential could be compromised.

The consulting agency in 2011 estimated that in 2015 Germany would lose its market leading position in terms of production value to China in four segments of the

machine building industry; going from a production value of 38 billion to a production value of 16 billion.[6]

Another research on default trends during the economic crisis highlighted that the sectors with the highest default risk in Germany were the automotive industry and the plant and machinery industry.[7]

The will to define a new industrial model comes from the need to increase productivity levels and maintain and increase the competitive potential.

German government has taken this challenge and decided to institutionalize it.

Today, the term Industry 4.0 (Industrie 4.0 in German) identifies the government's program which aims to outline the industrial policy for the next 10-15 years that aims to digitize the national manufacturing industry.

The Industry 4.0 program is a highly centralized and institutionalized program. The coordination is carried out by a steering committee whose task is to outline the strategies and to target individual work groups. A Scientific Advisory Committee has also been established, it is a support authority that supervises the strategies and public activities, composed of leading figure from academia, manufacturing and IT industry and a governing board.

The program involves many entities: suppliers and manufacturers of automation such as Siemens, Bosh and Festo, ICT companies such as SAP and ESG, manufacturing companies primarily the automotive industry, research center such as Acatech and Fraunhofer Institute and industrial associations and trade unions.

The Industry 4.0 technology is based on Cyber Physical Systems and sensors related to the world of the Internet of Things.

Germany has reacted in a coherent and timely manner to a dangerous situation for its economy and for its own industry, but the ghost of "deindustrialization" is leading many governments to action, also driven by the same European Union that has become the promoter of this change through the initiative Horizon 2020.

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[6] Roland Berger Publications, April 2011, Production Systems 2020- Global challenges and strategies for the mechanical engineering industry.

[7] Roland Berger Publications, 2010, Insolvenzen in Deutschland 2010 – Trends in der Wirtschaftskrise.

The following chart shows how things have changed in the European scenario in terms of industrial share of value added.

For most of the countries the industrial share of value added has decreased.

Fig1.3. Industrial share of value added (% of GDP)

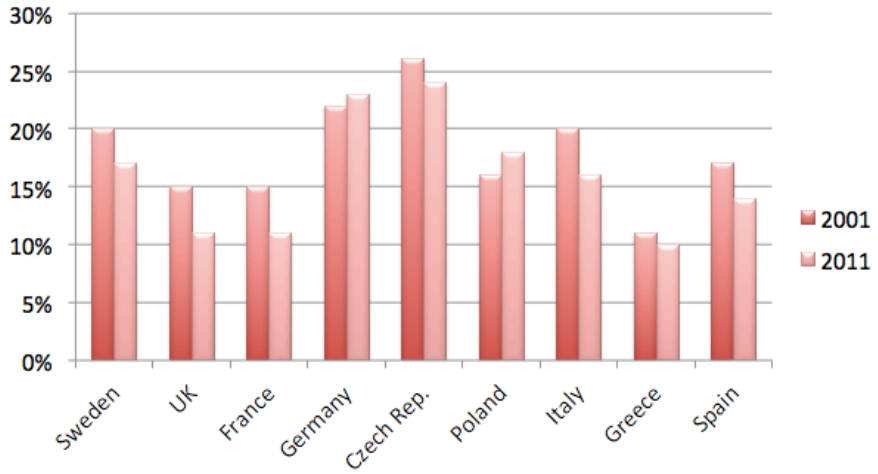

Chart 1: In the percentage calculation are excluded electricity, mining and quarrying.

Source: UNCTAD

The European Union launched "Europe 2020" the strategy for the European Community that aims to recovery the economic situation and defend the European competitiveness.

National governments understood the importance of the phenomenon and have launched several initiatives.

United Kingdom launched "*Catapult*" to reactivate the British manufacturing sector which hadn't been considered for a long time. France launched "*Industrie du future*" based on a public-private partnership to transform and innovate French industry, Denmark launched "*MADE*", the Netherlands launched "*Smart Industry*" and Sweden launched "*Produktion 2030*", Belgium launched "*Made different*" and Austria launched "Production der *Zukunft*".[8]

[8] Data from https://ec.europa.eu/digital-agenda/en/digitising-european-industry.

What about Italy? Is Italian industry, mostly composed by SMEs, ready to face this new technological transformation? How are our companies facing or how would they face this evolution?

Italy, despite being the second manufacturing power in Europe and among the top 10 in the world, launched a national government program just in September 2016.

The Italian government has been late in providing its interpretation of the European digital agenda [9], the Italian program has been published four years later than Germany.

Some national initiatives were announced such as "*Industry 4.0, la via italiana per la competitività del manifatturiero*"[10] from the Ministry of Economic Development and the "*Cluster technologico nazionale Fabbrica Intelligente*"[11] from the Ministry of Education, University and Research but we were still far from what might be called an industrial policy.

Carlo Calenda, the Italian minister for the economic development, presented in September (2016) the national plan *"Industria 4.0"* which allocates 13 billion euros of public resources to enable innovative investments through tax incentives and 10 billion euros to support companies' innovation through auxiliary services. The national plan should start in 2017 and has a duration of four years. [12]

Italy is a manufacturing country, 84% of total exports in 2014 were manufactured goods[13], despite the economic crisis the manufacturing sector is still our main competitive advantage at a global level and this national delay could became a problem.

This industrial transformation is going to redesign the global value chain and could return the competitive advantage to the Italian manufacturing industry, for two main reasons: digital manufacturing allows lowering of productions costs and higher level of personalization and this, consequently, could enhance product value.

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[9] The Digital Agenda is part of the project: Europe 2020: *Europe's growth strategy.*

[10] "Industry 4.0, la via italiana per la competitività del manifatturiero" aims to take advantage of digital opportunities to create jobs and growth. The document will be signed by the Ministry of Economic Development and has been compiled by Stefano Firpo.

[11] "Cluster technologico nazionale fabbrica intelligente": it is based on a framework agreement on the smart factory theme signed by some regional authorities (CNR, AFIL, ASTER, Cluster Marche Manufacturing, SIIT, MEDIS, MESAP) and the Ministry of Education, University and Research.

[12] www.sviluppoeconomico.gov.it "Piano nazionale Industria 4.0"

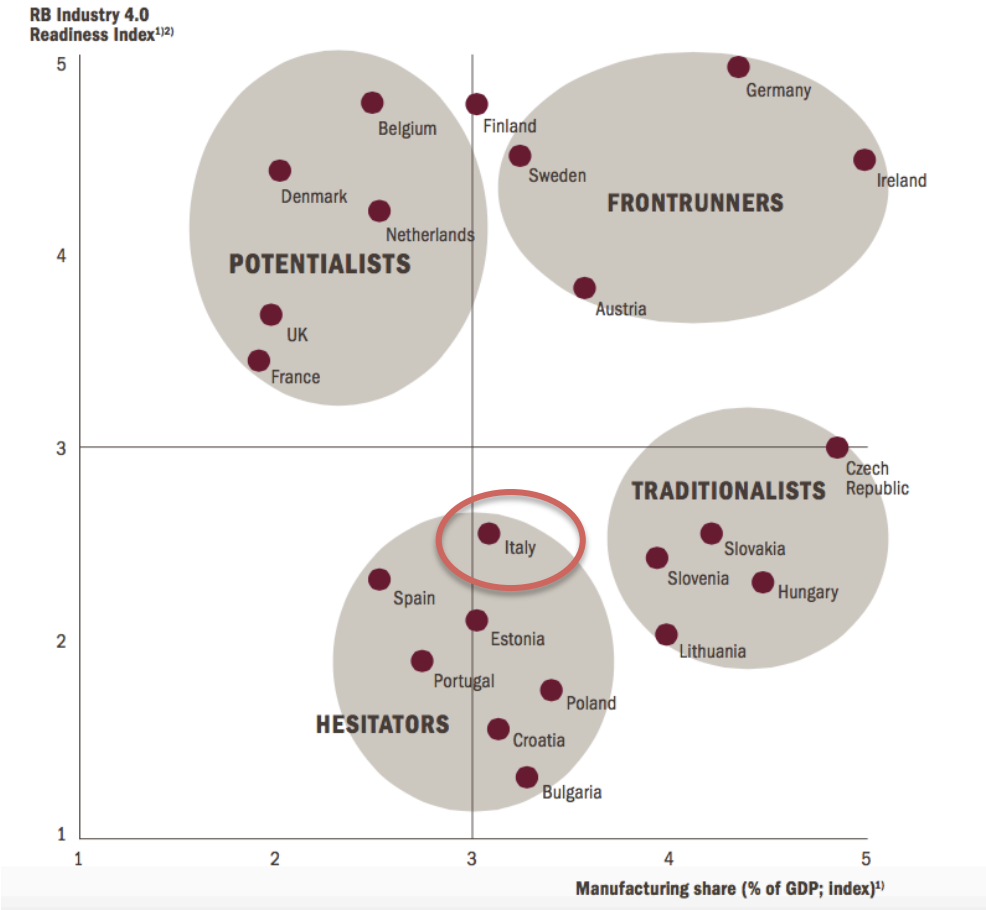
[13] UnctadSTAT data.

Roland Berger created an index, called Readiness Index, to identify those countries that are ready to face this fourth industrial revolution and those countries that are facing more difficulties.

The index is built considering the "industrial excellence" combining sophistication of production processes, degree of automation, workforce readiness and innovation intensity and the "Value Network" combining value added, industry openness, innovation network and Internet sophistication. The combination of these two categories determines a country's position in the RB 4.0 Readiness Index.

This obtained value is then combined with the Manufacturing share.

Fig1.4. Industry 4.0 Readiness Index



1=low, 5=high

Source Roland Berger Strategy Consultants – Readiness Index (2014)

Italy is placed by this index among the hesitators, a cluster characterized by a lacks of a reliable industrial base, fiscal problems and structured future strategies.

Overseas, in 2011 Obama's government launched the Advanced Manufacturing Partnership (AMP) in support of the reindustrialization program, from the American point of view it was important to outline a strategy that would create jobs.

Compared to the German case, the American program is much less centralized, it is based on the creation of a "Smart Manufacturing Platform" an open and interoperable platform mostly based on integration systems in order to integrate physical and IT resources. Here too, important entities are involved such as technology suppliers including GE and Rockwell Automation, ICT companies such as CISCO, HP, Intel and IBM, Manufacturing companies such as P&G and General Motors and research centers.

The Chinese government has recently proposed its "*Made in China 2025*" strategy to promote domestic integration of digital technologies and industrialization.

Making processes more efficient and production more technological has meant that cost of labor has become a less critical factor, therefore new competitive scenarios are rising. Outsourcing due to labor cost seems to no longer be the best strategy, many companies that had outsourced their production processes ten years ago are bringing the production back in house, this phenomenon is known as reshoring.

The example of this new trend is Adidas, the German sportswear company is bringing back the production after 20 years of production in Africa. The new plant is located in Ansbach, Germany, and it will be open at the end of 2016. It is called "speed factory", a new factory concept where man and machine work together side by side thanks to an innovative automated procedure. Adidas aims to manufacture bespoke sports shoes at closer proximity to consumer. [14]

> "It's a new era in footwear crafting: with greater precision, unique design opportunities and high-performance. Products of tomorrow are going to look different to what we have today."

[14] http://www.adidas-group.com/en/media/news-archive/press-releases/2016/adidas-expands-production-capabilities-speedfactory-germany/

Glenn Bennett, executive board member of the Adidas Group responsible for global operations.

The new production processes is able to bring to market new collections in less than 45 days and to manufacture individual running shoes faster and at a lower cost.[15]

1.3. Digital fabrication: definition and technologies

Digital fabrication allows people to produce objects using machines controlled by computers, usually these tools are able to produce a finished or a semi-finished product in one production step.

The first numerically controlled machine tool was created by researchers from Massachusetts Institute of Technology in 1952 (Gershenfeld, 2012). Instead of programming the virtual world, from then on it was possible to program the physical world.

Digital fabrication has changed a lot since the 50s, subject to the exponential technological revolution of information technologies (More's law), it became more precise, more time efficient and less costly. Digital technologies are now applicable to all steps of the value chain.

[15] Roland Berger Publications, ‚The industrie 4.0 transition quantified: how the fourth industrial revolution is reshuffling the economic, social and industrial model.

Fig1.5. Cost decrease of digital technologies

Technology	Cost per unit	Cost per unit	Cost decrease
DRONES	2007 $100K	2013 $700	-99,30%
ROBOTS	2007 $550K	2014 $20K	-96,36%
3D PRINTING	2007 $40K	2014 $100	-99,75%
SENSORS	2009 $30K	2014 $80	-99,73%

Source: World Economic Forum White Paper (2016)

We are going to analyze the main digital technologies involved in the manufacturing process.

1.3.1.Subtractive Manufacturing and CNC

Subtractive manufacturing is a well known process in traditional production. It consists of processing a block of material from which the parts that are not necessary to the realization of the finished product are removed. The process is the same as that of a sculptor who shapes stone. Although this technology has been used for a long time in production processes, it has been strongly influenced by digital manufacturing industry. In the past, production with CNC (Computer Numerical Control) machines implied a long period of amortization that was economically reasonable only for high-volume production, nowadays it is possible to automate programming that allows production of small quantities of machine parts with far

more reasonable prices. The modern subtracting manufacturing technologies use CNC machines which are able to independently manage a product or a part of it starting from a digital 3D design. The two typical examples of this kind of production are the lathe, more suitable for circular pieces, and the milling machine.

The first and most simple type of milling machine is the 3-axis machine that allows you to work the product along the three main axis. The technological evolution added two more axis, creating the 5-axis milling machine, which is able to work more geometrically complex products.

These machines can work a very wide range of materials: from wood to various types of metal to plastic.

1.3.2.Laser Cutting Technologies and 3D scanners

Laser cutting is a technology that uses a direct laser beam to cut flat-sheet material as well as structural and piping materials.

The modern laser cutters are computer numerical control machines that build a project starting from a CAD design.

The laser cutter is not a recent invention, the first application dates back to 1965 when it was used to drill holes in diamond dies (Bromberg, 1991). However, the digital manufacturing industry is continuously improving this technology thanks to new digital solutions.

A 3D scanner is a device capable of analyzing the real world, objects or environment, and collect information related to its shape, volume and appearance. Its function is to convert this information into three-dimensional models, totally faithful to reality. This technology is common in industrial design applications, such as reverse engineering and prototyping, in the medical industry for the realization of orthotics, prosthetics and dental implants and in the cultural industry for the quality control and documentation of cultural artifacts. The 3D scanner has great potential in terms of “Mass Customization” (Gilmore, Pine II, 2000), it could be applied, for instance, in tailor’s shops of the future where it is possible to scan a body shape and

create a perfect fitting for a real made to measure dress.[16] It could also be applied in the footwear industry to achieve tailored forms in order to solve orthopedic problems or simply to achieve a greater degree of comfort.

1.3.3.Additive Manufacturing and 3D printing

Additive manufacturing is a method that creates three-dimensional objects by depositing thin layers of material, the gradually added material layers form the base for subsequent layers.

This technology development dates back to the 1980s (Kodama, 1981), but the market was probably not ready for this technology, and the term additive manufacturing only gained wider currency in the first decade of the 2000s.[17]

First applications for 3D printers were related to rapid prototyping, and still are (Sherman, 2004). They allow testing of a product rapidly without making big investments because there is no need for all the extra equipment such as molds or other assembly material, that are needed tools in traditional manufacturing. In fact, additive manufacturing has the great advantage of achieving very complex geometries which would otherwise be impossible to achieve with CNC machines or molds in a single process; parts that were formerly a prerogative of subtractive methods could be now be more profitably via additive ones.

Three-dimensional models that have to be printed are created by CAD (computer aided design) software, 3D scanners or photogrammetry software.

There are many different 3D printers types:

- SLM: selective laser melting
- DMLS: direct metal laser sintering
- SLS: selective laser sintering
- FDM: fused deposition modeling
- FFF: fused filament fabrication
- SLA: stereolithography

[16] In the exhibition, new craft, part of the Milan *Triennale,* is exposed tailoring of the future created by "Assyst System srl".

[17] Source: Google books Ngram Viewer of the term "additive manufacturing".

In recent years 3D printers have become more sophisticated and less expensive, in part due to patent expiries and partly due to spread of open source technologies. A new trend related to the maker movement opened the way to desktop 3D printers for consumer use, the main project is the RepRap founded by Adrian Boyer in 2005 that created and sold a 500$ 3D printer. The aim of the project was to produce a self-replication device giving anyone the possibility of having a small production system through which they can create the objects that they need for everyday life for themselves.[18]

The latest Gartner research highlighted the high development of the 3D printer market, it estimates that almost 500.000 3D printers will be distributed worldwide in 2016 and this number is expected to double over the next three years.

Additive manufacturing is often associated with the mass customization concept, firstly because it is not subject to economies of scale so it is possible to produce small numbers of products; secondly, thanks to cloud computing and user friendly software, even non experts can design their object or personalize a product. It potentially creates a decentralized, geographically independent and distributed production.

A big issue, however, is still the matter of how to move the use from rapid prototyping to rapid manufacturing, empirical evidence shows that it is not an immediate transition.

This technology has been applied in many industries: aerospace for the creation of vehicles parts, architecture for the creation of scale models, automotive and medical replacement. Leroy Cronin of Glasgow University tried to print medicines[19], other researches are focused on the implementation of steam cells capable of generating new tissues and organs.[20]

New Balance presented its shoes with a 3D printed midsole last January at Consumer Electronic Show (CES) in Las Vegas, Adidas and Nike are going in the same direction.

[18] www.reprap.me
[19] www.ted.com Lee Cronin: print your own medicine.
[20] National Institute of Health (NHI) (2015) use of 3-D printers for the production of medical devices.

1.3.4.Automation and Robotics

Automation and robotics are very broad and complex concept, we try to provide a general overview without claiming to provide a technical description.

The term automation identifies the use of control systems for operating equipment. General motors established the first automation department in 1947 (Rifkin, 1995).

From then on the term automation has characterized the industrial evolution of the second half of the 20th century up to even influence the service sector.

There are different types of automation tools:

- ANN: Artificial neural network
- DCS: Distributed Control System
- HMI: Human Machine Interface
- SCADA: Supervisory Control and Data Acquisition
- PLC: Programmable Logic Controller
- Instrumentation
- Motion Control
- Robotics

Automation is used to replace hard physical labor or monotonous work, to limit dangerous work conditions for human workers and to make production faster and cheaper, and most of the time it can perform tasks beyond human capabilities.

Robotics is a sub-branch of automation, robots are automated machines that try to imitate human behaviors and substitute human workers in dangerous environments or manufacturing processes. The first industrial digitally operated and programmable robot worked on a General Motor assembly line in 1961.[21]

[21] This robot is called *Unimate* and was created by George Devol in USA.

1.3.5. Cloud computing and Big Data

The internet allowed the development of a new resource, called cloud computing, which delivers IT resources through the web without using physical processors such as the RAM, hard drives etc.

The cloud computing is a significant revolution because it allows access to digital services, reducing management costs leading to the development of entirely new management roles assigned to supervision of virtual teams and the shift to remote work spaces.

Cloud computing is driving increasingly blurred the line between the computer and the web.

The IT technologies, the Internet and the evolution of sensors in particular, have led to massive generation of information and data.

This amount of information generated through new technologies (faster machines and larger datasets) and that comes from heterogeneous sources is grouped under the term Big Data.

At the base of Big Data is the ability to make predictions based on correlations, converting a phenomenon in quantitative terms so you can tabulate and analyze it.

Managing these Big Data is one of the challenges of our time and it will be one of the main activities of our future. The actual difficulty is not the access to information but it is their management and interpretation.

This is Mckinsey's opinion about the constraint of Big Data revolution:

> "A significant constraint on realizing value from Big Data will be a shortage of talent, particularly of people with deep expertise in statistics and machine learning and the managers and analysts who know how to operate companies by using insights from big data".

Industry 4.0 is a relatively recent phenomenon and still little studied, there are many institutional documents but still few scientific studies.

For the writing of this chapter, reference was made to the library Google scholar, to the documents made available by the European Council and to research published by the aforementioned counseling agencies.

CHAPTER2
THE DIFFUSION OF DIGITAL MANUFACTURING TECHNOLOGIES IN THE ITALIAN MANUFACTURING SECTOR

2.1.Italian manufacturing sector

2.1.1.Overview

Italy is a manufacturing country, over the years it has combined manual skills, know-how and a particular aesthetic sense, creating a unique and inimitable recipe which is recognized all around the world.

In the annual ranking[22] of the Confindustria Study Center (CSC), Italy is ranked at the eighth position worldwide in manufacturing [Tab.2.1]. The leadership is still in Chinese hands with one third of the global production, while USA retain 14,1% and Japan 6,2%. The first European country in this ranking is Germany.

It is important to note that in 2012 the race of emerging countries suffered a significant deceleration, in fact, the global process of production chains fragmentation that had led for twenty years to the emergence of large manufacturing poles outside advanced economies traditional boundaries, seems to have stopped. While developing countries are experiencing a period of adjustment, developed countries are implementing socio-economic policies that revive the production industry.

Given these dynamics, globalization of trade and production seems to have entered a new period of adjustment.

[22] 2014 Annual ranking, Industrial Scenario: "Produzione e commercio: come cambia la globalizzazione. La manifattura italiana riparte da buone basi" Centro Studi Confindustria, Novembe 2015.

Tab2.1: Countries sorted according to the percentage share of world manufacturing output in 2014

Producing Country	% share of world's manufacturing output (current prices and exchange rates)				Rate % average annual growth in manufacturing output (2005 prices and exchange rates)		% share of world population (2014)
	2000	**2007**	**2012**	**2014**	**2007-2012**	**2012-2014**	
1 China	8,3	14,3	28,3	32,8	9,4	7,1	18,9
2 USA	24,5	17,7	14,2	14,1	-1,0	3,3	4,4
3 Japan	16,0	9,5	8,7	6,2	-3,6	0,0	1,8
4 Germany	6,7	7,5	5,3	5,3	0,1	1,5	1,1
5 South Korea	3,2	3,9	3,8	3,7	4,2	2,7	0,7
6 India	1,7	2,8	3,0	2,7	5,9	3,1	17,8
7 Brazil	2,0	2,6	3,0	2,6	0,6	-0,7	2,8
8 Italy	**4,2**	**4,5**	**2,6**	**2,5**	**-5,3**	**-1,9**	**0,8**
9 France	4,0	3,9	2,6	2,5	-2,7	0,2	0,9
10 Russia	0,8	2,1	2,1	1,9	0,2	0,6	2,0
World					*0,8*	*2,5*	
Advanced Countries	72,4	60,0	46,3	43,7	-1,6	1,5	12,9
Euro Area	21,0	23,1	15,4	15,1	-2,3	0,5	4,4
BRIC	12,8	21,8	36,3	40,1	7,5	5,7	41,5

IHS 2014 estimation: Countries sorted accorting to the percentage share of world manufacturing output.
Advanced countries: EU-15, Switzerland, USA, Canada, Japan and Korea.
Source: CSC processing based on IHS and ONU data.

Table 2.2 shows the sector global ranking. In the textile, clothing and leather sector Italy is ranked in the second position after China proving its ability able to face strong price competition coming from labor intensive countries.

This seems to be mainly due to the repositioning of Italian products, the transformation of the Italian industrial fabric would occur through a shift toward the top of the range. (CSC, 2015)

The Italian positioning is also relevant in the jewelry sector, furniture industry, metallurgy and machinery sector.

The variance in sectorial ranking shows how Italy has a strong cross-sectorial heterogeneity.

Germany, which is our benchmark, ranks among the top ten producers in all considered sectors.

Tab.2.2: ***World rankings for manufacturing sectors***

Sector	Producing country									
	ITA	CHN	USA	JPN	DEU	KOR	BRA	IND	FRA	RUS
Total Manufacturing	**8°**	1°	2°	3°	4°	5°	6°	7°	9°	10°
Textile, clothing, leather	**2°**	1°	3°	11°	12°	9°	5°	4°	15°	20°
Jewelry, toys and other industries	**4°**	1°	2°	3°	24°	12°	13°	7°	21°	14°
Furniture industry	**5°**	1°	2°	3°	4°	17°	8°	40°	6°	13°
Non-metallic mineral products	**6°**	1°	2°	3°	4°	7°	5°	8°	10°	9°
Metallurgy and metalworking	**6°**	1°	2°	3°	5°	4°	9°	7°	8°	10°
Machinery and mechanical appliances	**6°**	1°	2°	4°	3°	5°	8°	11°	7°	9°
Medical equipment, optical, watches	**6°**	2°	1°	5°	3°	8°	14°	19°	7°	10°
Food and Tobacco	**7°**	1°	2°	3°	5°	14°	4°	11°	6°	10°
Paper Industry	**7°**	1°	2°	6°	3°	24°	10°	33°	9°	8°
Publishing and printing	**7°**	2°	1°	3°	4°	15°	13°	22°	6°	18°
Rubber-Plastic	**7°**	1°	2°	3°	4°	5°	6°	10°	8°	13°
Electrical machinery and apparatus	**7°**	1°	3°	4°	2°	5°	6°	8°	9°	15°
Pharmaceutical	**9°**	1°	2°	4°	6°	17°	11°	10°	7°	24°
Chemistry	**11°**	1°	2°	3°	4°	5°	6°	8°	9°	12°
Motor Vehicles, trailers and semi-trailers	**13°**	1°	2°	4°	3°	5°	7°	10°	8°	17°
Other means of transport	**14°**	2°	1°	7°	5°	4°	12°	8°	3°	9°
Coke and petroleum products	**15°**	2°	1°	4°	9°	6°	7°	5°	13°	3°
Electronics industry	**24°**	1°	2°	5°	8°	4°	11°	26°	12°	22°
Computers and office machines	***39°***	*1°*	*2°*	*3°*	*13°*	*14°*	*5°*	*23°*	*28°*	*17°*
*Variance in sectorial rankings**	***73,4***	*0,2*	*0,3*	*4,0*	*27,5*	*34,0*	*9,9*	*102,2*	*34.5*	*28,5*

**The variance is the sum of the squares of the deviations from the average value of each ranking, unweighted.*
Source: CSC and IHS data processing.

However, if we consider the Trade Performance index (TPI) [23], a more sophisticated indicator, it is evident that the first three rankings are dominated by European countries. Italy holds the first position in the three classic product groups of Made in Italy: textile, clothing, hide, leather goods and footwear.

Tab. 2.3:						**Trade Performance Index Ranking**
	2006			2013		
	1	2	3	1	2	3
Transportation means	Germany	France	South Korea	Germany	**Italy**	South Korea
Non-electronic mechanical	Germany	**Italy**	Sweden	Germany	**Italy**	Sweden
Chemistry	Germany	Netherlands	France	Germany	Netherlands	Belgium
Basic manufactured products	Germany	**Italy**	Sweden	Germany	**Italy**	Taiwan
Other products	Germany	**Italy**	Switzerland	Germany	**Italy**	Netherlands
Electrical mechanical and white goods	Germany	**Italy**	France	Germany	**Italy**	Netherlands
IT and consumer electronics	Sweden	China	Singapore	Malaysia	Netherlands	Singapore
Processed food products	Netherlands	Germany	France	Germany	Netherlands	France
Wood products	Germany	Finland	Sweden	Germany	Finland	Sweden
Textiles	**Italy**	Germany	Taiwan	**Italy**	Germany	China
Clothing	**Italy**	China	Romania	**Italy**	China	Turkey
Hide, Leather goods and footwear	**Italy**	China	Vietnam	**Italy**	China	Vietnam

Source: CSC processing on UNACTAD and WTO data.

Italy occupies the second position behind Germany in the following categories: means of transport, non-electronic mechanical, basic manufactured products, other products, Electrical mechanical and white goods.

The trade performance index allows you to identify the best performer countries in the global commercial game, this means that they are not necessarily important under the point of view of quantity but they play a strategic role. This is why a country like China almost disappears from the rankings, while the United States do not even appear.

[23] Trade Performance Index (TPI) developed by the International Trade Center is an index composed by 22 quantitative commercial performance indicators that assess and monitor the multi-faced dimensions of export performance and competitiveness by sector and by country. It monitors the evolution of export diversification for products and markets, the export dimension, the country competitiveness and specialization both sectorial and geographical.

It is interesting that a more sophisticated measure pushes economies that are characterized by a smaller size at the top of the list, whose role in world trade is more "strategic" than the quantitative dimension of their foreign trade would be able to assess. (CSC, 2015)

In 2014 the euro area GPD started to increase while in Italy a modest economic upturn occurred only starting from the first quarter of 2015. The Italian GDP rose by 0,3% in the last quarter of 2014. In recent years the Country has regained competitiveness thanks to an evolution in global demand that is more favorable to Made in Italy products. [24]

However, export alone is not enough, one of the main problems of the Italian economic crisis and the reason why the economic upturn is still so slow is the collapse of domestic demand, the key to a return to growth is the re-launch of the internal market.

Despite these positive signs, industrial production is still lower by 20 percentage points compared to 2008.

The latest report of the Bank of Italy[25] pointed out a strong heterogeneity between sectors, highlighting allocative efficiencies of the national economy lower than the European level.

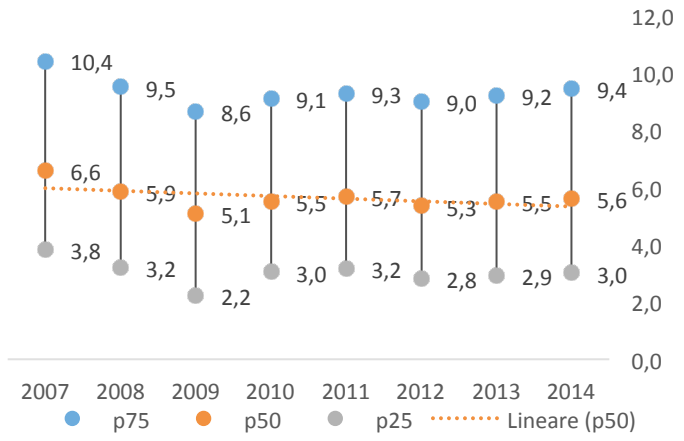
Industrial production began to rise again in 2015 due, largely, to capital goods, the whole manufacturing sector has recovered 1.5 percentage points compared to an average of 0.6 percentage points of the national economy. (Bank of Italy, 2016)

Regarding the three sectors involved, a brief analysis of profitability that takes into account the average value of the EBITDA from 2007 to 2014, will be presented. [26]

From 2007 to 2014 the profitability decreased in all three sectors, they have encountered difficulties in reaching the levels prior to the crisis.

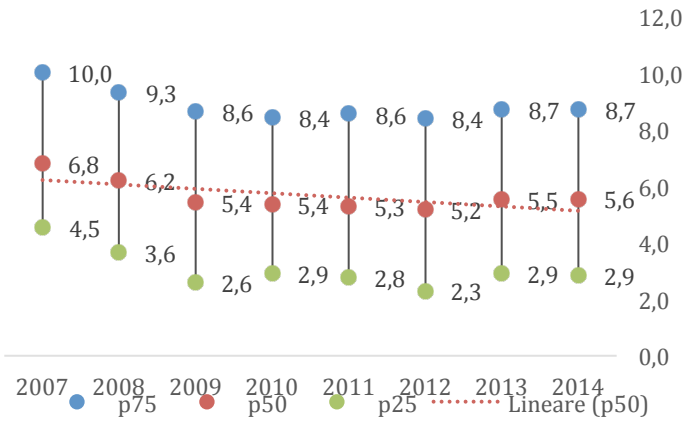
[24] ICE report 2014-2015, ITA- Italian Trade Agency, ICE- Agency for the promotion abroad and the internationalization of Italian companies.
[25] Bank of Italy annual report, May 2016.
[26] AIDA.Bwd Database

Fig2.1. Segment profitability analysis: Fashion-Accessories



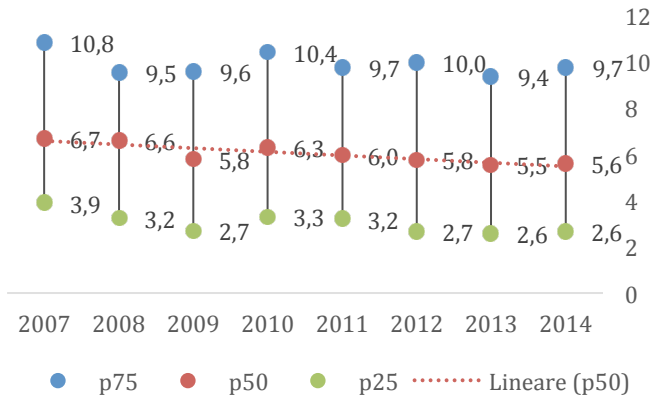
Source: AIDA-Bwd database processing

Fig2.2. Segment profitability analysis: Furniture-Design



Source: AIDA-Bwd database processing

Fig2.3. Segment profitability analysis: jewelry



Source: AIDA-Bwd database processing

Productive and trade relations between local enterprises and sectors should be pushed for, supporting business networks that hybridize manufacturing with design, creativity and productive culture, these competitive elements are often not valued enough.

These networks embody that production model of innovation and territorial cohesion that is at the basis of our identity and our competitiveness.

It is also important to underline that the Italian entrepreneurial fabric is mainly composed of small and medium-sized family-run businesses; that is defined as "Family Capitalism". [27] To give an idea of the effect of the family capitalism, a survey conducted by Unioncamere on Italian Manufacturing SMEs has found that 90% of manufacturing SMEs that have between 20 and 499 employees are family businesses. [Tab. 4]

Tab 2.4 **Percentage of family manufacturing SMEs**

	Family-run SMEs	Not family-run SMEs	SMEs
TOTAL	86,9	10,4	100,0
		Sectors	
3A Made in Italy	91,0	9,0	100,0
Mechanical	88,5	11,5	100,0
		Number of employees	
20-49 employees	92,2	7,8	100,0
50-499 employees	84,0	7,5	100,0
		Geographical distribution	
Nord-West	90,5	9,5	100,0
Nord-East	87,7	12,3	100,0
Center	90,9	9,1	100,0
South	90,3	9,7	100,0

Source: Unioncamere Study Center survey on Italian Manufacturing SMEs (20-499 employees).

This business structure has been particularly vulnerably to the economic crisis, in fact, the Bank of Italy pointed out a decrease of the value added by 18% from 2007 to 2013 for small companies, 9 percentage points more than the overall average.

[27] Centro Studi Unioncamere. Rapporto unioncamere 2015: "*Alimentare il digitale, il futuro del lavoro e della competitività dell'Italia.*"

This governance trend of many Italian companies has allowed the development of a territorial and cultural sensitivity that is still difficult to imitate and that ensured the fortune of the Italian economy for many years. The most important thing is for this link with tradition to become a solid base for future development and not the arrival point.

The following table shows the impact of the three main "Made in Italy" Industries: Fashion-Accessories, Furniture-Design and Jewelry compared to the whole manufacturing industry.

The Fashion-Accessories sector worth 77 billion euro and it accounts for 9% of total Italian manufacturing.

The Furniture-Design sector worth 19 billion euro, this means 2,3% of total manufacturing, whereas the Jewelry sector worth 5 billion euros, 0,6% of total manufacturing.

Tab2.5 Fashion-Accessories, Furniture-Design and Jewelry: overview.

Industries	**N° Companies (units)**	**N° Employees (units)**	**Production Value (million euros)**
Total Manufacturing	407˙344	3˙733˙118	853˙491
Fashion-Accessories	61˙062	470˙918	76˙867
Furniture-Design	18˙773	142˙616	19˙456
Jewelry	8˙088	30˙387	5˙187
TOT	87˙923	643˙921	101˙510
Quote%	21.6	17.2	11.9

Source: ISTAT and ASIA 2013, database processing.

Fig2.4: Number of companies

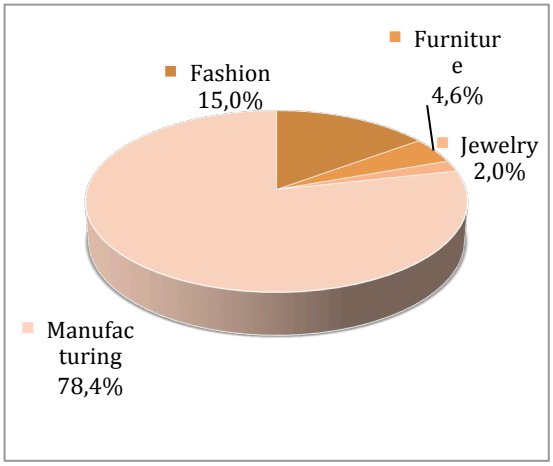


Fig2.5: Number of Employees

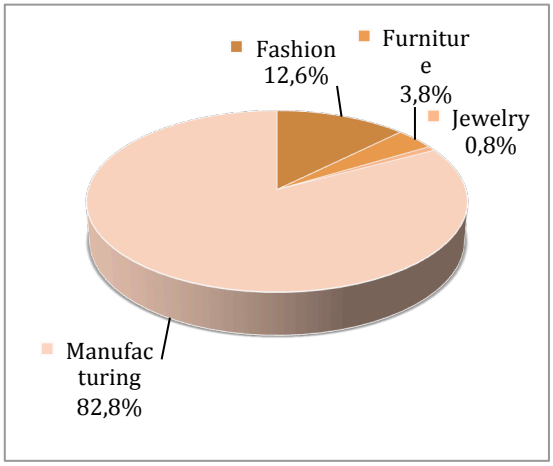
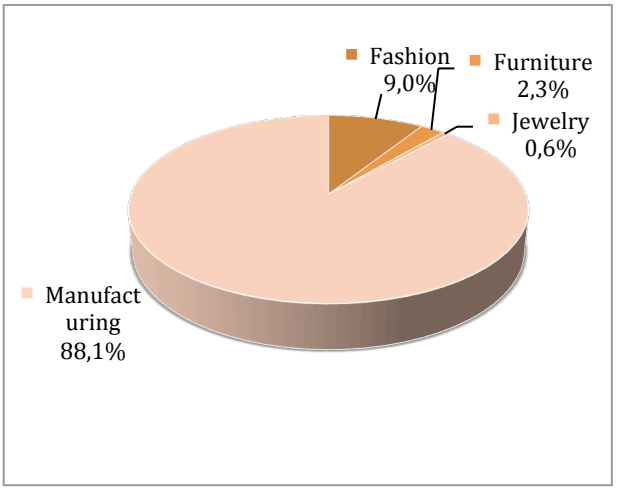


Fig2.6: Production value



Fashion=Fashion-Accessories; Furniture=Furniture-Design

Source: ISTAT and ASIA 2013, database processing.

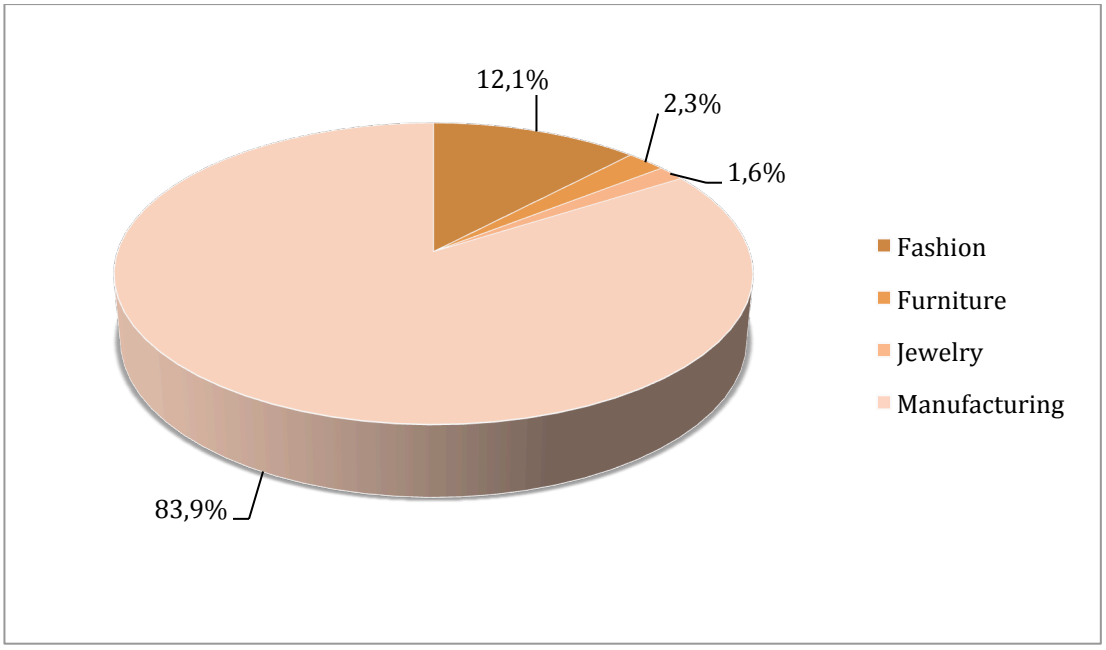
In the first part of the chapter general data concerning export volumes of the Italian manufacturing industry were presented and compared with the rest of the world.

The following graph (Tab 2.10) shows the percentage of export of sectors involved in the research compared to the total Italian manufacturing export values.

In 2015 the Italian manufacturing industry was worth 397 billion euro, representing 96% of total exports, the value grew by 3,7% over the previous year.

Fashion and Accessories sector accounts for 12% of total manufacturing, it is one of the most important sectors of our economy; Furniture-Design and Jewelry industries, in terms of exports, have a size much more reduced, weight respectively 2,3% and 1,6%.

Fig2.7: Export share



Source: ISTAT Jannuary-December 2015

The analysis carried out by size shows an economic structure characterized by small and medium-sized enterprises, more than 50% of the analyzed companies have less than 50 employees.

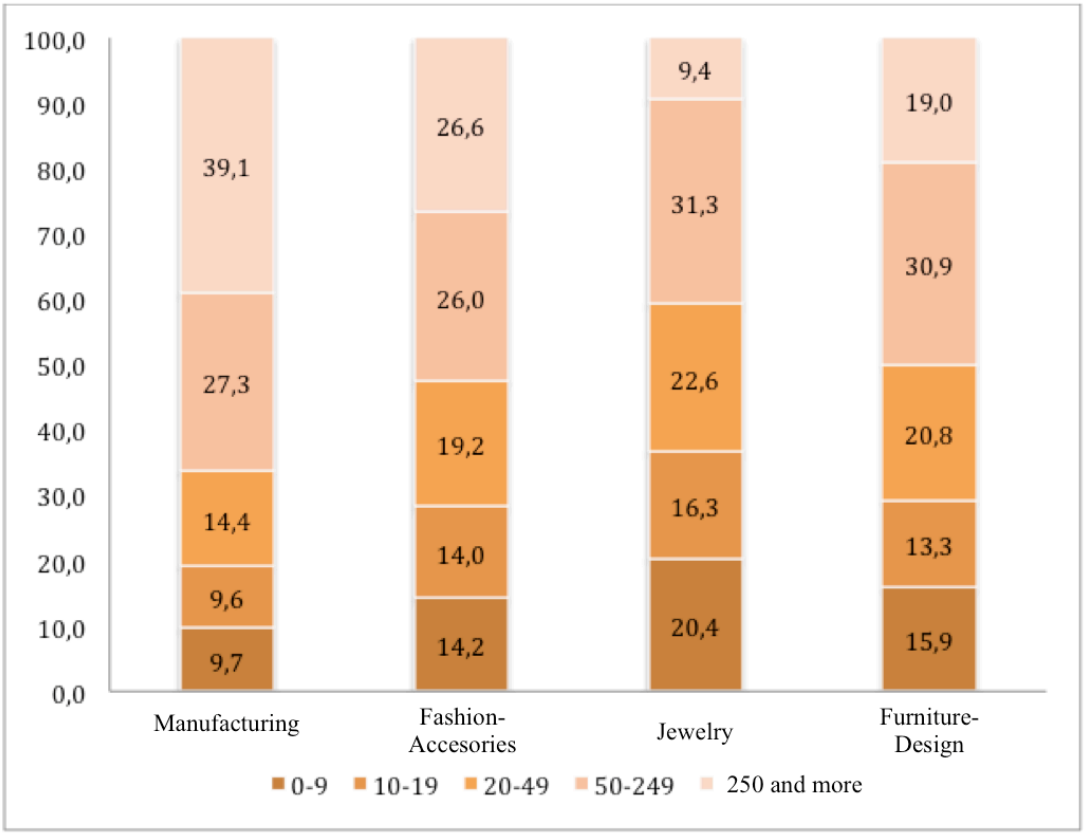
The jewelry sector, in particular, is characterized by a high number of very small companies, the number of companies that have fewer than 10 employees is over 20%. (Tab 2.11)

The prevalence of small companies is confirmed by the average turnover of the companies considered.

If the average turnover of manufacturing enterprises amounted to 2,14 million euro, the fashion industry has an average turnover of 1,34 million euro, the furniture

sector of 1,04 million euros while the jewelry industry has an average turnover of 644 thousand euro. (Istat - Asia database, 2013).

Fig2.8: Size classes by number of employees.



Source: ISTAT and ASIA 2013, database processing.

2.1.2. Heritage and Innovation

Industrial districts have been the symbol of a successful Italian industrial model. Becattini defines them as social-territorial entities characterized by the active presence of both a community of people and a population of firms in one historical and confined area. (Becattini, 1990) Since they are limited to a geographic area, they are characterized by a homogeneous system of values and views that has led to a peculiar transmission of knowledge, most often tacit, and skills.

The huge competitive advantage of Industrial districts is their uniqueness because they are not replicable elsewhere. Their strength, however, was based on an unstructured socio-economic balance, the system worked but big shocks such as the single European currency, the Chinese competitiveness and the evolution of consumption showed its fragility. There were few technologies and few innovations in many of those companies that made Italy successful in the 90s. (Micelli, 2011)

The economic crisis had a huge impact on the Italian manufacturing industry: from April 2008 to March 2009 the manufacturing activity fell by 26,6% (CSC, 2015), only in the last two years production has begun to increase significantly.

Only in the Veneto region between 2009 and 2014 almost 5500 manufacturing companies have been closed. If we consider the industries that suffered more, we found the furniture industry that declined by 17%, wood industry that declined by 15%, and clothing that declined by 11%. [28]

The effects of the crisis have also affected the dynamics of the manufacturing sector investments that in Italy suffered a fall of 37,9%.

The fall of investments had a negative impact on the production potential of Italian companies, but the Confindustria Study Center research (CSC, 2015) shows that the investments and manufacturing value added ratio reveals a higher rate of investment of Italian businesses than the global average. The decline in manufacturing output has not, therefore, significantly reduced the propensity to invest.

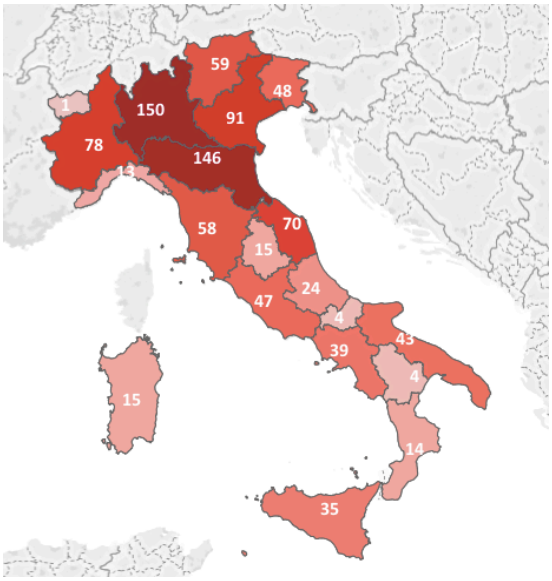
The Italian companies' innovation trend also turn out to be positive although spending on R&D remains low. This could be due to the small companies dimension that leads to innovation activities that are not formalized or planned and to an incremental development of products and processes.

Aster, a public-private consortium of the Emilia Romagna region, revealed, in our country, more than 5000 innovative start-ups, the majority of which belonging to the trade and services sectors and 954 of them belonging to the manufacturing sector. [29]

[28] CISL Veneto: Industria manifatturiera veneta. Crisi e trasformazione.
[29] http://www.aster.it/tiki-index.php?page=startupinnovative

The map shows the distribution of these new manufacturing industries that have based their business on technologies and innovation. The two regions with the highest number of innovative start-ups are Lombardia and Emilia Romagna followed by Veneto and Piemonte.

Fig.2.9: Manufacturing Startups distribution



Source: Aster S. Cons. P. A.

The collected data show a growing interest in new digital innovation, many companies detected by Aster decided to invest in new digital technologies described in the first chapter.

It is true that start-ups are often an inflated phenomenon, but they are a symptom of a country that is trying to restart.

Therefore it is interesting to investigate whether this small entrepreneurial phenomenon, that is sensitive to technological and digital innovation, is typical only of small experimental companies or if it is actually affecting the entire Italian manufacturing system.

During Venice's 56th International Art Exhibition the exhibit entitled: "*Guardando Avanti, l'evoluzione dell'arte del fare. 9 storie del Veneto digitale – non solo digitale".* [30]

The theme of the exhibition was the interaction between tradition and new technologies as the curator Aldo Cibic says: "this is innovative technology at the service of hands' intelligence." The aim was to present an alternative to traditional manufacturing, sheltered behind old processes, to investigate new development opportunities.

The exhibition on the evolution of the art of making passed the baton to La Triennale di Milano where the exhibition New Craft will be staged until September 2016. [31]

The protagonists of this exhibition are Italian companies that have been able to take advantage of new digital technologies by putting them at the service of tradition, know how and craftsmanship; succeeding first of all in looking to the customer with new eyes, not as a passive subject but as an active and involved subject. (Micelli, 2015)

The Italian debate on the impact of digital technologies is fairly recent, but it is intensifying and spreading.

Since there is not a clear national vision, there are different points of view that seek to interpret this digital transformation.

Professor Franco Mosconi, University of Parma, stressed the idea that the Italian position as the second manufacturing country in Europe is by no means an established position, there is a lack of a national debate to outline consolidation and implementation strategies. (Mosconi et al, 2015)

When we talk about digital transformation and Industry 4.0 two main ways of interpretation can be considered. One is tied to the industrial world where people mainly talk about process efficiency and resource optimization, the other is tied to

[30] 56th International Exhibition of art of Venice, Venice Biennale. 2015. President: Paolo Baratta, Curator: Aldo Cibic.

[31] New Craft exhibion hosted in the Fabbrica del Vapore has been curated by Stefano Micelli and Designed by Studio Geza.

the craftsmanship world that uses digital technologies to increase the production value.

According to the Minister for the economic development Calenda Italian companies must achieve a greater digital maturity, they have to be able to collect and analyze data, but, above all, they have to rethink their business models under a digital point of view.

The Italian minister aims to the development of standardized and interoperable strategies to achieve effective cooperation networks at European level; he aims also to reduce the digital divide of SMEs, creating contamination environments that develop knowledge and skills. [32]

Even the president of Confindustria Vincenzo Boccia faced the issue of alignment of Italian companies to industry 4.0. He focuses mainly on the size of companies, considering the size an important driver for the technological evolution.

Boccia states that small is not beautiful[33] and that in order to face the challenge of Industry 4.0 small businesses must look to large enterprises. He is convinced that the digital opportunity is not merely a question of technology, especially for Italy, but it is above all a cultural and dimensional issue. In his opinion Italy should become the "Boutique of the world"[34] producing personalized products through industrial processes.

Another point of view is provided by Paolo Manfredi of Confartigianato, he sees in small Italian businesses a good starting point.

The entrepreneur becomes, at the same time, the guardian of traditional values and the innovator able to exploit digital technologies to increase the value of its product.

The keywords become know-how and customization. (Manfredi, 2016)

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[32] Speech relating to the industry 4.0 by Minister Carlo Calenda at the Chamber of Deputies, 15 June 2016. The Italian government's strategy for the development of the Industry 4.0 will be officially presented in the first week of August and it will be focused on the following five pillars: a new and unique governance system, infrastructure development, digital skills development, the development of a network between research centers and companies and new standard statement for a standardized digital European market.

[33] Corriere della sera, 26/05/2016, Dario Di Vico, La svolta di Boccia "Piccolo non è bello, ora bisogna crescere". http://www.corriere.it/economia/16_maggio_26/svolta-boccia-piccolo-non-bello-ora-bisogna-crescere-34379cc6-2376-11e6-853e-9c2971638379.shtml

[34] Speech by Vincenzo Boccia at Symbola Summer Seminar 2016 held in Treia.

Paolo Manfredi in its book speaks about "potential of innovation" and "artisan value". He pushes Italian artisans/entrepreneurs to strategically rethink their business model focusing on quality and customization, digital technologies are important tools to keep competitive advantage, but a change of mindset is needed to adapt skills to the new tools.

When it comes to this Industry 4.0 a common perspective is complex to be defined and, as often happens, there is no recipe.

In order to clarify, it is important to emphasize that with the term Industry 4.0 many different technologies are considered.

For instance, 3D printer and Industrial Automation are very different from each other.

The 3D printer provides an efficient process that is also suitable for small businesses, the industrial automation, on the other hand, needs higher company size and more complex organizational system in order to be efficient. (Giorgio Barba Navaretti, 2015).

Some quantitative researches have been carried out to analyze the level of innovation of Italian companies.

The first report on the impact of digital technologies has been made by Make in Italy foundation[35].

I had the chance to take part in the research carried out, this year, by *Fondazione Nord Est* and *Banca IFIS.*

The results that will be presented took in consideration a sample of 787 Italian companies belonging to the three Made in Italy core industries: Furniture-Design (F-D), Fashion-Accessories (F-A) and Jewelry (J).

It is a wide ranging research which aimed to understand how widespread these technologies are, how they are used and what organizational and economic impact they have had.

The choice of sectors comes from the desire to investigate manufacturing categories that are usually characterized by a low level of technological innovation

[35] Make in Italy CDB Foundation Onlus, www.makeinitaly.foundation/

but that have, at the same time, a high economic value, as has been previously described.

The results will be presented in the following chapter.

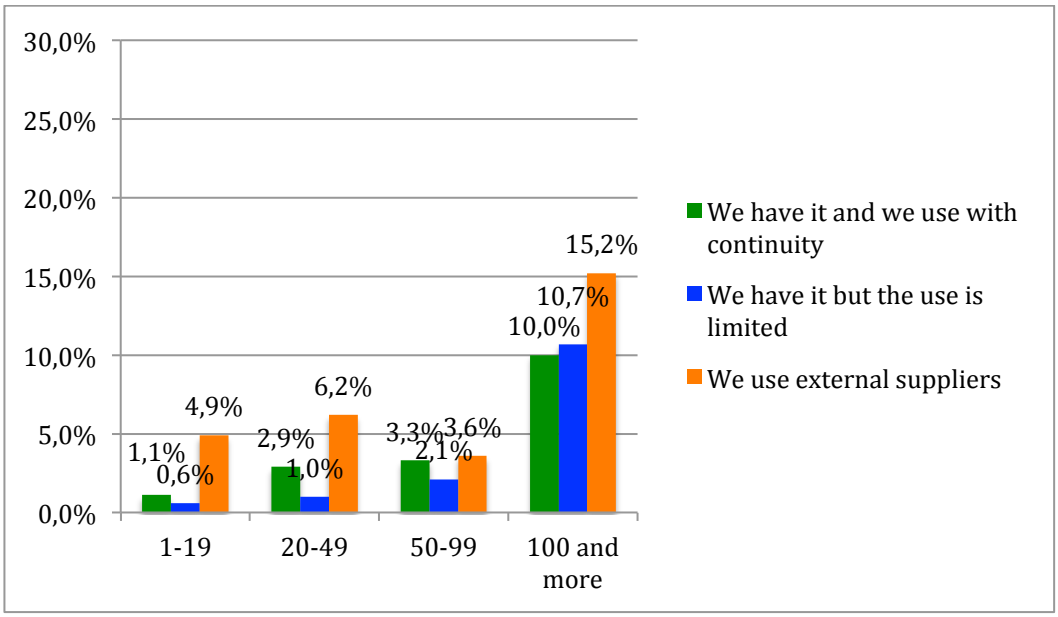
CHAPTER 3
DIFFUSION OF DIGITAL TECHNOLOGIES AND THEIR IMPACT

3.1.Digital manufacturing

The research took into account partnerships and corporations belonging to the considered sectors. The sample consisted of 787 companies: 45,8% belongs to the Fashion and Accessories industry, 33,4% belongs to the Furniture and Design industry, 20,8% belongs to the jewelry industry. Almost 50% of companies surveyed have fewer than 20 employees.

The research found that 25% of companies surveyed use 3D printing, the data increases with the increase of the dimension, this means probably that larger companies have more ability, from a financial and managerial perspective, to take advantage of the latest technologies.

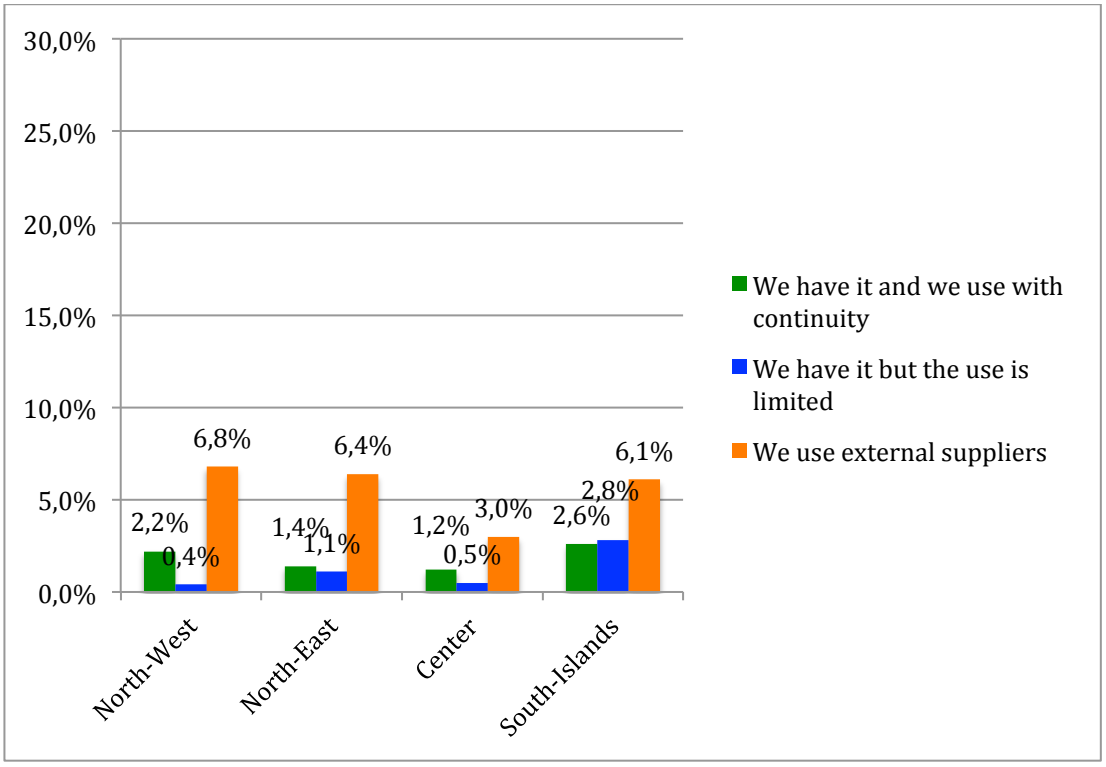
Fig3.1. 3D Printer and 3D scanner: company dimension and technology diffusion



Source: Fondazione Nord-Est

The research conducted by geographic area has detected that the areas where 3D printer is more widespread is the Northwest and South of Italy.

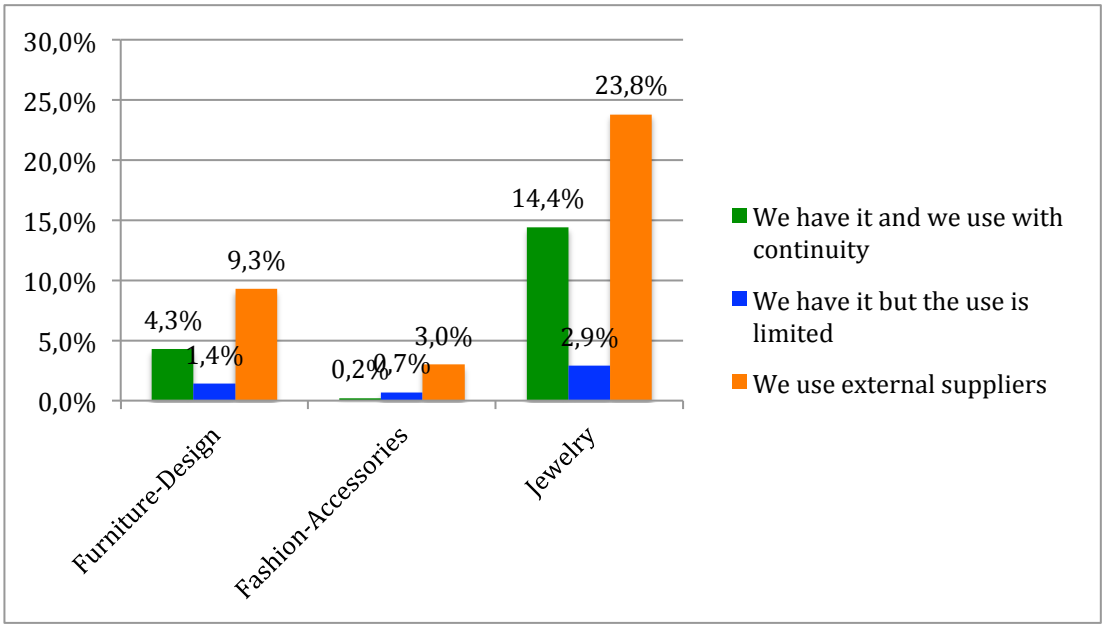
Fig3.2. 3D Printer and 3D Scanner: use by region



Source: Fondazione Nord-Est

The industry with the highest percentage of use is the jewelry industry, 14,4% of surveyed jewelry companies has the technology and use it with continuity.

Fig3.3: 3D Printer and 3D Scanner: use by industry



Source: Fondazione Nord-Est

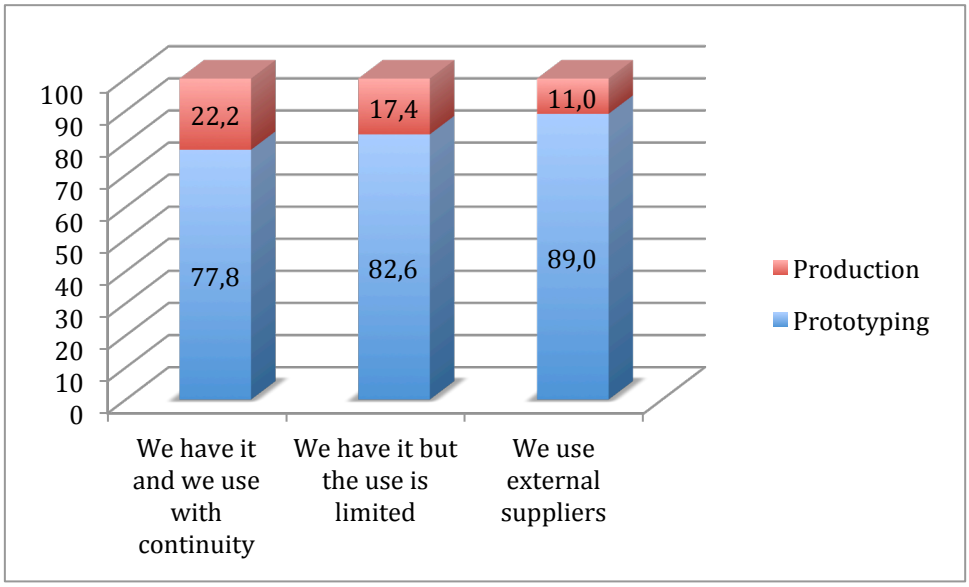
However, the survey shows that the majority of companies rely on external service providers, deciding not to invest in the technology.

Among those not using additive manufacturing or 3D scanning 72,1% said that they consider such technologies not functional to their business, 19,3% said that they do not know the technology while 6,8% said that they know the technology and that they are considering purchase.

Among companies that use the 3D printer with continuity, the most affected are those processes related to new products design and prototyping, 77,8%, the production process is involved in 22,2%.

The following chart shows how the use of the 3D printing technology is more prevalent among those companies that own the technology. The use of technology inside the company seems to facilitate the experimentation and learning process that involves also the productive part.

Fig3.4: 3D Printer: where it is used



Source: Fondazione Nord-Est

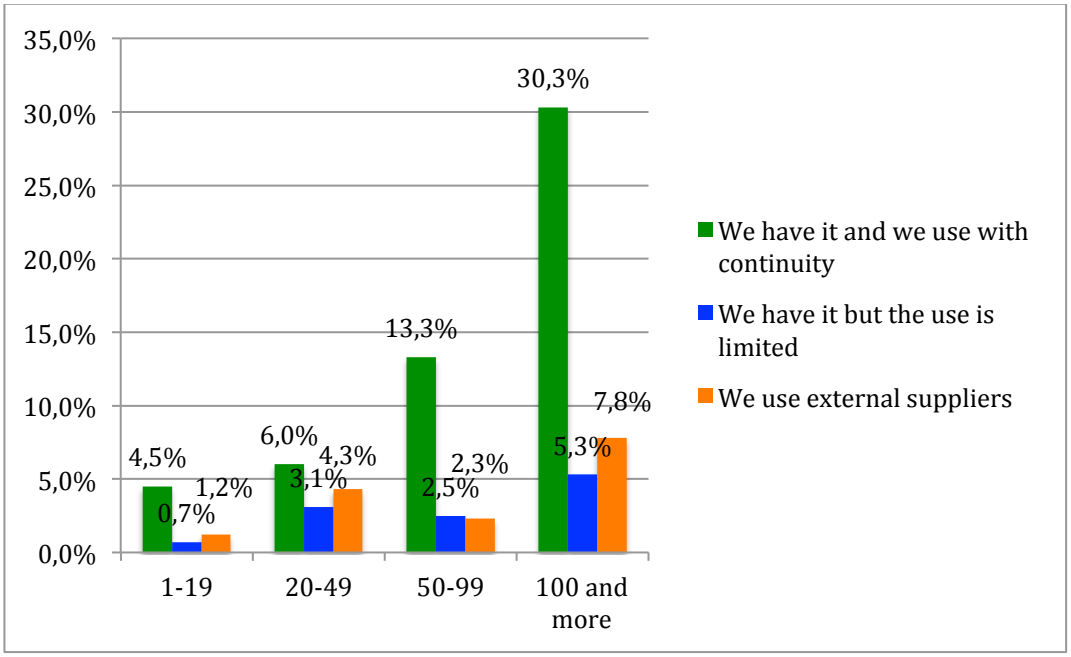
In fact, one of the benefits expected by companies is reduction of design and prototyping time (17,4%), and other significant benefits are related to design acquisition and customer service such as the realization of customized 3D models and a greater involvement of the customer in the design process.

The possibility of creating products with very complex shapes and geometries is considered important, but not the most important benefit.

On the other hand, factors that seem to prevent or slow the spread of the technology are: the limitation of materials that can be used (30,0%), the investment required for the equipment (29,3%) and the investment required for the software (27,8%).

The results regarding robotics show a level of penetration of 30% among those companies with more than 100 employees. As in the case of 3D printers that value increases with size of the firm.

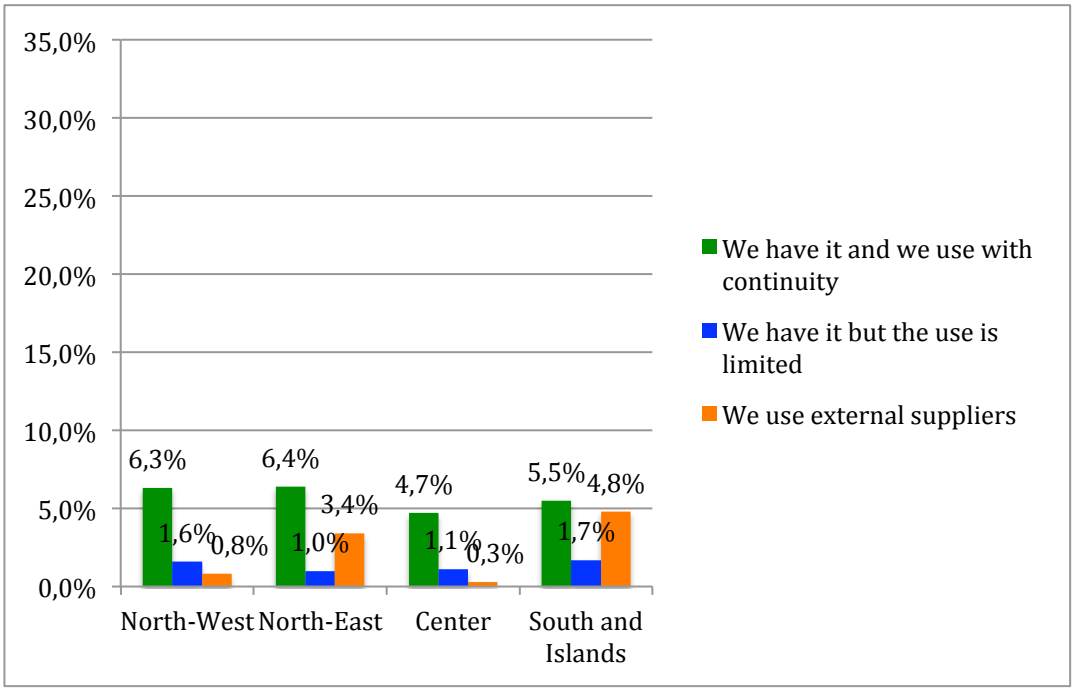
Fig3.5: Robotics: company dimension and technology diffusion.



Source: Fondazione Nord-Est

The region with the highest percentage of use is the northeast followed closely by northwest.

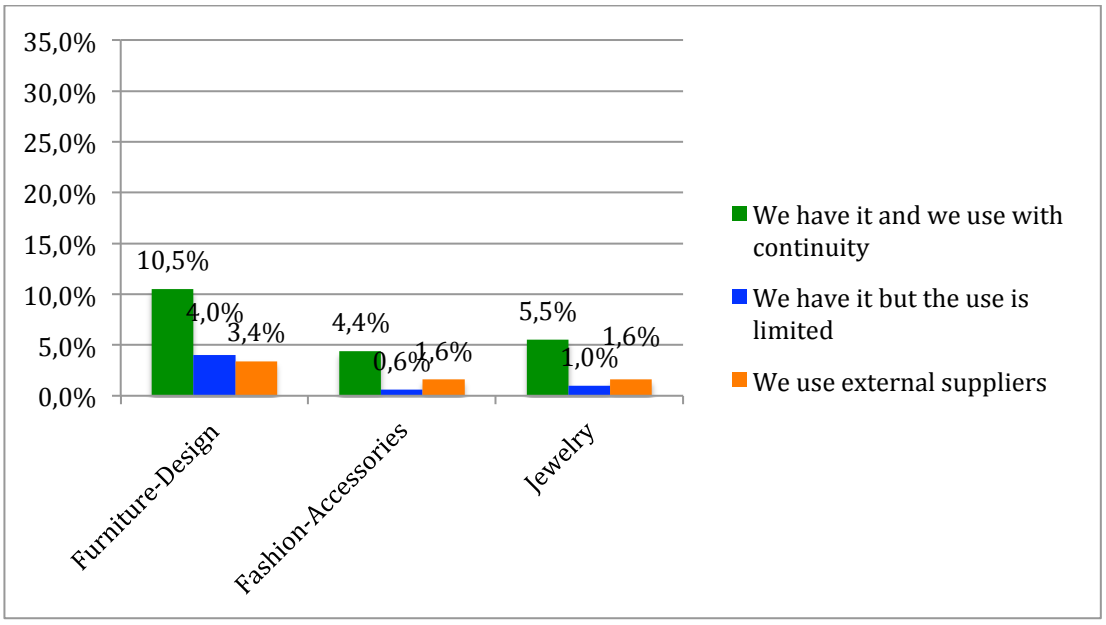
Fig3.6. Robotics: use by region



Source: Fondazione Nord-Est

The use of robotics is more prevalent among Furniture and Design companies (10,5%). It is less common in industries such as fashion and accessories.

Fig3.7. Robotics: use by industry



Source: Fondazione Nord-Est

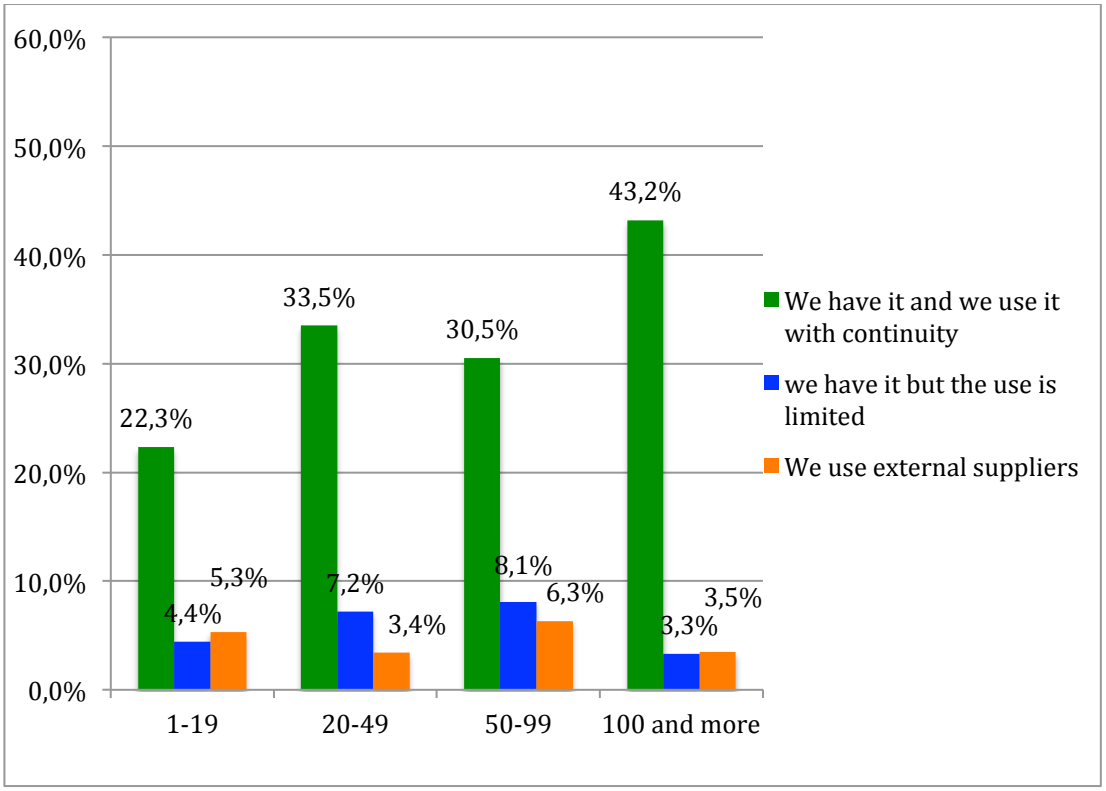
The research shows that robotics is a resource mainly used internally. Companies that use it invested in technology and machinery integrating its production process.

Among those not using robotics 72,1% said that they don't consider such technologies functional to their business, 22,5% say that they do not know the technology while 5,4% say that they know the technology and that they are considering purchase.

If we consider a slightly older technology we note that the pervasiveness level rises significantly. Numerical control machines (CNC) could be considered a widespread technology in all company size categories.

The values increase with the size of the firm.

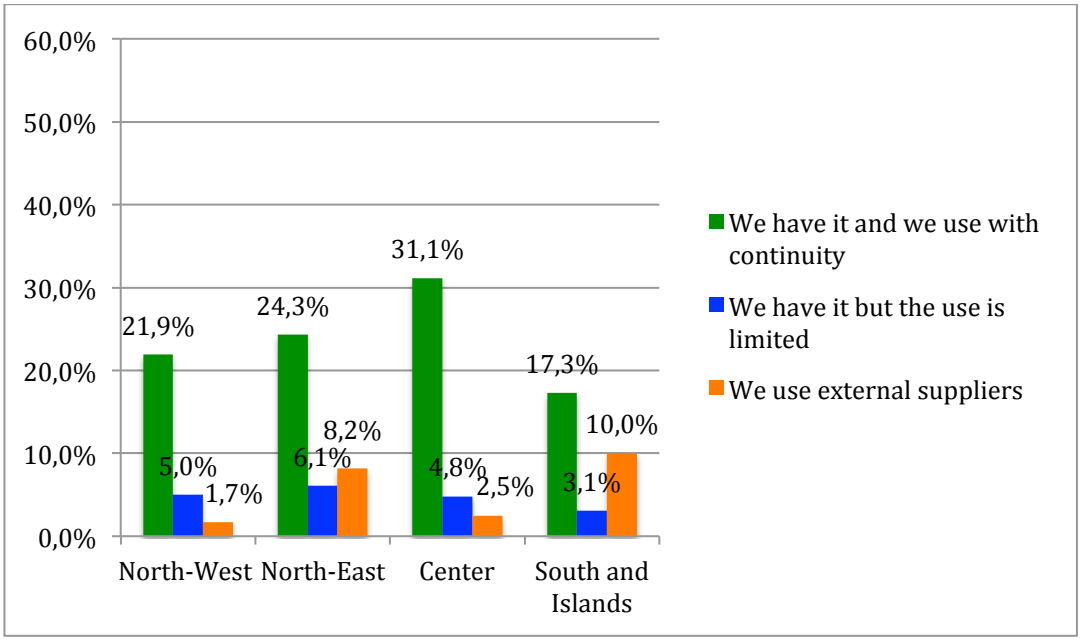
Fig3.8 CNC: company dimension and technology diffusion



Source: Fondazione Nord-Est

This technology is prevalent among companies located in the center area of Italy (31,1).

Fig3.9 CNC: use by region

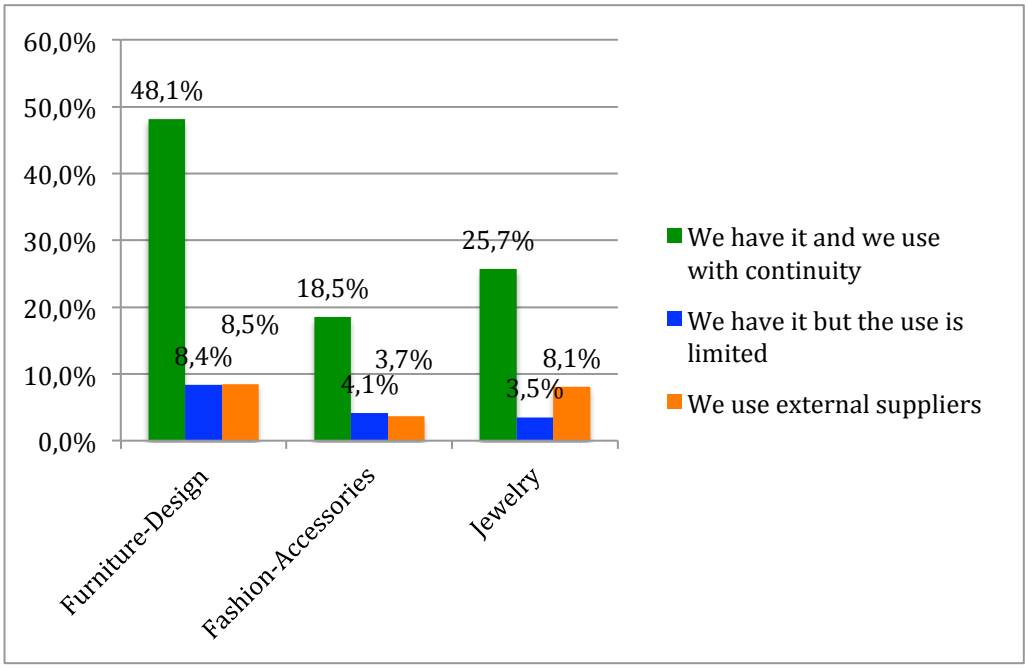


Source: Fondazione Nord-Est

Numerical control machines are mainly used in furniture and design industry more than 50%, they are less used in the fashion industries.

Numerical control machines are mainly internally used, the high percentage of companies who claim to own the technology and use it continuously shows that it is rather well established.

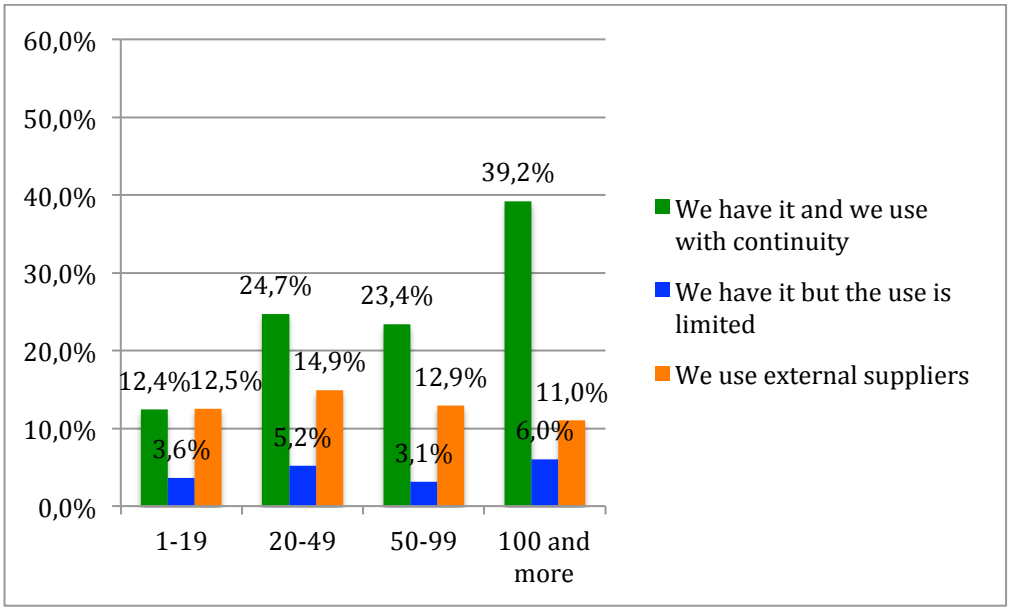
Fig3.10. CNC: use by industry



Source: Fondazione Nord-Est

The last technologies taken into analysis are: the laser cutter and other cutter systems supported by computers.

Fig3.11: Laser cutter and other systems: company dimension and technology diffusion

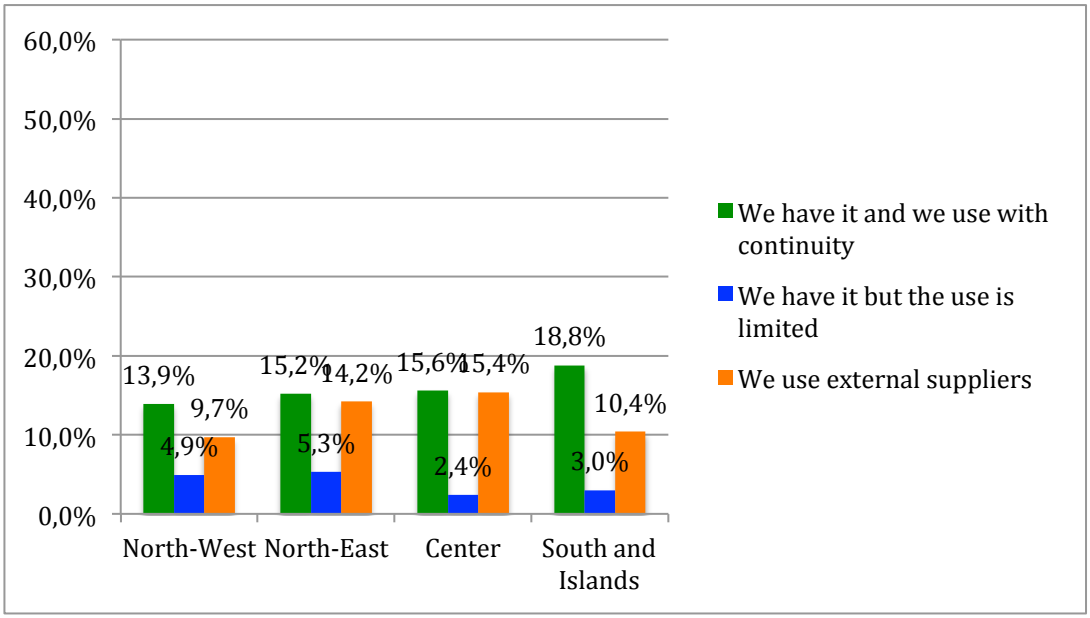


Source: Fondazione Nord-Est

More than 40% of companies use these technologies, in particular among those who have more than 100 employees.

Here too, the spread of technology by region.

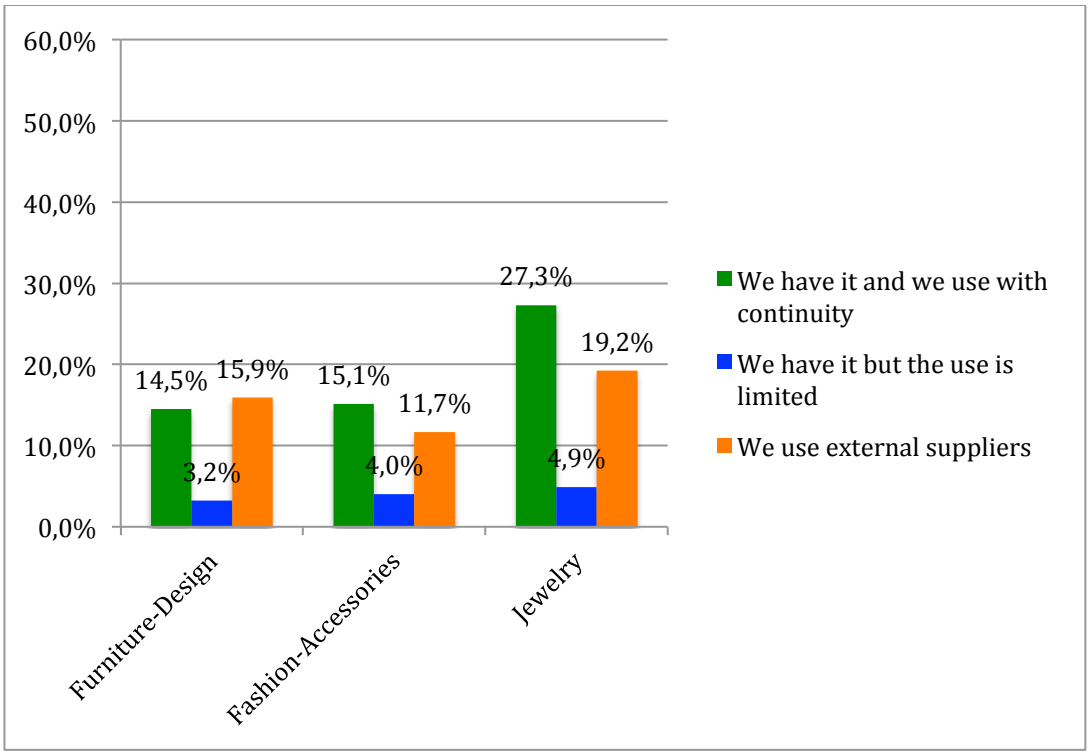
Fig3.12. Laser cutter and other systems: use by region



Source: Fondazione Nord-Est

The use of laser cutter technologies is prevalent among jewelry industries.

Fig3.13. Laser cutter and other systems: use by industry



Source: Fondazione Nord-Est

To use laser cutting or other cutting systems, most companies turn to external services, while jewelry companies use these technologies internally and continuously in almost 30% of the cases.

3.2.Technological frontier and profitability

The research carried out by Fondazione Nord Est showed that there are substantial differences among the three considered sectors, therefore a differentiation even in the analysis of the technological level is needed.

Three different technological frontiers have been identified: the Furniture-Design sector uses mainly robotics and laser cutting technologies, Fashion-Accessories sector uses mainly laser and other cutting systems, while Jewelry industry uses mainly 3D printing and laser cutting technologies.

Therefore, the balance sheets of the businesses that are on the technological frontier were analyzed. In order to be considered on the technological frontier the company must have answered that it has the technology and it uses it with continuity.

Then, these balance sheets have been compared with those of the companies belonging to the industry of reference. Two main trends have been identified: the profitability and the growth from 2007 to 2014.

Tab3.1: Database definition

2014	Number of cases	Revenues (average value)
Furniture-Design	**2.408**	**€ 2.344.400**
Furniture-Design (F-D*)	**73**	**€ 5.612.700**
Jewelry	**584**	**€ 2.093.100**
Jewelry (J*)	**44**	**€ 3.474.100**
Fashion-Accessories	**7.811**	**€ 2.736.000**
Fashion-Accessories(F-A*)	**64**	**€ 5.864.000**
Sample's Balance sheets	**181**	**€ 3.889.500**
AIDA's Balance sheets	**10.803**	**€ 2.559.500**

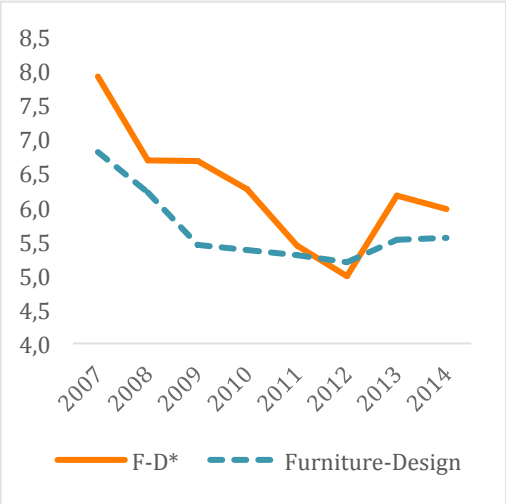
F-D, J*, F-A* : companies that are on the technological frontier;*

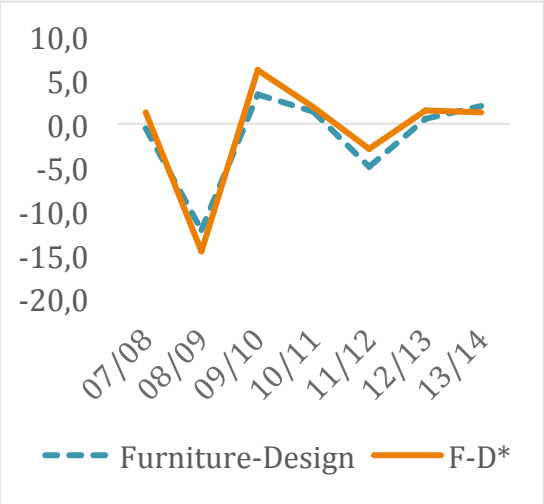
Source: AIDA-Bwd database processing

Considering Furniture and Design industry, companies on the technological frontier register better performance than the average sector, even if the gap is not large. In fact, in 2012 companies on the technological frontier registered a worst performance.

There is no difference, however, between the growth trend of the companies on the technological frontier and the growth trend of the industry.

Fig3.14(a)Profitability: Furniture-Design Fig3.14(b)Growth: Furniture-Design



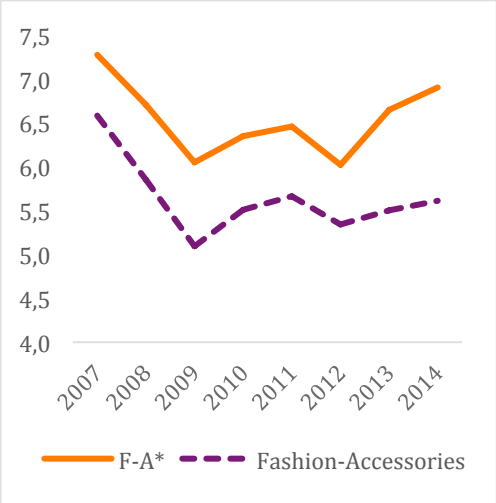


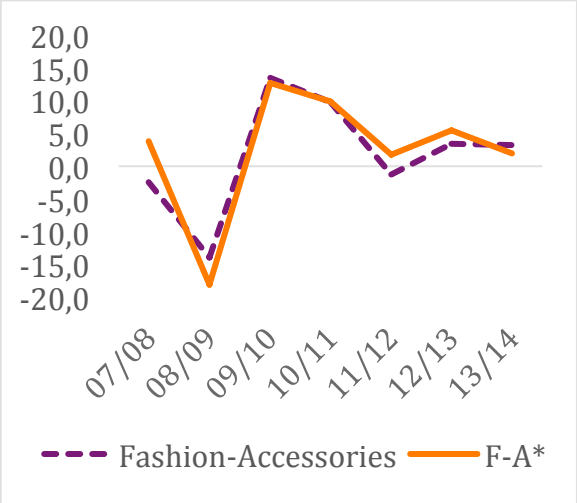
Source: AIDA-Bwd database processing

In the fashion and Accessories sector, companies on the technological frontier register, constantly, a better performance than the average of the sector in the last seven years, in fact the EBITDA is always higher than the average.

Even in this case the growth trend of companies on the technological frontier coincides with the one of the reference sector.

Fig3.15(a)Profitability: Fashion-Accessories **Fig3.15(b)Growth: Fashion-Accessories**

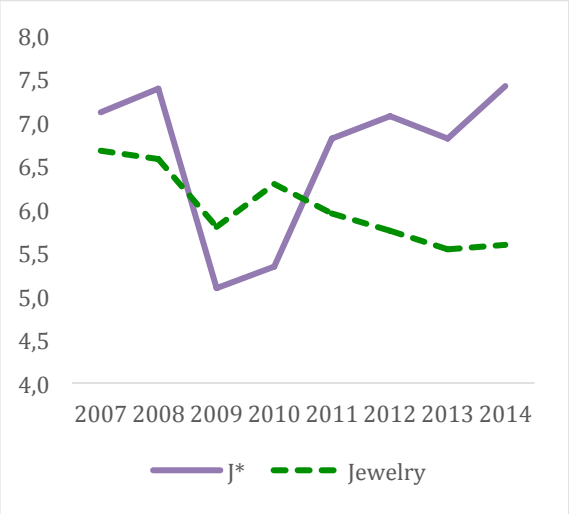




Source: AIDA-Bwd database processing

Considering the jewelry industry. The companies on the technological frontier register an upward trend after 2011, from that year the EBITDA rises steadily surpassing the industry average even if the difference between the two values is slight.

Fig3.16(a) Profitability: Jewelry **Fig3.16(b) Growth: Jewelry**



Source: AIDA-Bwd database processing

Within the debate on the role of digital manufacturing, customization has been recognized as one of the most important opportunities.

Therefore the research tried to investigate what was the trend of profitability and growth of those companies that implement a personalization (companies that have more than 70% of products designed to customer specification have been considered).

The personalization strategy seems to be no crucial for the furniture and design industry, profitability and growth levels coincide with those of the reference sector, in some cases are even lower.

Fig3.17(a) Profitability: F-Dper

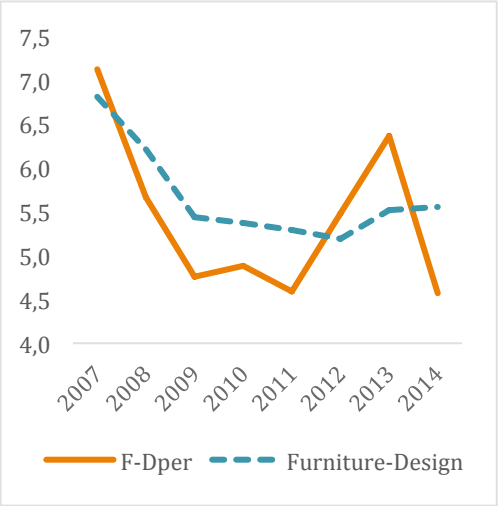
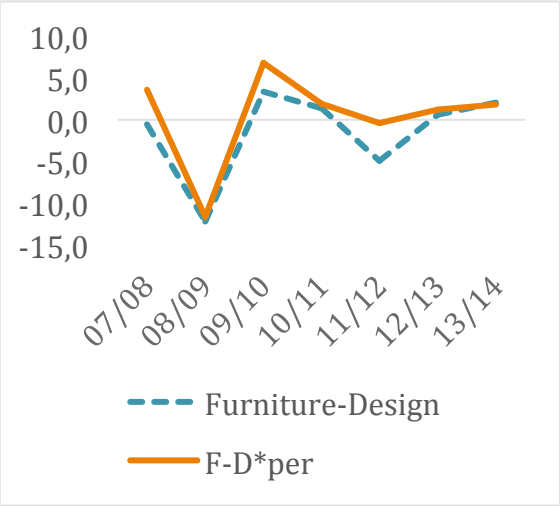


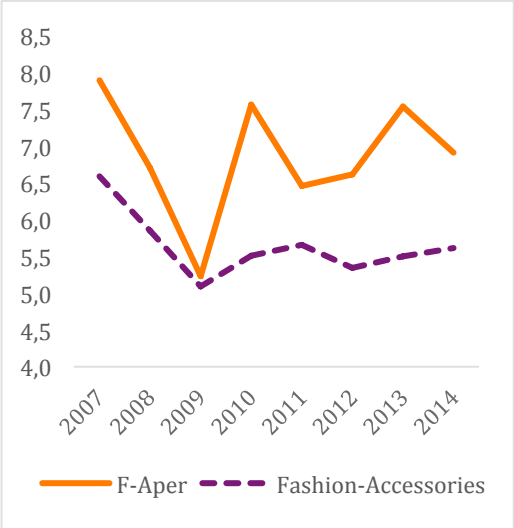
Fig3.17(b) Growth: F-Dper

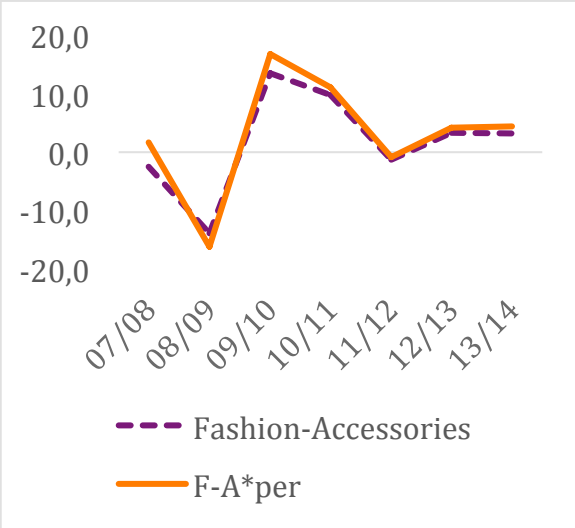


Source: AIDA-Bwd database processing

The personalization strategy has a greater impact on fashion companies in terms of profit. The research results show higher levels of profitability in those companies who customize their products compared to the reference sector.

Fig3.18(a) Profitability: F-Aper **Fig3.18(b) Growth: F-Aper**



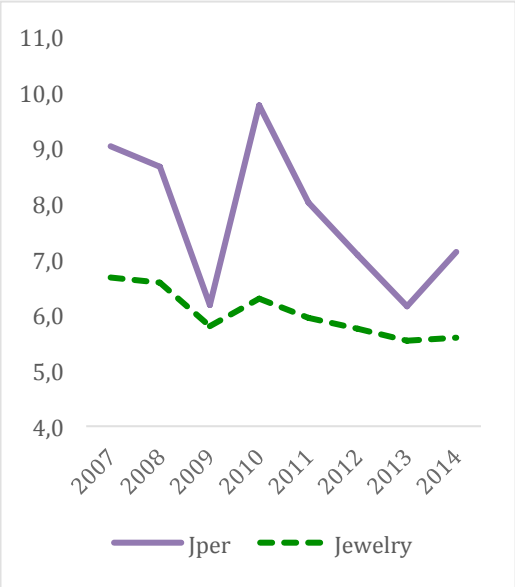


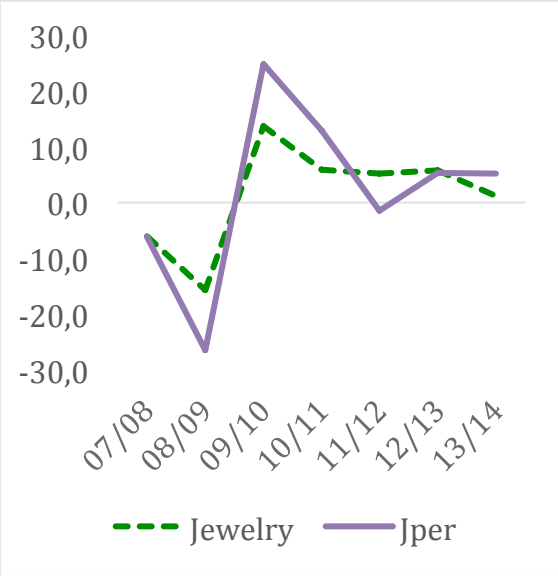
Source: AIDA-Bwd database processing

Customization represents a strategic tool to increase profitability also in the jewelry sector. Levels of profitability are higher than the average sector.

The growth trend seems to be fluctuating, but broadly in line with the sector.

Fig.3.19(a) Profitability: Jper **Fig3.19(b): Growth: Jper**





Source: AIDA-Bwd database processing

The following graphs show the profitability and growth trends of those companies that combines digital technologies and personalization strategies.

The interesting result that emerges from this analysis is that sectors are benefiting from the customization of their products increase their perfomance through the use of digital technologies, especially the fashion and jewelry sector [Fig 3.21(a);Fig. 3.22(a)].

Despite the growth trend is fairly consistent with the one of the reference sector, the latter two sectors are growing slightly more than the industry average [Fig 3.21(b); Fig. 3.22(b)].

Fig.3.20(a)Profitability: F-D*F-Dper

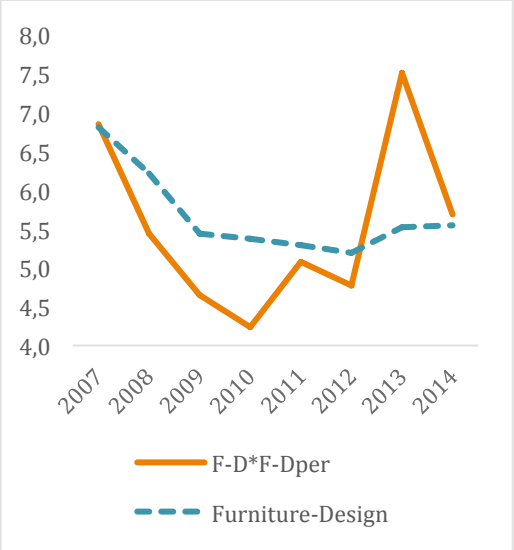
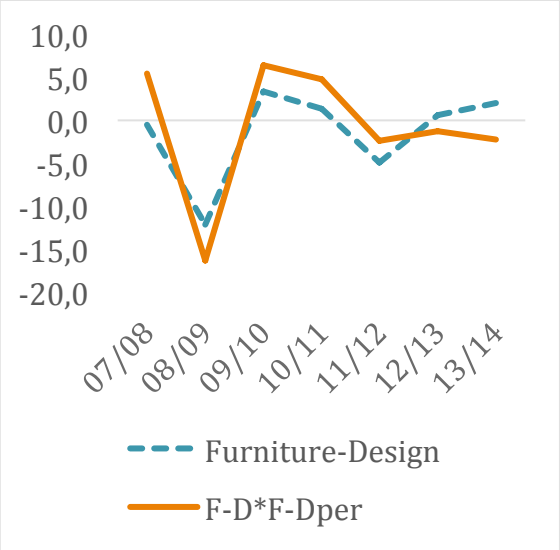


Fig3.20(b) Growth: F-D*F-Dper



Source: AIDA-Bwd database processing

As we have previously seen the furniture industry takes advantage of digital technologies, while it is much less sensitive to customization strategies.

Fig3.21(a) Profitability: F-A*F-Aper

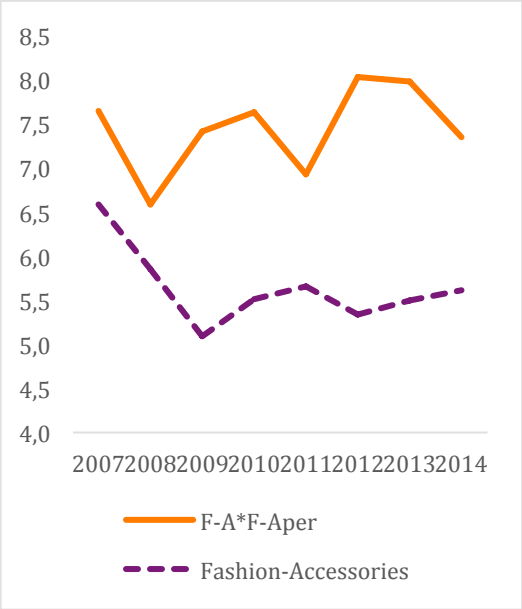
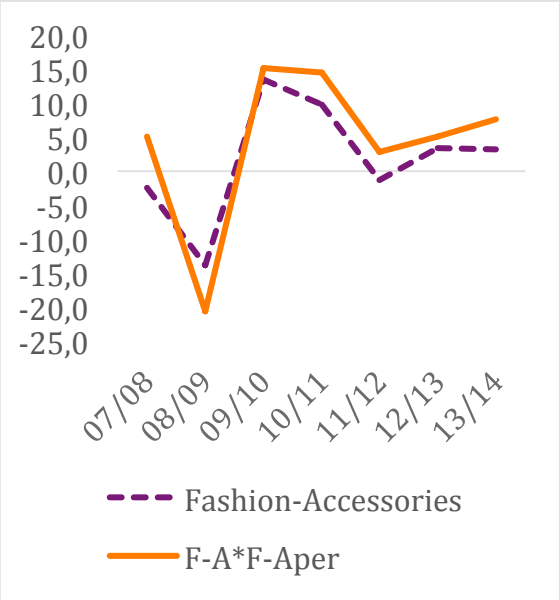


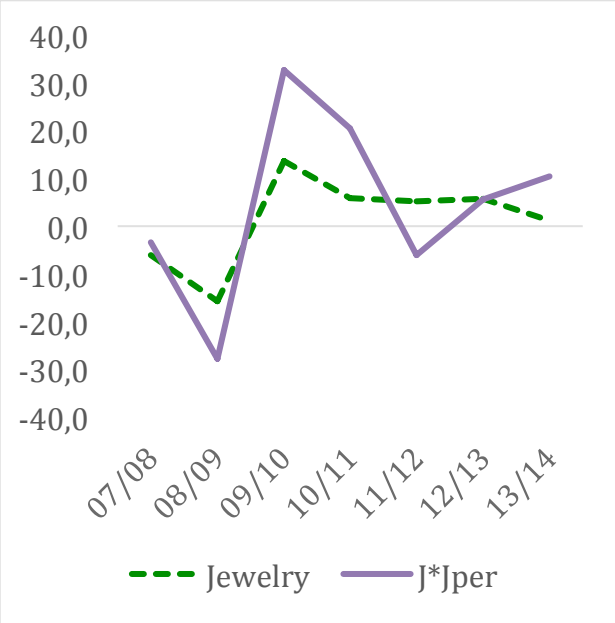
Fig3.21(b) Growth: F-A*F-Aper



Source: AIDA-Bwd database processing

Fig3.22(a) Profitability: J*Jper

Fig3.22(b) Growth: J*Jper



Source: AIDA-Bwd database processing

3.3.Italian Fab-Labs: small artisanal realities or possible promoters of spread of digital technology

The first Fab-Lab was founded at MIT in Boston, brainchild of Neil Gershenfeld, it is an open laboratory equipped with digital fabrication technologies. The Fab-Lab concept is strongly linked to the philosophy of the maker movement based on the idea of self-production and collaboration.

> "A Fab Lab today fills a room, weights about 2 tons and costs about $100000. That includes 3-D scanning and printing, large-format and precision machining, computer-controlled lasers and knives, surface-mount electronics production, embedded programming and computing tools for design and collaboration. With these, it is possible to locally produce and customize products that are mass-produced today, such as consumer electronics and furniture." Neil Gershenfeld

When Gershenfeld opened the first Fab-Lab at MIT he did not expect that model would be replicable elsewhere, but it happened very fast, not just in the USA but all around the world as well. The objective is to create a global network, and if one wants to be a part of that network one has to follow some rules, for example each Fab Lab, in order to be defined as such, has to be open to the public, it must have digital manufacturing technologies, it has to share tools and processes with the Fab-Lab network and it has to share activities within the network.[36]

In this context it is important to mention the presence of Fab Labs because Italy, in recent years, has seen the birth of many institutions of this kind. It is competing for second place with France in terms of number of Fab-Labs behind USA, according to the monitoring website: Fablabs.io.

There is an important difference between Italy and France: while in France fab-Labs are financed by the state, in Italy they are financed by private funds.

Furthermore, Fab-Labs are important because they are born with an educational intent, their role is to spread digital culture by providing all the technologies.

The census of digital fabrication labs conducted by Menichelli and Ranellucci in 2014 found that the main technology of the Fab-Lab is the 3D printer, electronic

[36] http://wiki.fablab.is/wiki/Fab_Lab_conformity_rating

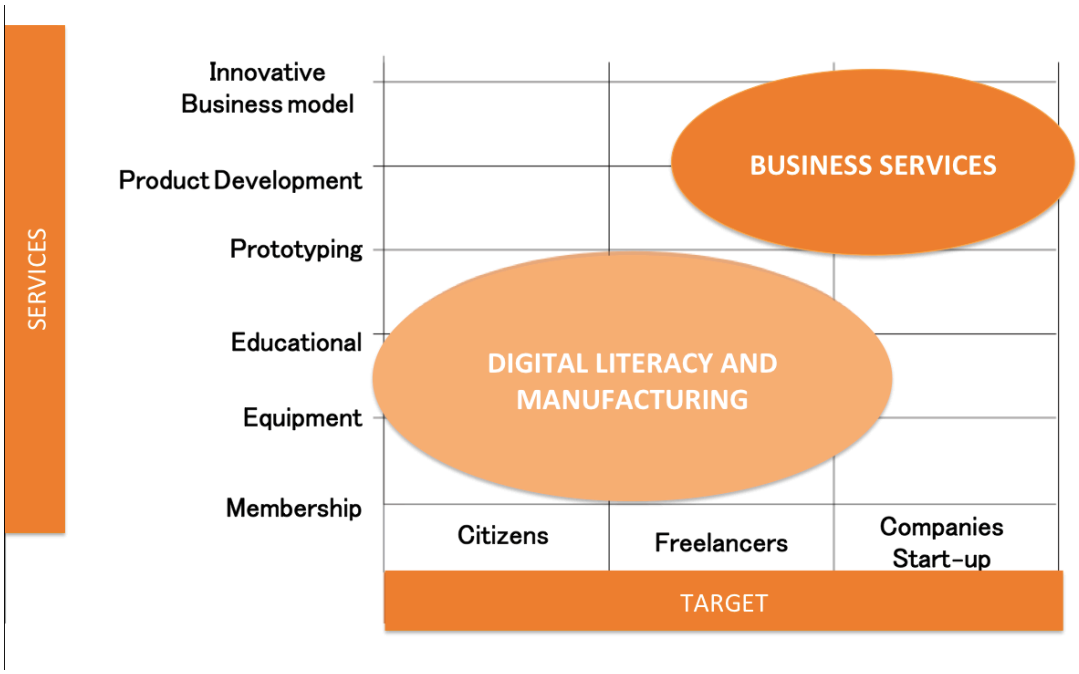
prototyping boards like Arduino are also widespread. They seem to have less availability of milling machines, lathes and technologies for laser cutting (they are present in less that half of the laboratories under analysis).

This is not surprising, first of all because 3D printing is the symbol of the maker movement, second of all because it is becoming more affordable. The cost of this technology has decreased of 400 times in 7 years (Bacchetti, 2011)

The other mentioned technologies are more tied to the industrial-manufacturing field as emerged from the research presented in the previous section.

In its first report on the impact of digital technologies the Make In Italy Foundation conducted a qualitative analysis on Italian Fab-Labs and it outlined two different vocations: one aims at business services, the other deals with digital literacy among businesses and citizens.

Fig3.23. Fab-Labs: two emerging models



Source: Make in Italy Foundation

Fab-Labs are an interesting phenomenon because they are becoming centers of experimentation and innovation, since they are open to the public they involve many

different stakeholder categories: students, citizens who made the digital their hobby, and companies and entrepreneurs that want to discover new technological opportunities.

These places could push many Italian manufacturing companies to technological innovation, not only by spreading digital culture but also providing support for applying those technologies.

The main advantages of digital manufacturing are: customization, small scale production and production of unique pieces, which are also the great strengths of the Made In Italy production that allows us to maintain our level of competitiveness.

Digital technology partly eliminates two major limitations of Italian manufacturing: high production time and high costs.

This is why it is so important for our business fabric to know and understand this new digital transformation, Italy has long understood that it can never compete in large volumes; diversification, quality and customization, this is what the market recognizes us.

But Italian craftsmen and manufacturers can not present themselves to the market as they did thirty years ago, they must learn to free themselves from the weight of a tradition that, today, can really constitute a constraint (Micelli, 2016).

All the conditions for the new technological frontier to meet tradition are fulfilled, creating new professional figures of digital craftsmen, who are able to combine the passion for the know-how, technological experimentation and the ability to make products.

3.4.Digital technologies: cultural, productive and organizational impact

Digital technologies change the way we imagine products and services, since the democratization of technology is advancing and many barriers are falling business leaders have to find new sources of value and competitive advantage.

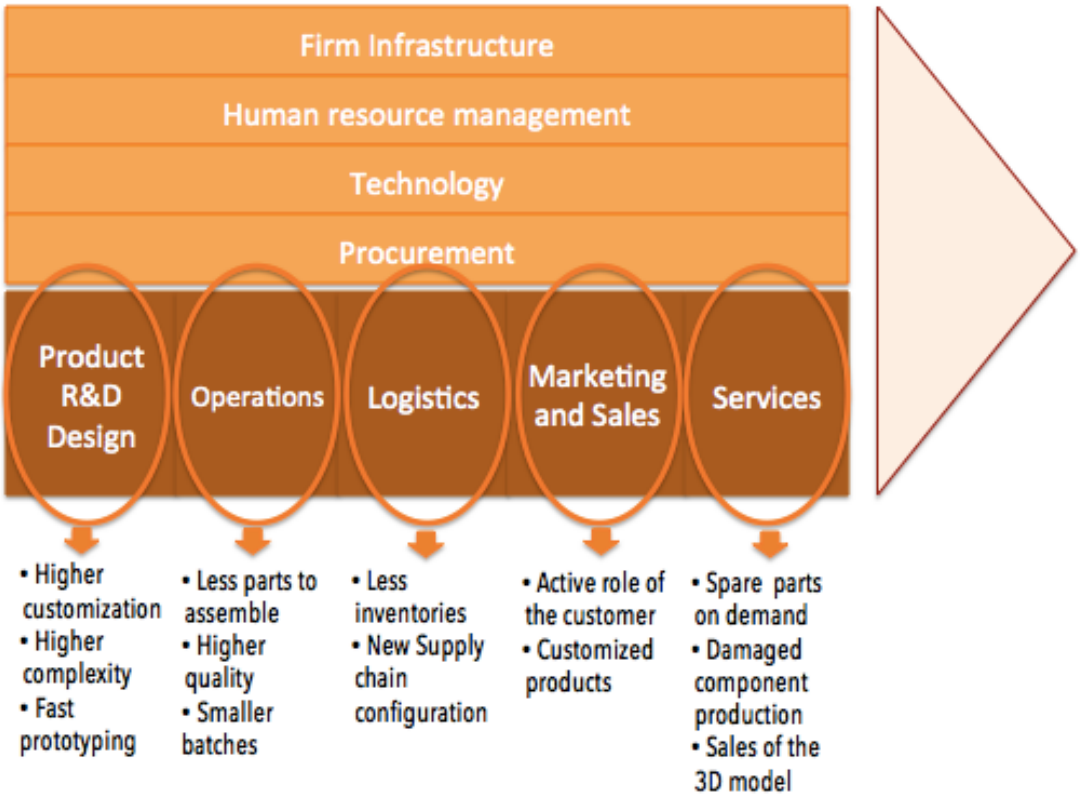
New digital technologies have and will continue to have an impact on the company's value chain. They allow companies to supply customized product and services thanks to cloud computing and e-commerce. The production will become faster and leaner because products can be designed by following specific customer

requirements. Thanks to new technologies it is possible to reduce the number of parts that are necessary to assemble and they increase the degree of complexity and quality of product.

Also the logistics will change because there will be less inventory along the supply chain.

The high degree of customization is reflected on sales and after-sales services as well, because it is possible to produce spare parts only where they are needed and when they are requested by customers, it is possible to rebuild a damaged component and made it exactly like the original one.

Fig3.24. Impact of digital manufacturing on company's value chain



Source: RISE-Research and Innovation for Smart Enterprises. University of Brescia.

All new technological tools may redefine how work is done, they allow companies to realize rapid improvements in productivity (Manyika, J et al., 2014).

Many jobs could be affected by technologies such as advanced robotics and automated knowledge work. The current problem is creating a labor force that is able to face this technological transformation. The demand of skilled workers especially in technical field will increase and many manual jobs are going to disappear, this means that many workers have to be retrained.

CHAPTER 4
CASE STUDIES

4.1. Methodology

After conducting a qualitative analysis in collaboration with *Fondazione Nord-Est,* I selected a group of companies belonging to the evaluated sectors that claim to use some of the described digital technologies.

In the end, seven case studies were selected: two cases belong to the furniture industry, two cases belong to the jewelry industry, two cases belong to the fashion and accessories industry and one case belongs to the footwear industry; all companies are located in Veneto region.

The CEO of each company was interviewed directly, the model of the semi-structured interview has been followed for the preparation of the questions. (ATTACHMENT A)

The interview seeks to grasp the characteristic features of the business model of each company, with a focus on the production process.

Each respondent was asked which technologies are used in the production process, if they were internalized or outsourced, how long they have used them, and the main areas of use, particularly if these digital technologies are applied in the design or in the production process or both.

The case studies' analysis were subsequently analyzed by a reworking of a model proposed by Taran (2015) which breaks down the business models reducing them to four key areas:

1. **What does the company provide?**
    a. Value Proposition
2. **Who does the company serve?**
    a. Target Customers

3. **How does the company provide it?**
    a. Customer relationship
    b. Value chain architecture
    c. Core competences
    d. Partner Network
    e. Digital Technologies
4. **How does the company make profit?**

Companies were analyzed according to this business model in order to use a unique interpretation key.

It is crucial at this point of the research to shift the focus on enterprises to seek a match between what was presented previously and the actual application areas.

We have seen the results of a quantitative research that outlined a trend, albeit still weak in some aspects, towards a digital transformation. Economic results show that those who have invested in digital technologies have a higher profitability.

The following qualitative analysis goes into companies to better understand strategies, objectives and the main reasons that have brought or not brought them to the digital transformation.

4.2.The Italian response to digital transformation

In the previous chapters it has emerged that digital transformation is involving many stakeholders, particularly large corporations and government institutions.

In this context, Italy plays a peculiar role, first of all because it still lacks a focused business plan: despite the creation of the cluster "Fabbrica Intelligente" the ministry for economic development has not submitted a defined and formal plan. Second of all, as previously discussed, the Italian entrepreneurial fabric is dotted with small and medium enterprises, a large number of companies that are important elements of an eco-system but that are not big enough to be protagonists.

The businesses studied do not have enough institutional value to be included in a government plan like those that exist with Siemens in Germany, with Dassault Systèmes in France or with Tesla Motors in the United States.

They are companies that have seen in digital technology the answer to their needs. The adoption of technology has taken place gradually, following a bottom up strategy.

The Italian response, in the absence of a national guideline, originates from the need to improve production processes.

For many of the case studies innovation is the result of experimentation: Arper improved its production chain by adapting the work of the automated machines to the work of the upholsterer, creating the first automated upholstery in the world. Similarly, a jewelry company such as Fope understands that automated production can give a strong added value to its production of high quality jewelry. Thus the introduction of the 3D printer becomes another evolutionary step toward the reduction of time and costs of the prototyping phase and the production of highly detailed gold belts.

Laser technology has been included for some years within the D'orica jewelry business, the introduction of this technology has allowed the company to reach an otherwise unobtainable level of detail and quality. This company is also experimenting with molecular gold processing, a process that is paving the way for the custom manufacturing of jewelry products with the 3D printer. The laser cutting technology is also used by Zordan, a manufacturer of furniture solutions, even though it does not own the technology.

Ownership of the technology is not a determining factor, the analysis of cases showed that companies often resort to external service providers because the production volume and the speed at which these types of machines become obsolete don't justify the investment.

The acquisition of these technologies is also related to the maturity of the technologies themselves.

The established technologies are more frequently present within companies. This can be an almost trivial observation, but, considering that the latest digital technologies are presented by many as revolutionary and strongly democratic, we should expect a disruptive approach by companies. But when you look at the reality of business, it turns out that the diffusion of new technology is slowed down by the usual worries and economic evaluations.

An example is the company Maison 203 where the entire printing process is delegated to an external supplier.

While old technologies are included in the production phase, in most cases new technologies are involved in the design phase.

These trends also emerge from the research presented in the previous chapter.

A very important element that emerged from the research is the fusion between technology and craftsmanship: a common thread that connects all the interviews and that shows that Italian production is still strongly influenced by craftsmanship.

Orlando and Lucia, owners of Maison 203, define themselves as digital artisans, their 3D printed jewelry requires a manual finishing work that is not so different from the traditional artisan job.

The same trend is observed in D'orica, the goldsmith company, where despite the use of highly advanced technologies 75% of the work is still done manually.

The combination of technical and digital knowledge and manual skills requires, however, a redefinition of competencies and sometimes the inclusion of new jobs.

In the case of the clothing company Confezioni Barbon, generational change is followed by technological updating. The upgrading of skills in the company has been a key factor in setting business transformation in motion, increasing new skills without losing old ones.

Within Arper, the largest and most structured company among those analyzed, resistance to change has been mitigated thanks to a widely shared corporate culture.

In general, the value of the product is still strongly linked to the concept of heritage.

Undoubtedly, the choice of sectors is crucial when we talk about the value and role of the made in Italy, but what stands out is the union of expertise and technology, the technology does not replace the value of human resources in this context, it enhances it.

The third factor that has emerged is the level of innovation. The innovation is taking place only at process level and not at the product level.

In all cases that have been analyzed, in fact, the technologies enter the production process to improve quality and performance, but digital innovation does not involve products.

The Internet of Things has not yet joined these companies, this may be due to in part to the nature of the product that is still valued for its "classic" features, in part to the lack of knowledge of this new technological frontier.[37]

It is noted that the use of new technologies does not line up with the number of innovative business models, the analysis revealed no particular innovation within business models.

Companies use few digital marketing strategies and only Maison 203 uses e-commerce as a sales channel.

Relation with customers and word of mouth among users in the industry still seem to be the predominant commercial strategies.

In the case of Gritti-Pas de rouge, it has emerged that the supply chain still plays an important role. Often technological innovation is made by component suppliers, so the company that assembles the final shoe undergoes innovation passively.

It is also fitting to make a few comments on the size of firms, because all surveyed companies are small and medium-sized enterprises. For some time in Italy there has been a debate about how the size of companies influences the level of development.

Some scholars think that SMEs are less prepared to handle structural changes that the industry 4.0 requires, the main causes of this are lack of skilled workers, aversion to risk and change and limited investment capacity. (Kagermann, et al., 2013)

Geissbauer, et al., (2014) have a different point of view which maintains that the level of product portfolio optimization is independent from firm size and that SMEs are already preparing for the digital edge.

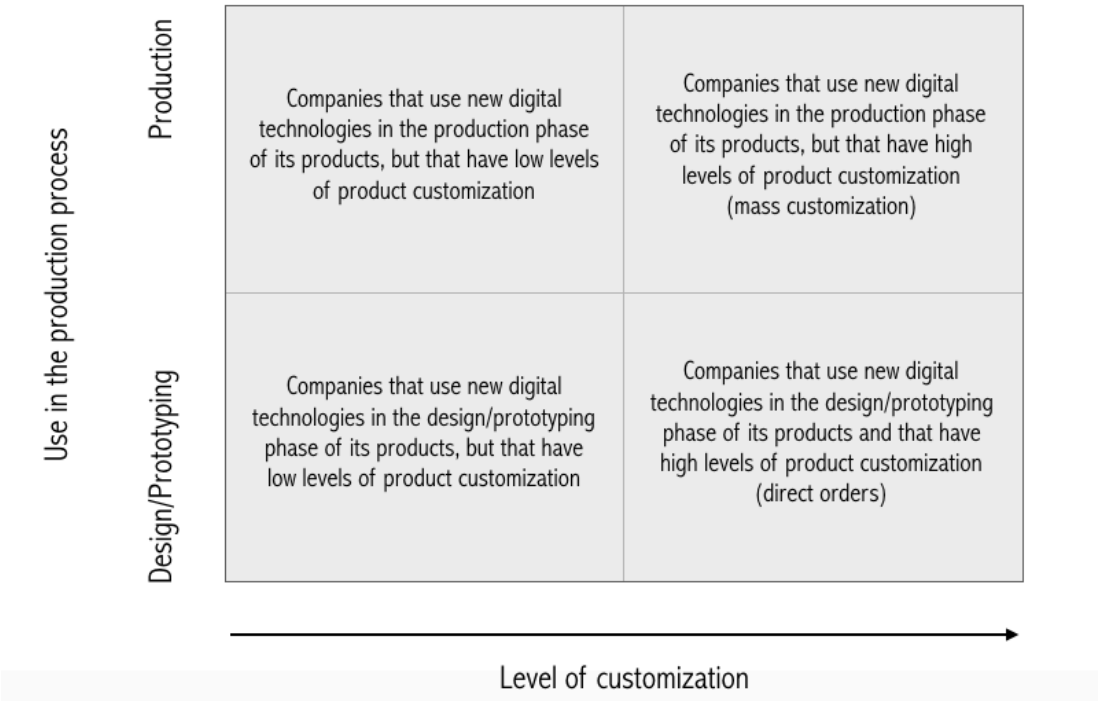
On one hand small companies are flexible, on the other big companies have greater availability of resources.

[37] According to the research conducted by Fondazione Nord-Est less than 10% of companies surveyed know of and use these technologies.

Another important consideration relates to customization strategies, specifically to what degree the introduction of these technologies has led to sufficient flexibility for providing an advanced customization service. The result seems to be limited. There are some customizable elements but we are not yet looking at a fully customizable product. It is interesting to note that even a start up, small, flexible and digital as Maison 203 has decided to not offer 100% customizable products.

I tried to analyze the cases through two parameters: the use of digital technologies in the production process and the level of customization in order to verify if the use of digital technologies at the production level will increase the level of customization.

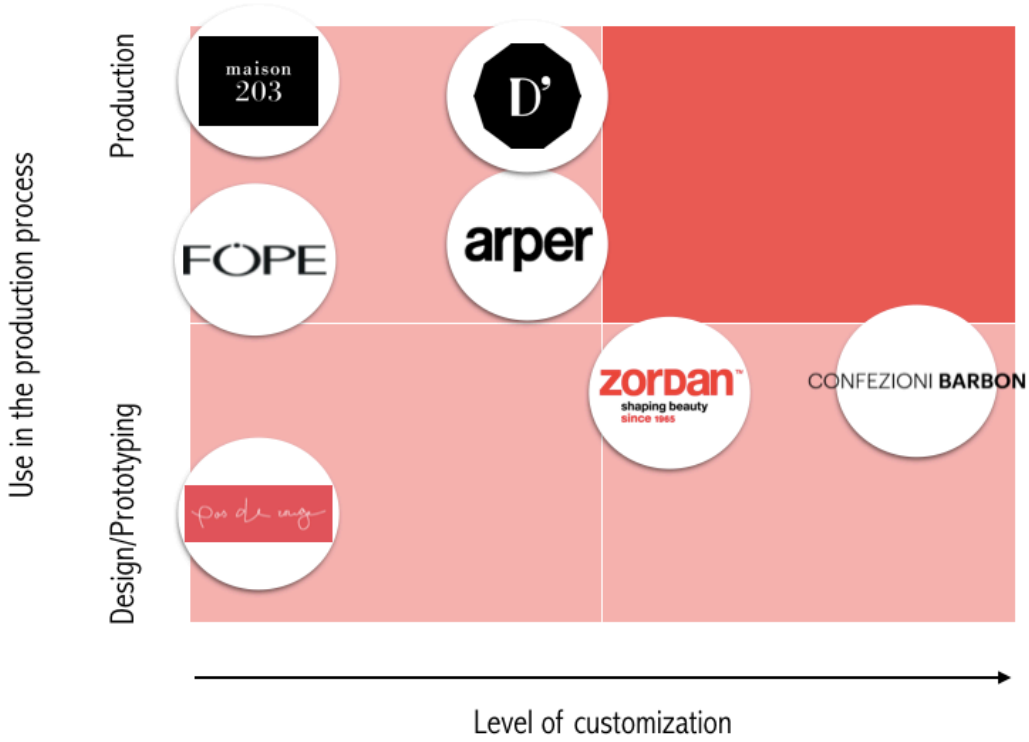
Fig4.1.(a): Digital technologies/customization Matrix



Source: Personal elaboration

Considering the seven companies' case studies, we can fill the matrix as follow.

Fig4.1.(b): Digital technologies/customization Matrix



Source: Personal elaboration

For none of the cases analyzed the digital technology has led to a mass customization strategy, or at least not yet. High customization levels are linked with B2B strategies and not with a new concept of customer service.

A final analysis is dedicated to the performance of the analyzed companies, excluding Gritti-Pas de rouge and Maison 203 for which it was not possible to find the information.

Arper, Zordan, Fope and D'orica are growing businesses, revenue is growing steadily. The analysis of profitability (EBITDA %) compared with the industry average is positive, especially for Arper, Zordan and Fope, showing that these companies that are on the technological frontier are, on average, better performing.

The revenue of Confezioni Barbon has declined in recent years, while the EBITDA margin is in line with the industry average.

In the following section the seven case studies will be presented in detail.

4.3.ARPER SPA

Company profile

Arper is a furniture company based in Treviso, it was founded 25 years ago, at the beginning the company worked for third parties. At a certain point the owner decided to create its own line with the help of a designer in order to became independent and the company stopped work on commission.

This was a key element for the company's strategic evolution that became, in ten years, a symbol of the Italian design manufacturing in the furniture field.

Since the beginning the property decided to structure the company from a managerial point of view and enrolled a CEO, external to the family, and a team of managers to bring the company worldwide. This was upstream for that time in the Italian context, where the majority of businesses were owned and managed by the family who had the property and the structure, most of the time, was not formalized.

Today, Vincenzo Rivizzigno, current CEO runs a multinational company with more than 90 employees and almost 70 millions of turnover.

It is a company with a strong vision.

What do the company provide?

<u>Value Proposition</u>

"In pursuit of the essential"

Arper provides a 100% Italian product. It produces a limited range of furniture such as seats, sofas and tables.

One of the characteristic products of the company is the Catifa chair, designed more than ten years ago, it has become an evergreen product design and a trademark symbol.

The Arper's product differs from others for its Nordic style and the high technical knowledge, typical of Italian artisans. It is addressed to a constantly innovation processes, both for what concern the product and design and production process.

> "Is an object as elemental as a chair or a table still subject to insight or innovation? After eons of development, is still something to be done? We say: Absolutely. Everything is in flux – life, culture, technology – and that basic fact demands a considered response. Good design is a synthesis of technique, cost material, function, use, taste and sustainability." From Arper's website.

Who do the company serve?

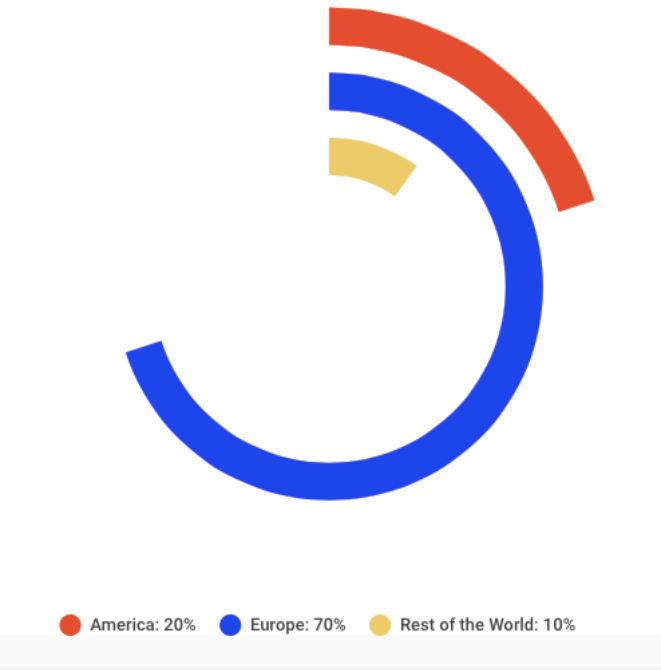
Target Customer and markets

Company's target is the contract segment, it operates in the niche of design to furnish big corporations, companies and banks.

The company has 13 units located around the world, including showrooms and branch offices. It has a productive unit in USA, one in Australia and it is opening a new one in Japan.

Sales are distributed as follow:

Fig4.2. Sales distribution: Arper.



The highest percentage of sales is still concentrated in Europe, but from the discussion with Mr. Rivizzigno emerged that this percentage is changing in favor of the Asian market, the CEO has stated that he aspects a sales division as follow: 50% in Europe, 25% in Asia and 25% in the American continent.

How do the company provide it?

Customer relationship

Since big corporations are the main target, the relationship with the customer is peculiar because there are several decision makers, in particular there are the buyer, the company and the influencer that is the architect or the interior designer who made the project.

Very often in order to reach the client it is necessary to work with the influencer that becomes the warrantor for the success of the product.

The relationship becomes more important when elements of personalization are inserted, Arper does not provide customized product but it allows clients to personalized its products, changing color, fabric or type of finishing.

Value chain architecture and partners network

Arper internalized the two key processes of its production process: the upholstery and the manufacture of iron.

The entire design process is carried out within the company where there are two departments: the design and prototyping department and the engineering department.

These two departments define new product concepts and handle special needs during the personalization process.

For the supply of raw materials and other services, the company uses some local producers.

The opening of production units in other countries comes from the need to get closer to the end customer in order to improve the quality and timeliness of the service.

This approach represents a highly significant business decision because it gives more importance to the customers than the production process. Customer proximity

entails a better service and a different level of customer involvement that allow the company to increase the value of the product offered.

Core competencies

Craftsmanship and know how are key factors for the product recognition. One of the winning strategies for this company was the decision to not relocate production to those countries where labor costs were lower.

Therefore, the company hadn't offshored their production to China when it was pretty much used, few years ago, for this sector, but they kept all the production and the relative knowledge in Italy, the employee turnover is under 1% and many artisans are there since the company foundation, does it means that the company can count on a strong company knowledge, on company historical memory and on a high level of involvement. Now they are "mature" enough to face the delocalization not to reduce costs but to be more closed to the customer. The company is able to combine innovation and craftsmanship maintaining a very high quality standard of product and service.

> "The workers are people who worked with us since the beginning, so they have Arper in their DNA, design and service, they have the mindset and the vision of the company. It is a great advantage because you don't have to teach or explain corporate identity, it is already implicit but clear. This has allowed us to go calmly to produce abroad." V. Rivizzigno.

Digital Technologies

In the prototyping and design process a 3D printer is used, while there are a 3D scanner and a 3D copier for modeling. The first digital machines of this kind have been introduced in the company six years ago. In some cases, if the project is too large to be managed in-house they turn to outside suppliers.

The technology that is most widely used in the production process is robotics and automation.

The company has two cutting machines: one for hides and skins and one for fabrics; both machines are controlled by software that reproduces the CAD drawing of the patterns, in order to minimize the wasted fabric.

The cutting of fabrics is done according to the orders required.

The really innovative part is the automation of the upholstery, Arper is the only company to have automated the work of the upholsterer through robots.

Robots has been designed for the company and for the functions they had to perform, the engineering industry is developing other possible solutions to increase the level of automation.

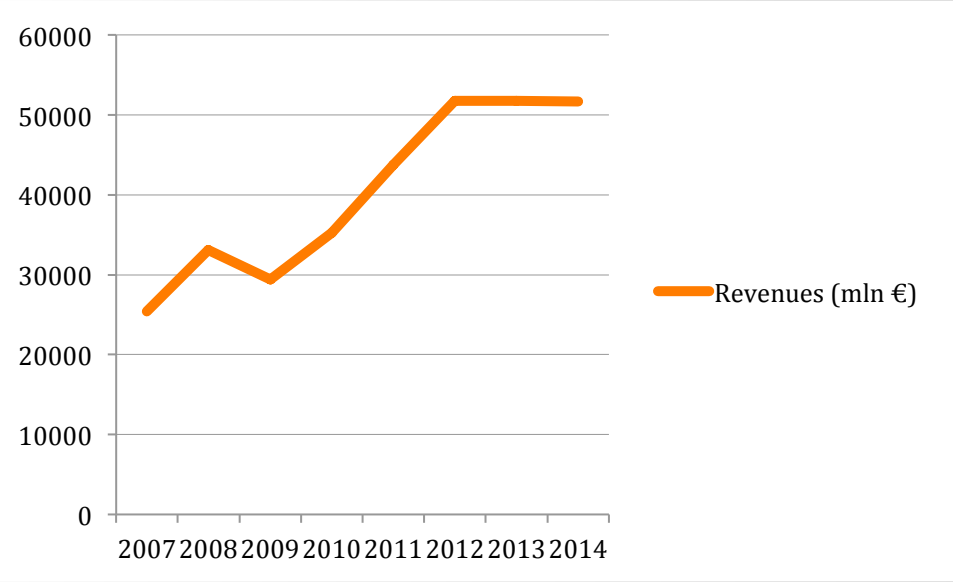
First of all automation has allowed the company to distance workers from dangerous work situations, the quality of the working conditions rose and to minimize accidents at work and occupational diseases.

Second of all automation has allowed the company to replicate the quality of artisanal work at lower costs. Not every process has been automated, knowledge and skills of upholsters are still important and this technology did not have a negative impact in terms of personnel involved but it allowed to improve the production process, qualitatively and economically.

How do the company make profit?

The company sells products under its own brand and it is growing significantly, from 2010 to 2015 the company's turnover has increased fivefold.

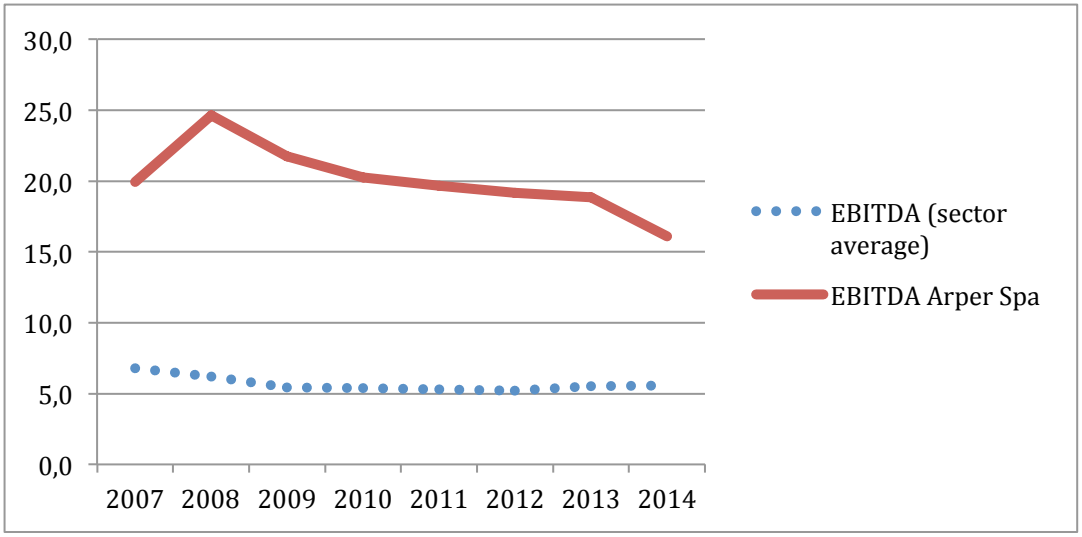
Fig4.3. Revenues: Arper spa (2007-2014)



Source: AIDA-Bwd

If we compare the EBITA% of the company with the industry average EBITDA% we note that Arper's profitability is higher than the industry average.

Fig4.4. EBITDA % (2007-2014)



Source: AIDA-Bwd

4.4.ZORDAN 1965 SRL

Company profile

Zordan srl was founded by Attilio Zordan in 1965 in Valdagno, Vicenza, it was a technical joiner specialized in commercial installations, at that time the main buyer was the Marzotto Group.

In 2000 the three sons of the founder became part of the company and in 2008 they took over the father's company, Maurizio Zordan as CEO, Alfredo Zordan as CCO and Marta Zordan as CFO.

At the end of the last century the company started to supply furniture for the retail sector of luxury brands and started strategically to diversify its customer portfolio.

The company was able to evolve from a managerial point of view keeping the craftsmanship of its product, from a technical joiner to an international flexible company able to adapt to each customer needs.

Today, Zordan Group is composed by two divisions: Mono-Brand shopfitting dedicated to the creation of furnishing projects for high-end retail chains and tailor-made interiors, which is a division created following the acquisition of the company *Delta Arredamenti*, a company specialized in made to measure furniture.

The company holds the majority share of Marzorati Ronchetti in Schio, Vicenza, and of Woodways in Mitchigan.

The company has 55 employees and a turnover of 14 millions.

What do the company provide?

Value proposition

"shaping beauty"

The CEO describes his company more as a service provider than a product provider. Most of the products are made to measure, so the ability to communicate with customer becomes a key factor, the good relationships with customers and the product quality are the competitive advantage of this company.

The company receives customer requirements and realizes the project from the technical design to the furniture's assembly.

The clients belonging to the luxury world has prompted the company to raise the quality level of its products and services.

"We give the best of ourselves on complexity" Maurizio Zordan

Who do the company serve?

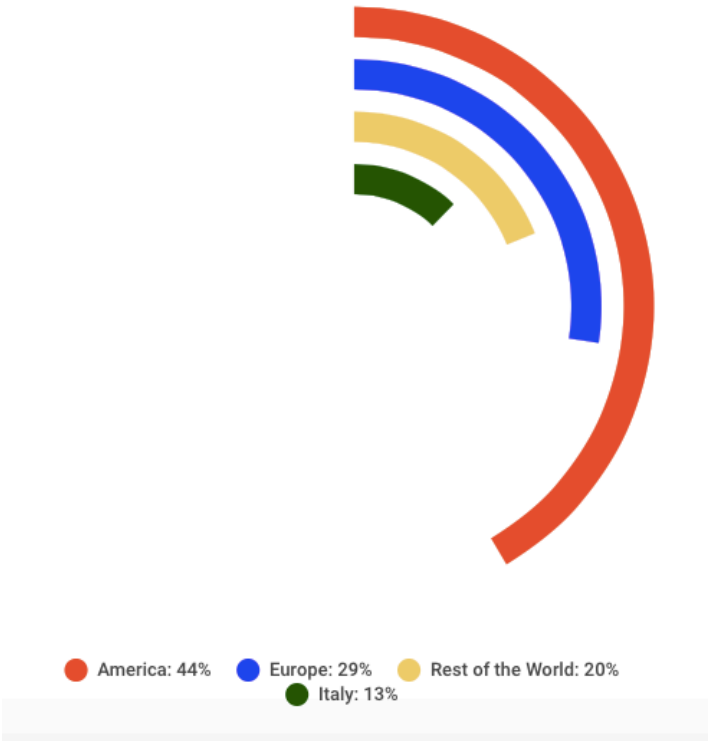
Target Customer and markets

The target customers are mainly big fashion houses. The project is defined by the architect, hired by the luxury brand, the role of Zordan is to carry out the instructions.

The structure of this business means that there are not international strategies for individual markets, this company is brought in the world by luxury brands that manage their store at a global level.

However the current distribution of sales is the following:

Fig4.5. Sales distribution: ZORDAN SRL



How do the company provide it?

Customer relationship

Since each project is entirely customized the relationship with customers is really important, there are strong interdependences between parties. The value lies in supporting the customer step by step: listening, interpreting, creating and monitoring the entire process.

Even marketing and communication strategies require a coherent approach to this business model, focusing on direct communication and customer care instead of standardized communication.

Value chain architecture and partners network

The company has not a design office, the project is created from the customer. The company role, therefore, is to achieve it in the best way possible. In order to do so, the company has two joiner, one carpenter area and a technical office that manage the engineering part with 2D and 3D software in order to prepare the architect's project for the production.

It can count on a strong network of experienced suppliers in the Vicenza area, they have about 280 suppliers, around 32% in woodwork, 25% in logistics and 20% in metalwork.

Core competences

The company has always worked on specific customer requirements, becoming an important player in the world of high level contract furniture. Customization is handled through a flexible corporate structure, this has allowed it to develop a great capacity to manage complexity. The management of complexity is related to the supply of a high level service that leads to customer loyalty.

Digital Technologies

Workstations with CNC machines were introduced in 2002, initially it was used machines with three axes, now the production department uses 5-axis machines.

It was launched recently a testing phase of three-dimensional scanning of spaces but in Mr. Zordan opinion it is still a difficult process.

A widely used technology is the laser cutting, but it is used in outsource because the production volumes do not justify the purchase of machinery. The use of this cutting technology is not recent, it has used from 10-15 years.

The use of additive manufacturing seems, however, not having applications in this field of production yet. The main reason is that wood could not 3D printed and metal's additive manufacturing, that could be used to produce small furniture accessories is not competitive, more than that, the metal details printed in 3D still not hold the aesthetic comparison with those produced by subtractive manufacturing.

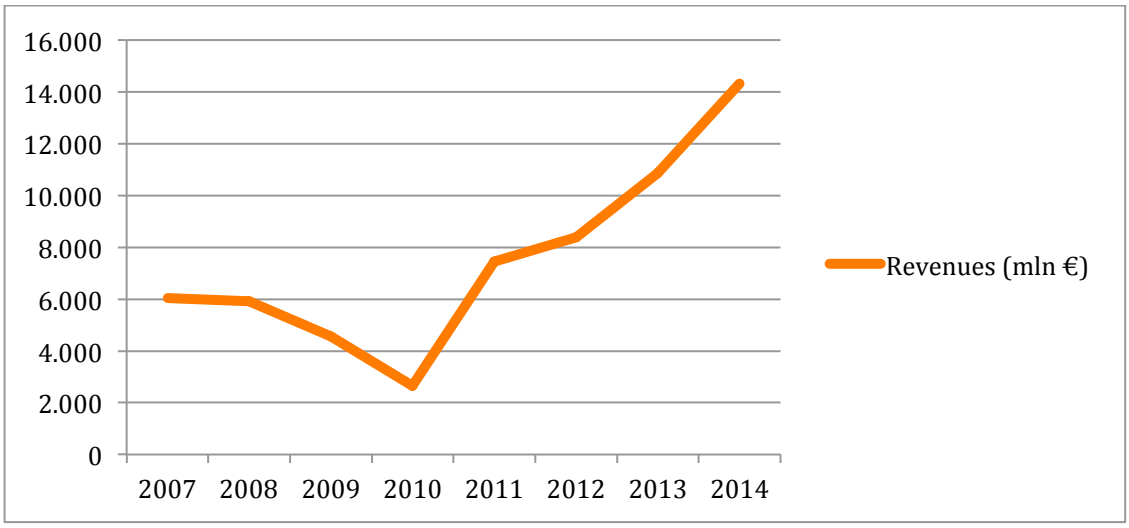
> "CNC machines allowed us to gain precision and efficiency in our production process. Transfer complicated operation to machines is something that is constantly done, the point is to integrate processes: prototyping with the production phase and the suppliers' relationship, this is the true value for customers. But, when you work on custom-made products it is also difficult to automate and robotize operations."
> Maurizio Zordan

How do the company make profit

The offer of a so exclusive and high quality service, combined with a clear organizational structure and a constantly updated communication strategy has enabled the company to grow steadily in recent years.

The following chart shows the turnover evolution.

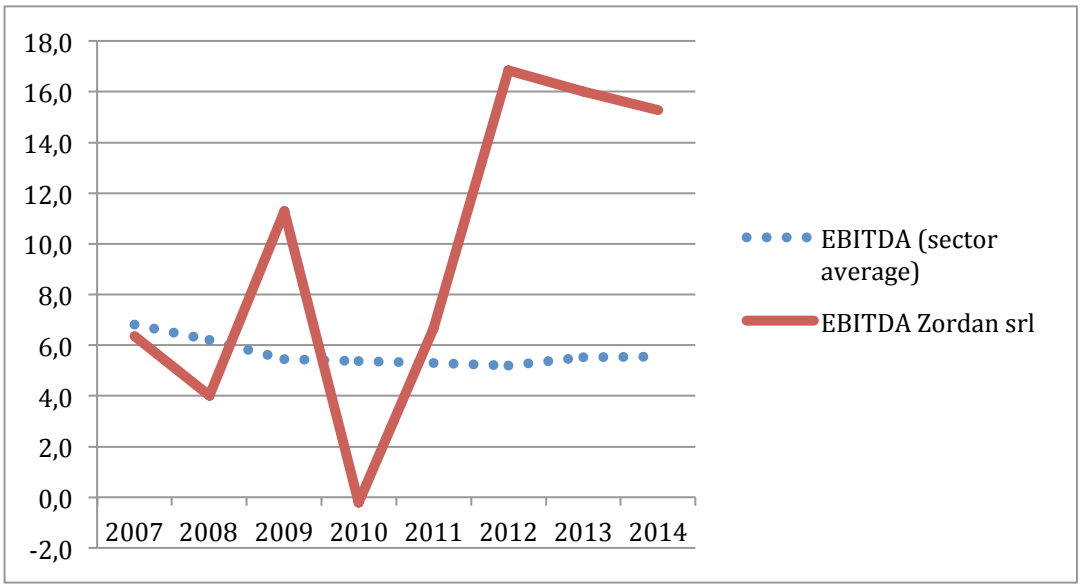
Fig4.6. Revenues: Zordan srl (2007-2014)



Source: AIDA-Bwd

From 2010 onwards, also the level of profitability was maintained above the industry average.

Fig4.7. EBITDA %(2007-2014)



Source: AIDA-Bwd

4.5.FOPE SPA

Company profile

Fope SPA is a goldsmith company founded in 1929, it is located in Vicenza, in the heart of the jewelry district.

The entire production takes place in Vicenza headquarters, each jewel has "made in Italy" etched on it.

Fope craft their products according to the highest quality standards in respect of work conditions, environment and the sourcing of the materials used.

It is a certified member of the Responsible Jewellery Council and has achieved the voluntary certification according to the Traceability & Fashion system.

It has a sales volume of 19 million euros. Around 40 people work everyday to carry on this example of an Italian luxury industrial manufacturing, well known all around the word.

What do the company provide?

Value proposition

Fope sells jewelries under its own brand and the peculiar line and shape of each product have led this company to build a really recognizable brand. Products are all made in Italy, to be more precise in Vicenza.

Since every process, from the design to the commercial assistance is manage within the company, the competitive advantage of this company is also related to the service that it offers to the client, Fope offers a complete support thanks to the

control of the entire value chain. Furthermore the product has a high component of innovation: the elastic and flexible gold mesh is one of the most representative patents of this company.

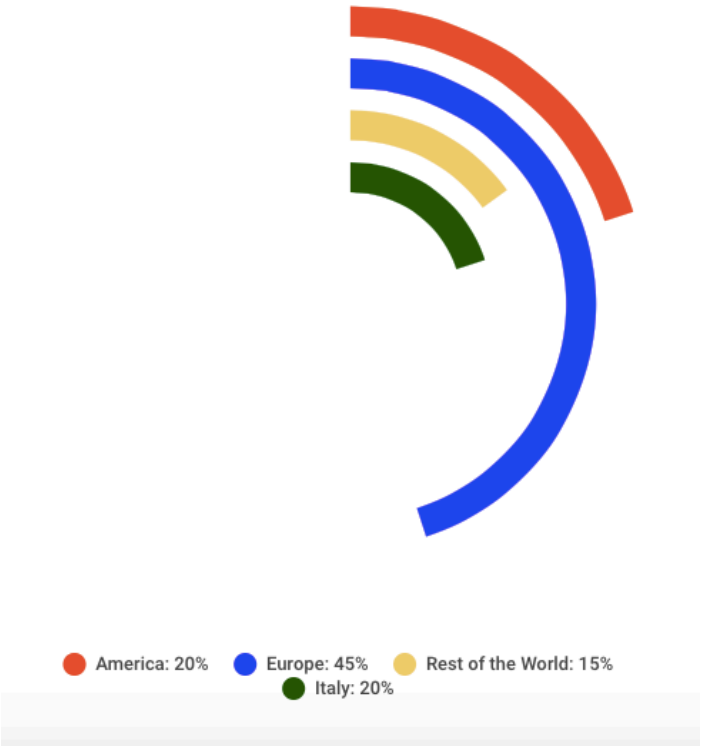
Who do the company serve?

Target customers and markets

The target customers are the jewelry stores with which the company has a direct business relationship, the company in fact exercises direct control over the final distribution chain without using third-party distributors.

The strategic decision has allow the company to decide which type of jewelry would sell its product, it can control the final distribution under a commercial, administrative and communication point of view.

Fig4.8. Sales distribution: FOPE SPA



The European market remains the reference market, whereas Americas is the second one in terms of sales distribution.

How do the company provide it?

Customer relationship

Since the relation is not mediated with a third party customers can count on an efficient client service and support. Fope has about 600 points of sales in the world and their control is completely centralized.

The company manages the merchandise and the supply of goods and it organizes events and communication campaigns in stores to promote the brand.

The relationship with the jeweler is so much important for this company that it organizes company visits and activities in store to maintain and consolidate this relationship.

Value chain architecture and partners network

Jewels are made in Vicenza that is known as the world capital of the gold processing. The manufacturing base is composed of hundreds of active enterprises, about half are artisan firms in the sector of high-level jewelry, costume jewelry and precious stones.

The district allows a technology spillover and a liable furniture network.

The production is managed according to a make-to order strategy to minimize inefficiencies.

Fope is vertically integrated and centralized but it relies on a network of agents for those markets where the presence of the brand is less strong.

Core competences

The company has a long history, knowledge of materials and techniques date back to the ancient knowledge of goldsmiths.

But the company has been able to innovate its production process, it has, today, a high level of industrialization, many machines were custom made and were adapted to company needs.

The combination of the ancient craft expertise and new technologies leads to the production of a masterpiece with a high level of innovation.

Digital Technologies

The company uses several CNC machines, they have automated many processes improving quality and technological innovation.

It uses the 3D printer for about eight years, they substituted the old 3D printer with a new one two years ago. This machine is used both for the prototyping and the production part, in particular for the production of belts.

The main advantage brought by 3D printing has involved the design stage, before the adoption of this technology prototypes were hand-made by spending a lot more time.

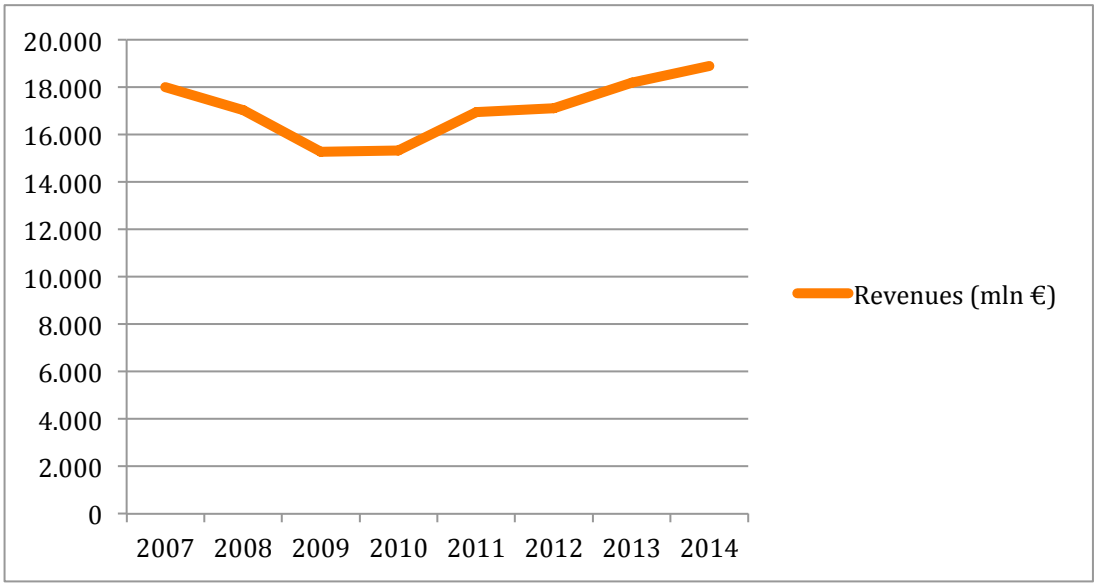
This company does not use the laser cutter technology because it seems not having many applications.

> "Many manufacturing that we do are impossible to realized without new digital technologies, such as the elastic mesh. Thanks to this technologies it is possible to make processes more efficient. I think that the adoption of these new technologies belongs to a natural evolutionary process to move forward." Diego Nardin, CEO.

How do the company make profit?

The turnover has grown steadily in recent years, the control of the entire value chain has allowed the company to manage its resources efficiently.

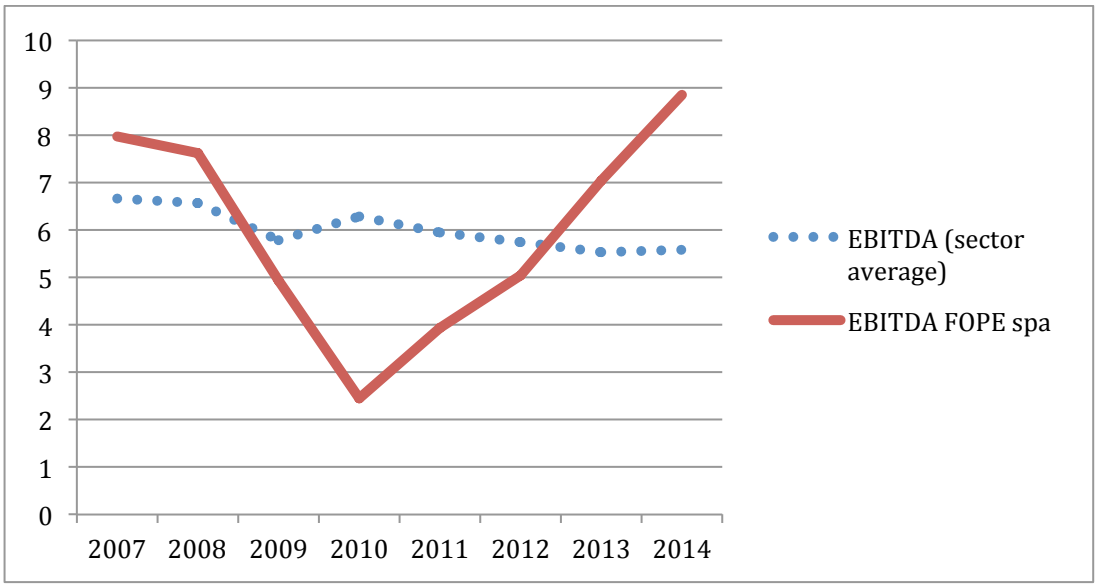
Fig4.9. Revenues: FOPE spa (2007-2014)



Source: AIDA-Bwd

The company's EBITDA fell below the industry average from 2008 to 2012, in the last three years, however, the profitability exceeded the average sector.

Fig4.10. EBITDA% (2007-2014)



Source: AIDA-Bwd

4.6.D'ORICA SRL

Company profile

D'orica is a goldsmith company founded 27 years ago by Gianpiero Zonta and his wife Daniela Raccanello, in Vicenza. They wanted to create a small company with a high level of welfare for its employees and a high quality product.

The company is located in an eco-friendly building built to minimize environmental impact.

They decided to complete all the production stages within the company, in Vicenza.

The company has experienced cyclical periods of crisis that led the owner to revise several times its strategies.

> "The last three years have been the best years aver, as I said each crisis we experienced was extremely healthy because it was useful to challenge our work and the status quo, they bust us to find alternative roads. I have always tried to do what I wanted my boss did when I was an employee, common sense and ethics. The human and the environmental aspects have always been important: involvement, passion and the ability to delegate. A company is a common good and being an entrepreneur is a mission." Gianpietro Zonta

The company has a sales volume of 13 million euros and it has 20 employees.

The company is currently engaged in an ambitious project, two years ago it began to reconstruct the production chain of the Italian silk and to produce it at its headquarter in Nove. It is an ambitious project because the European silk production has been abandoned many years ago, but the reaction from the market is extremely positive, the first supporters of this project are the fashion houses whose want to use

this valuable material that has returned after decades to carry the designation "Made in Italy". It is strange that it was a gold company to undertake this adventure, but the innovation boundaries are never so clear.[38]

What do the company provide?

Value proposition

The D'orica's product represents the perfect union between the technology and manual skills. They always keep up with technology and product innovation. But, despite the high level of technology the craft part is still dominant, it represents the 75% of the product. This combination of culture and technology is really appreciate by customers and made the D'Orica jewel a successful product.

They define themselves "gold tailors" for the wide range of products and the high level of customization.

The aim of the company is to produce timeless luxury jewelry.

Who do the company serve?

Target customer and markets

D'orica sells a niche product and has positioned itself over the years in a high-end market.

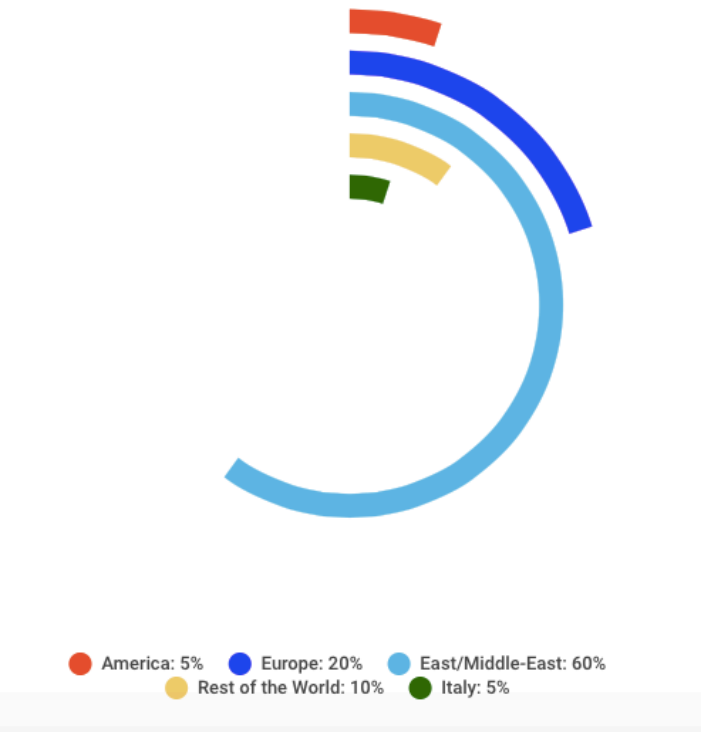
They address themselves mainly to jewelry through importers but they also face private client for special products.

The company since its establishment has been open to international markets, today it sells mainly abroad particularly east and middle-east.

The following chart shows D'orica's sales distribution in the last year.

[38] The project is called: "Seta Etica", www.setaetica.it

Fig4.11. Sales distribution: D'orica srl



How do the company provide it?

Customer relationship

The company avails itself of importers for the main markets who have the task of distributing the products to the individual jewelers.

It participates, also, to international fairs to get directly in contact with the final customer.

Although the company does not exercise direct control over the distribution chain, it pays very much attention to the relationship with the end customer by monitoring the degree of satisfaction through annual questionnaires.

The company does not sell online by choice.

Value chain architecture and partner network

D'Orica has internalized all the processes and it allows it to manage a high level of product customization, the customer orders the product and defines its personal

configuration and then the orders goes to the production line. The production is totally make-to-order, due to the product typology batches are small.

It happened also, but not many often to produce unique and personalized pieces.

The company is able to produce per year more than 2500 product typologies.

Even if the company is vertically integrated the role of partners such as importers operating in international markets is really important. Also the partnership with schools characterized this company that involved professors and students to jointly develop projects.

Core competences

The product has high handcrafted components, artisans weave the various components, early cut by laser machines, by hands.

It is this handmade process that provides the typical shape of D'orica's products and that made the brand recognizable all around the world.

Digital technologies

The company makes an extensive use of laser machines to work individual gold components. This digital technology is used in the production process because it is able to get an otherwise unattainable level of detail and it guarantee a constant level of quality.

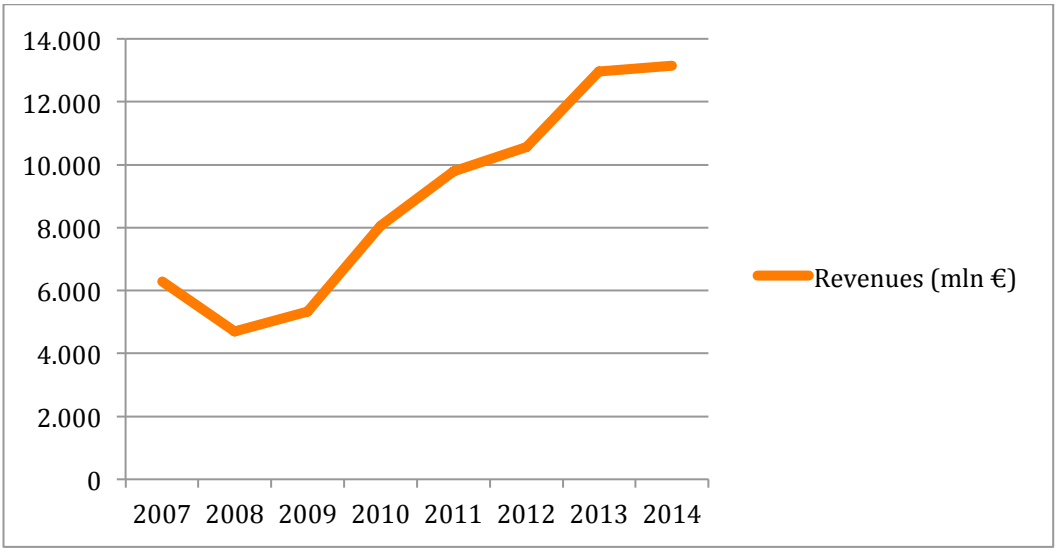
They own, also, a sintering machine that work the molecular gold, this machine is still in a test phase but the idea is to use it in the future to create totally personalized products.

The company owner's underlined also the importance of the management software that allows a faster and more detailed communication among customers, sales office and production office avoiding many mistakes and enhancing the entire customer service.

How do the company make profit?

The company is positioned at a high level in the jewelery market, high quality and refinement and high prices have allowed the company to maintain a significant competitive advantage above all in recent years.

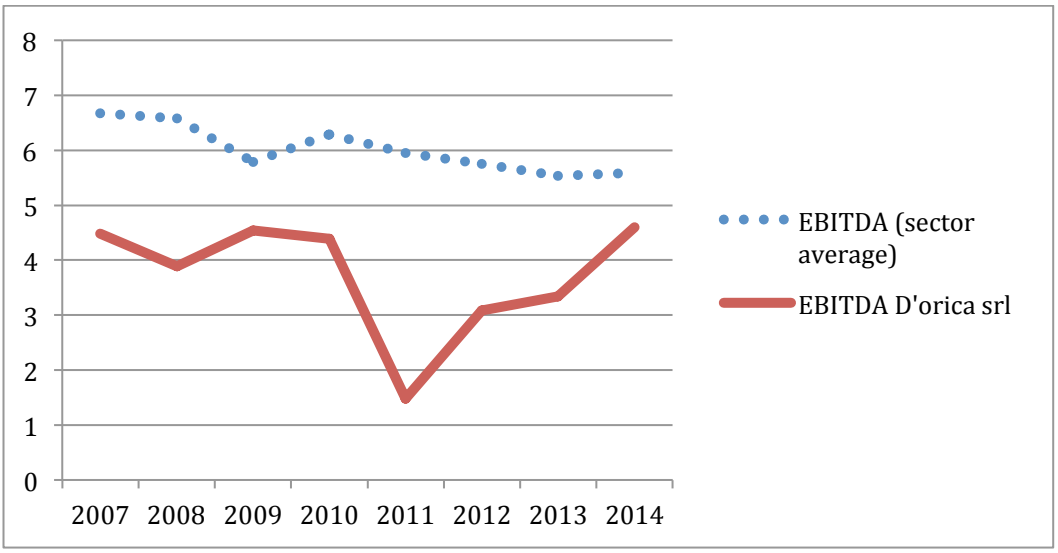
Fig4.12. Revenues: D'orica srl (2007-2014)



Source: AIDA-Bwd

The company's profitability is lower than the average profitability of the industry.

Fig4.13. EBITDA %(2007-2014)



Source: AIDA-Bwd

4.7.MAISON 203

Company profile

The company was founded in 2011 by a couple of designers: Orlando Fernandez Flores and Lucia De Conti. It produces 3D printed jewelries.

From a small town near Treviso Maison 203 is now sold in more than thirteen countries.

Thanks to their past experiences in several design firms, the two designers entered in contact with 3D printing technology and decided to experiment this new production method producing bijoux and sell them in a store in Treviso. The product has been quite successful so that they decided to improve the production and enlarge the offer.

After the first experience in Treviso, they made other experiences of direct sales in order to understand the product potential and their customers needs, at the beginning of 2016 they opened the first flagship store in Venice.

Maison 203 is still a small company, it counts four people, the two entrepreneurs and two collaborators, but it is constantly growing.

The high technology, the sophisticated design and the craftsmanship of finish has allowed them to realize a unique and recognizable product.

Orlando and Lucia define themselves “Digital Artisans”.

What do the company provide?

Value proposition

The products by Maison 203 are design objects mainly produced in nylon, PLA, steel and brass, they are all produced by new digital technologies.

They define themselves "Digital Artisans" because, although the 3D printer produces the entire object in one production process, the final touches are hand-made. 3D printer, in fact, is able to produce an object in just one process starting from a digital design, but in order to make that product salable some other manual actions are necessary, in this union lies a great value.

The product is different from one produced with traditional technologies because it has a peculiar shape and a high level of detail. Each product is designed in order to maximize the potential of 3D technology.

Who do the company serve?

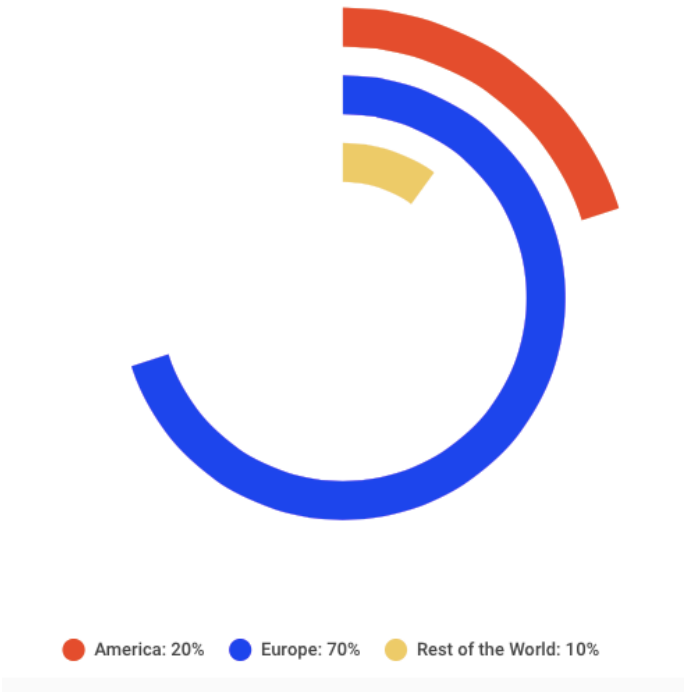
Target Customer and Markets

The target customers are people who love design and are interested in product innovation and new materials.

Especially abroad the product is distributed by museums and design shops.

The main markets are Europe and North America.

Fig4.14. Sales distribution: Maison 203



How do the company provide it?

Customer relationship

This company adopts a multi-channel sales strategy. Products are sold directly through the flagship store and the e-commerce. Direct selling allows you to have direct contact with the end customer, allows the assessment of current tastes and reactions to the new collections.

To reach a wider consumer pool they utilize multiple retailers around the world.

Value chain architecture and partner network

The company is still very small, Orlando and Lucia design, sometimes in collaboration with external designers, the product line.

The production, the 3D print, is an outsourced process. The founders explained this choice cause of the sales value that is still too low to justify the investment. The 3D printers used for the production of this jewelries are huge and really costly (200-400k euros) machines.

Another factor that makes the founders of Maison 203 reluctant to invest in this machine is the speed with which technology is evolving. One machine may become obsolete in few years, so the company decided to be more flexible and to be able to experiment also other technologies. The outsourced also the e-commerce service and the press office.

In the company headquarter there is the laboratory where products are smoothed, colored and finished.

Since the structure of this company is really flexible, partners becomes strategic hubs in particular designers and resellers. The first because allow the company to keep up to date and high the level of collections, resellers because have the task of communicating the product's features.

Core competences

Maison 203 makes the design its core business, creativity and product design innovation are the main and worth competences.

Digital Technologies

Digital technology is used in the whole production process, the reason why they choose this technology instead of others is that 3D printing allowed them to open a manufacturing business without doing big equipment investments, more than that the 3D technology allows them to produce sophisticated shapes.

In a company where design is the key element 3D printing technology becomes a strategic tool.

The company does not produce customized product yet, but this is a possible future way to enlarge the offer.

How do the company make profit?

These beautifully designed products seem to have a very positive response from the market, but few years of activities do not allow us to make accurate estimates of growth. The company has a turnover of around 200 000 euros, it is growing steadily, about one and a half every year.

4.8.CONFEZIONI BARBON

CONFEZIONI **BARBON**

Company profile

Confezioni Barbon was founded by Fernanda Barbon, a seamstress with 20 years of experience, in the 70s, the company started its activity as a small tailor's shop.

In the early 80s the company established itself as a laboratory specialized in the production of garments in high quality jersey.

By the time the company's business is legitimated by the acquisition of major clients, once the big Venetian clothing companies, such as Benetton and Stefanel, then some major fashion houses.

The generational change gave the company an important turning point, with the arrival of Fernanda's daughters, the clothing company has introduced automatic machines that have changed and greatly improved the production process.

Three years ago the company launched its own brand, Barbon, that represents 20% of turnover, the remaining 80% is still linked to the production for other brands.

Today the company, which remains a family business, has 40 employees and it is able to manage every stage of the creative process, from product design to production, and to manage collaborations with important national and international fashion houses.

What do the company provide?

<u>Value proposition</u>

"Made in Italy with Pride"

Confezioni Barbon produces in Italy for over 30 years high quality clothing in jersey.

> "Customers choose us because we are specialists of jersey, the processing of this fabric is not easy, it presents numerous challenges that with time we became good at

managing. We offer, also, the total control of production cycle that is guarantee of reliability." Katia, product manager.

The internalization of strategic activities such as prototyping and cutting tissue has enabled the company to gain a competitive advantage. It can, therefore, guarantee their customers full control of the production cycle and faster delivery times. The high quality of the products has allowed the company to position it-self in the high-end market.

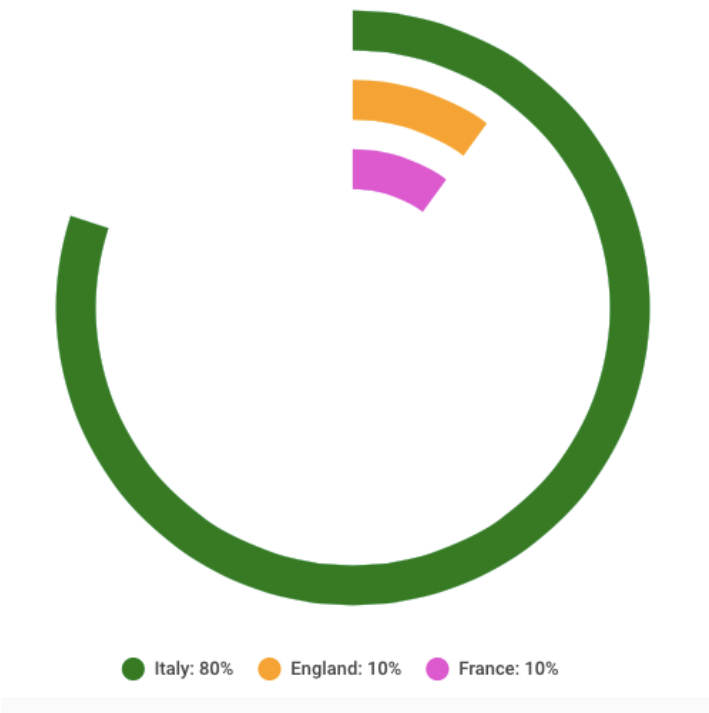
Who do the company serve?

Target Customer and Markets

The target customers are big fashion houses, small independent producers and young designers.

The reference market is Europe, because the brands are mainly Europeans, but the company is still part of a global value chain, the production is shipped in most cases in the Italian warehouses of the fashion houses that, then, deal with the logistics and shipment of goods across the world.

Fig4.15. Sales distribution: Confezioni Barbon srl



How do the company provide it?

Customer relationship

The company maintains a direct relationship with its customers, in particular in its core business.

Reputation seems to be the key to reach the market success, a good reputation with suppliers and customers allows the company to find new opportunities.

For the distribution of its own brand, the company uses a number of directly selected showrooms.

Value chain architecture and partner network

Confezioni Barbon is one of the few companies of its kind to have internalized the entire production process.

The pattern maker studies and processes the requests of customers, the pattern is then sent to the cutting room where skilled workers manage automatic cutting machines and finally the product is sent to the tailoring department to be tailored.

Fabric suppliers are very important partners because they are often a link between fashion houses and companies like this one.

Core competences

The most important value is the experience gained in working with this particular fabric. The specialization in jersey fabric has allowed the company to reach a very high standard and gain the trust of its customers.

Digital Technologies

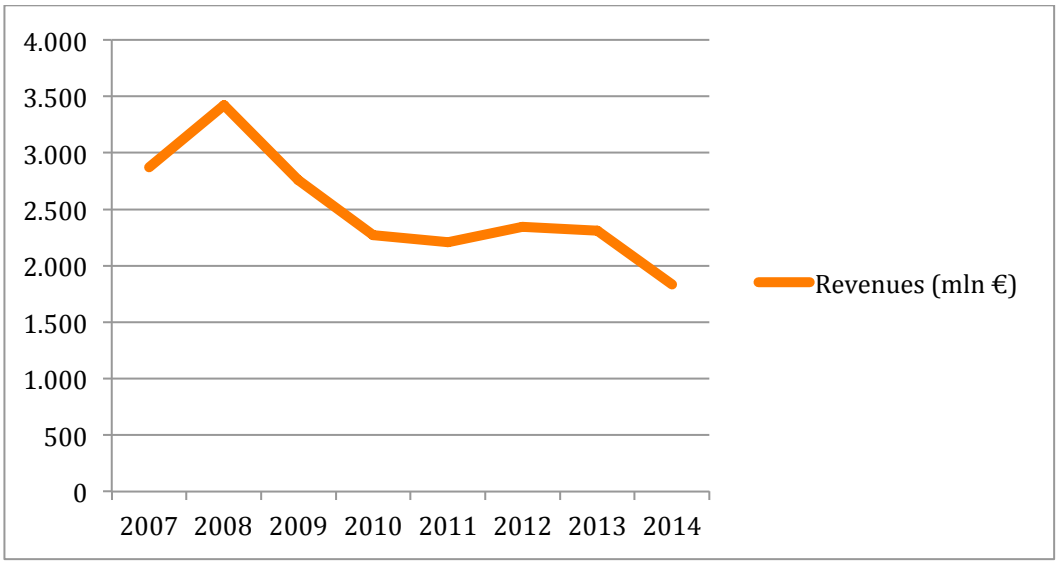
A decade ago, the entire work was done manually, now, many processes have been automated, especially major investments have been made on cutting machines. The digital control of the process allows to optimize the use of the fabric and to speed the cutting phase. Workers who were in charge of manually cutting tissues have been retrained so that they could adapt their skills to the new functionality of the machine.

Also the prototyping stage has been automated through the adoption of the design software.

"It was not easy, at every change you encounter a bit' of resistance, people think that the machine can not replace the eyes quality, in fact human skills continue to have an important role, but machines allow companies to achieve uniformity and optimize resources. The automation of processes and the use of digital technologies require a change of mindset, the strategic leap is to be able to emphasize skills and know-how through technologies that are facilitator not obstacles." Katia, product manager.

How do the company make profit?

Fig4.16. Revenues: Confezioni Barbon srl (2007-2014)

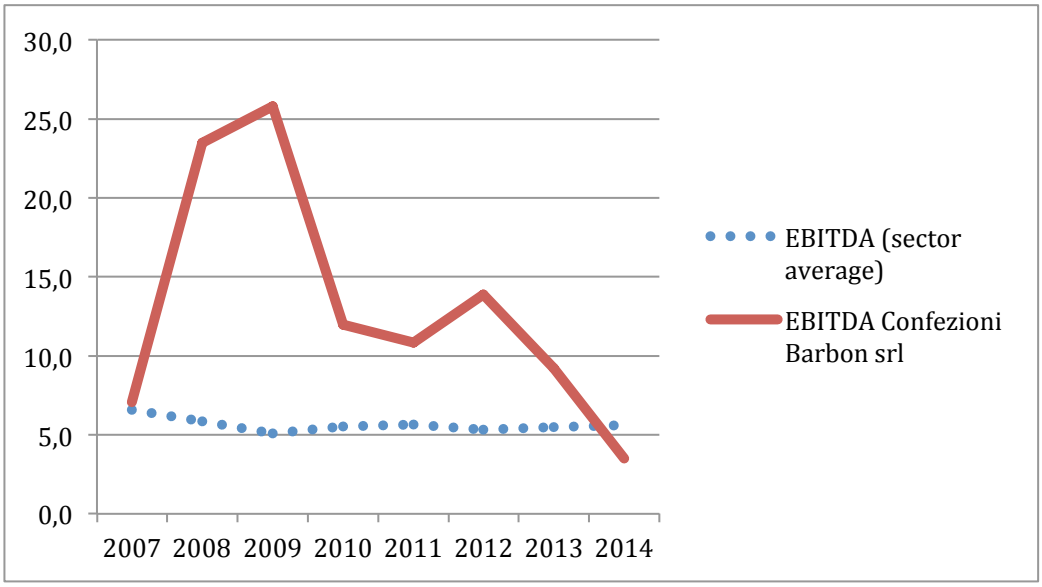


Source: AIDA-Bwd

Revenues have steadily decrease over the period considered, this decrease is due mainly to the loss of some major customers.

The profitability, albeit characterized by a fluctuating trend was maintained in principle higher than the industry average.

Fig4.17. EBITDA %(2007-2014)



Source: AIDA-Bwd

4.9.CALZATURIFICIO GRITTI – Pas de Rouge

Company profile

Gritti is a women shoe factory located in the footwear district of Brenta. It was founded in 1984.

The owners are shoes manufacturers for generations, the district of Brenta is one of the most important footwear districts that has been chosen as the place of production from the most important international luxury brands.

The brand is *Pas De Rouge*.

This company is famous for its "lavorazione a sacchetto" which is derived from the industrialization of the oldest and totally hand-made "lavorazione Bologna".

Each Pas De Rouge shoe is recognizable by the coral color of the lining.

The company has 40 employees and a turnover of 10 million euros

What do the company provide?

<u>Value proposition</u>

"The soft appeal"

Pas De Rouge is a Made in Italy product, but most of all it is Made in Riviera del Brenta. Each shoe is composed by at least sixty components that are studied to be more comfortable then possible, ready to wear and perfect for any time of the day.

They use high quality material and each Pas de Rouge shoe requires a high amount of work by hand.

They are the perfect solution for those who want to stay comfortable and elegant at the same time.

Who do the company serve?

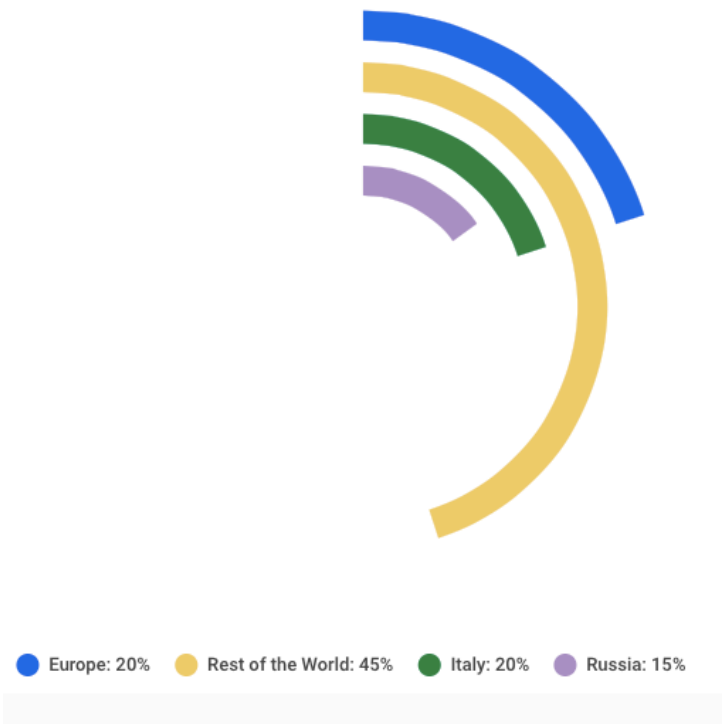
Customer target

The customer target are women aged 50 years and over that want to be stylish but that have also the necessity to stay comfortable.

The company employs retailers both in Italy and around the world.

The sales are distributed as follow.

Fig4.18. Sales distribution: GRITTI-Pas De Rouge



How do the company provide it?

Customer relationship

The company owns only a flagship store in Rome, for the main markets it has agents that keep contact with resellers. International fairs are important to reach new clients.

They don't have an online shop but they are testing a possible e-commerce future development.

Value chain architecture and partners network

The footwear sector is a market segment with a stable supply chain, many operations are outsourced such as the heels and sole production. The shoe factory usually cut the leather and apply the different components through the shapes.

Being in a district such as the one of Riviera del Brenta implies being in an network of suppliers and sales partners, having trusted technological partners for those parts who are not internalized is fundamental to maintain the quality high.

Core competences

Manual skills, the traditional know how of shoe making, the know how about the materials and the use of technologies.

Digital technologies

The digital technologies are externalized. Laser cutting is used for the production of heels because the technology allows to obtain lighter heels, "Special high-density rubber soles absorb 50% of vibrations, while the heels, made with innovative materials, are laser cut, making them extremely light and durable." They don't have a 3D printer, but their suppliers have it. 3D printer is used in the fase of prototyping in particular to create mould of particular shape for example sculture heels. But this technology is still too slow to be by imply in the traditional manufacturing process. It is true that it can be use to create something impossible to create just few years ago, but for sure it is implacable just in exceptional cases. The owner says that he sees a possibility for these technologies for the new trend of shoes made by plastic.ù

How do the company make profit?

From the interview with Mr. Zampieri came to light that the casual footwear market is undergoing the influence of the changing tastes, the success of the sneakers had a strong impact on casual shoe factory as Gritti.

But the company has been able to maintain its position within the market.

In 2014, the balance shit closed with a turnover of 9 million and 600 thousand euros, with a negative percentage change compared to the previous year by 23%.

CONCLUSION

In this thesis the digital transformation that is affecting the manufacturing sector has been analyzed, this transformation is affecting not only individual companies or sectors but it also involves many governments that are issuing focused industrial policies.

The digital transformation that is underway, defined as Industry 4.0, is seen by many as a prime opportunity to break the impasse in which the Western manufacturing world has been since the 2000s.

As with any process of change, opportunities are accompanied by threats that feed resistance to change, and even in this case there are alarming and dystopian visions of a future dominated by machines.

In the first chapter I have presented how this industrial revolution has been interpreted over the last five years by scholars, I attempted to give a clear and big picture of a process that is undoubtedly complex. Scholars, entrepreneurs, governments, institutions, and counseling agencies all intervened to provide their own interpretation of a world that is going faster day after day, like a race against time in which those who hesitate could be lost.

Focus on Italian reality was a due step, not only because of the high importance of the manufacturing sector, but also because this digital transformation seems to be made for us.

Creativity, quality, customization, few economies of scale are features that have always characterized the majority of our businesses.

Getting on the train of digital transformation is neither easy nor immediate, a change of business mentality and sometimes even business model is required.

What now seems clear is that Italian companies can not present themselves to the market as they did thirty years ago, they should have the courage to change, adapting the tradition to a changing world.

From the research on digital manufacturing conducted by *Fondazione Nord-Est* and *Banca IFIS,* it has emerged that digital technologies are spreading even in those areas that are, generally, less technological.

The evaluated technologies are more widespread in medium-sized and large companies that are more structured and have higher investment capacity.

The interesting side of the research is related to the identification of a specific technological frontier for each industry. The picture that emerges is more complex than expected, as each industry prefers the use of certain technologies over others. This distinction by technological frontier has allowed the creation of homogeneous clusters that have allowed a clearer and more reliable analysis.

Three different technological frontiers have been identified: the Furniture and Design sector uses mainly robotics and laser-cutting technologies, the Fashion-Accessories sector uses mainly laser and other automated cutting systems, while Jewelry industry uses mainly 3D printing and laser cutting technologies.

The results showed that companies that are on the technological frontier (and that use technologies described at the beginning of the elaborate) register better performance compared to companies in the same industry that do not belong to the technological frontier.

Another factor that has been considered was the customization of the product, in this case a higher level of profitability has been registered in companies that have implemented a personalization strategy in fashion and jewelry industries. The furniture industry, though sensitive to the use of technology, does not seem to be affected in the results by customization strategies.

The study of business cases has allowed a deeper analysis of the strategies adopted by companies using digital technology.

What emerges from the case studies is that the use of digital technologies is less recent and less disruptive than we expected. The use of these technologies often goes back more than 5/10 years and belongs to a technological upgrade process experienced by the company as a natural progression, sometimes the change is related to a generational change as in the case of *Confezioni Barbon,* in other cases it is related to a natural tendency to experiment as in the case of *Arper*, *D'orica* and *Fope*.

A different case is the small and recent Maison 203 that aims towards a more flexible and dynamic digital craftsmanship, unbound by capital constraints and aimed at a continuous process of experimentation, a business model 2.0: practical, flexible and fast.

The critical factor that has emerged is linked to the adaptation of skills, but in all cases that have been analyzed the use of technology has increased the value of human labor.

However it is important to emphasize that no highly innovative business model has been identified. The technologies are used to improve the production process, without any significant product innovation, the potential of these technologies has not been stressed yet.

Perhaps the development of an interconnected system with the participation of companies, universities, research centers and government initiatives could help small and medium-sized enterprises to innovate and to dare a little ‘more.

In conclusion, digital technologies seem to be a very important opportunity for our production system, rather than a threat.

The time is ripe to undertake a digital transformation aimed at increasing the value of our products in order to defend a competitive advantage, whether you want to call it “Made in Italy” or not, that makes our productions unique.

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Viaggio nell'Italia che innova – Idee, persone, impresa e territory, Oderzo, 15th July 2016.

APPENDIX A

TRACCIA INTERVISTA

A. DATI GENERALI

1. Per iniziare mi racconti un po' della sua azienda
   - Qual è la sua attività principale?
   - Qual è stata la sua evoluzione nel tempo? Ci sono stati dei passaggi critici nel tempo che le farebbe piacere sottolineare? (acquisizioni, fusioni, nuove tecnologie, nuovi prodotti, alleanze, nuovi mercati…)
   - (n° dipendenti, dimensioni)
   - Fa parte di un gruppo? Se si quale…

2. Mi può descrivere la tipologia di prodotti/gamma di prodotti?

B. MERCATI E PRODOTTI

3. Quali sono i vostri clienti?
   - In che modo vi relazionate con i vostri clienti (relazione diretta unidirezionale, relazione diretta bidirezionale come nel caso di progetti su misura o co-progetti, relazione tramite intermediari) Cercare di capire se attuano una strategia **purchase to order, assembly to order**, **make to stock** ecc.
   - È sempre stato così o ci sono state delle modifiche negli ultimi anni?

3bis: L'azienda vende prodotti con proprio marchio o marchi di terzi?

- Stima in % sul fatturato di quanto viene prodotto con il proprio marchio e quanto viene prodotto con marchio di terzi.

4. Vendete anche on-line? Avete un e-commerce di proprietà o vi appoggiate a piattaforme di altri?
   - Stima % del fatturato realizzata tramite e-commerce.

5. Quali sono, ad oggi, i principali settori e mercati di riferimento?
   - In che contesto si inserisce l'azienda.

6. In che modo vi relazionate ai mercati internazionali?

    - Vendita di prodotti diretta
    - Apertura di una rete di agenti
    - Apertura di filiali commerciali

7. Se vendete prodotti all'estero può dirci come si sono distribuite, approssimativamente, le vendite negli ultimi 12 mesi?
    - Italia %
    - Unione Europea %
    - Medio Oriente %
    - Oriente %
    - Nord America %
    - Sud America %

8. A suo giudizio, qual è la principale caratteristica per cui i vostri prodotti sono apprezzati dai clienti? E cosa vi differenzia dalla concorrenza?

    - Prezzo
    - Qualità
    - Progettazione e design
    - Tecnologia
    - Velocità di rinnovare la gamma
    - Ampiezza di gamma
    - (Diffusione sul mercato)
    - (Notorietà)

C. PRODUZIONE E TECNOLOGIE

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9. La progettazione/design avviene internamente, esternamente o è mista?
    - Che uffici/funzioni sono coinvolti nella fase di progettazione.
    - Come viene avviata la fase di progettazione? Da che uffici.

10. Capire se la produzione avviene in serie, se è modulare (*made to measure*) o customizzata (*bespoke*).
(necessario una stima)

    - Nel caso fossero presenti diverse tipologie di prodotti, come sono distribuiti i volumi di produzione.
    - Dimensione dei lotti di produzione e loro evoluzione nel tempo

11. Durante il processo di progettazione/design vengono utilizzate particolari tecnologie? Come ad esempio:

- 3D scanner
- 3D printing
- Robotica Automazione
- Taglio Laser

Se sì:

- Sono delle risorse internalizzate o vengono utilizzate in outsorcing? **Come mai questa scelta?**

- Da quanto tempo e come vengono utilizzate?

- Per cosa vengono utilizzate? (progettazione, prototipizzazione o produzione del prodotto finito.)

(Specificare cosa s'intende per robotica e automazione a seconda della tipologia d'impresa)

12. Durante il processo di produzione vengono utilizzare particolari tecnologie come quelle precedentemente descritte?

Se sì:

- Sono delle risorse internalizzate o vengono utilizzate in outsorcing? **Come mai questa scelta?**

- Da quanto tempo e come vengono utilizzate?

- Per cosa vengono utilizzate? (progettazione, prototipizzazione o produzione del prodotto finito.)

D. IMPATTO

Parlando dell'impatto che queste tecnologie hanno avuto…

13. Che impatto ha avuto l'utilizzo di queste tecnologie sull'azienda?

- Sono stati apportati alcuni cambiamenti all'interno dell'impresa per adattarsi alle novità?

- Ha avuto anche dei cambiamenti organizzativi? Impatto sulla gestione delle risorse umane, dismissione di vecchie e gestione di nuove competenze

- Considerazione sui vantaggi/ svantaggi ottenuti in seguito all'applicazione di queste tecnologie.

14. Che importanza assume il Made In Italy nella vostra azienda?

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